Wastewater Treatment

Recycled Water

Energy Production

Biosolids Reuse

Antioch Pump Station & Conveyance System Improvements Project

Project No. 20121

Request for Proposal: Engineering Services

June 2024

Delta Diablo is seeking proposals from qualified firms interested in providing Engineering Services for the Antioch Pump Station & Conveyance System Improvements Project, as described in this Request for Proposal. The selected Consultant will conduct an alignment study and evaluate long-term infrastructure investment needs based on previous analysis and updated condition assessment findings. The project is located in Antioch, CA.

Delta Diablo

TRANSFORMING WASTEWATER TO RESOURCES

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1 Introduction

Delta Diablo (District) invites proposals for the Antioch Pump Station & Conveyance System Improvements Project (Project) from qualified consulting firms to provide engineering services as described in the proposed Scope of Work defined in Section 11.

Qualified firms that submit a proposal will be evaluated in accordance with the requirements defined within this Request for Proposal (RFP). Upon successful negotiation with the District, the selected Consultant will enter into a Consulting Services Contract (Appendix A) to provide engineering design services for the Project in accordance with the general scope of work described in this RFP.

The District reserves the right to negotiate a modified scope of work with the selected Consultant. In addition, the District reserves the right to issue a new RFP and select a new consultant for future work and/or for other work not included in the negotiated contract.

2 District Background

The District is a California special district that provides wastewater resource recovery services for over 218,000 customers in the cities of Antioch and Pittsburg, and the unincorporated Bay Point community in east Contra Costa County. These services include wastewater collection, conveyance, and treatment; recycled water production and distribution; renewable energy production; beneficial biosolids reuse; pretreatment and pollution prevention; street sweeping; and household hazardous waste collection. The District's major wastewater collection, conveyance, and treatment system, and recycled water infrastructure elements are summarized below.

- Wastewater Collection: The District owns, operates, and maintains 43 miles of gravity sewers in the Bay Point community, while the cities of Antioch and Pittsburg own and operate their respective collection systems.
- Wastewater Conveyance: The District owns, operates, and maintains 14 miles of gravity sewer interceptors (12- to 42-inch diameter), 18.5 miles of force mains (4- to 24-inch diameter), flow equalization/diversion facilities, and five wastewater pumping stations. The majority of the system was constructed in the late 1970s and early 1980s.
- Wastewater Treatment: The District's WWTP has a permitted average dry weather flow (ADWF) of 19.5 MGD and a peak wet weather design flow capacity of 31.1 MGD. In 2023, annual average daily flow at the WWTP was 14.3 MGD with a maximum wet weather daily flow of 28.0 MGD. The WWTP was placed in service in 1982.
- Recycled Water: The District's Recycled Water Facility (RWF) was constructed in 2001 and has a permitted capacity of 12.8 MGD with 2023 annual average daily flow and maximum daily flows of 6.5 MGD and 12.3 MGD, respectively.

The treatment process at the District's WWTP consists of screening, grit removal, primary clarification, flow equalization, tower trickling filters, activated sludge, secondary clarification, disinfection, and dechlorination. Prior to disinfection and according to demand, secondary effluent is diverted to the District's RWF where it undergoes treatment through flocculating clarifiers, tertiary filtration, and disinfection prior to distribution for cooling tower make up water at two local Calpine power plants (~93% of the water) or landscape irrigation and other uses within the community. The portion of the recycled water that is used in the power plant cooling towers (blowdown) is returned to the WWTP and combined with secondary effluent just upstream of the disinfection process. Treated effluent is discharged into New York Slough via a deep-water outfall.

As a nationally-recognized leader and progressive "Utility of the Future," the District is firmly committed to organizational excellence, exemplary regulatory compliance, resource recovery, innovative approaches, sustainable solutions, and community engagement. In achieving its core mission of protecting public health and the environment, the District is focused on providing effective and reliable services, maintaining reasonable rates, and continuing to serve as responsible stewards of the public's resources and trust.

3 Project Background

The District owns and operates the Antioch Pump Station (APS), with an adjacent equalization storage basin, and dual 24-inch force mains (AFM 101 and AFM 102) that convey flows from the adjacent service area, as well as flows that are pumped to the APS from Bridgehead Pump Station (BHPS). The force mains were constructed in 1979 (AFM 101) and 1998 (AFM 102) using bar-wrapped, steel cylinder concrete pressure pipe.

In 2013, the District experienced the first leak from AFM 102 on Pittsburg-Antioch Highway near Verne Roberts Circle. The leak was evaluated and repaired with a cured-in-place pipe (CIPP) liner. At that time, a second potentially compromised section of AFM 102 on West 7th Street between G and H Streets was also lined as a preventive measure. In 2017, the District experienced a second failure on Pittsburg-Antioch Highway east of its Wastewater Treatment Plant (WWTP), which was repaired using CIPP liner. In December 2019, the AFM 102 pipeline segment immediately adjacent to the 2013 preventive repair failed, leading to an emergency repair using a new HDPE pipe spool. The leaks, which occurred at high points in the force main, were the result of corrosion of the pipe steel cylinder and bar-wrap. It is believed that gaseous sulfide was trapped in these locations, and could not be released due to non-functioning or previously-removed air relief valves. The gaseous sulfide corroded the interior mortar lining, steel cylinder, and bar-wrap, leading to each failure. AFM 101 has similar issues with trapped sulfide gas but because of a more favorable pipeline profile, the force main only had one failure, which occurred in 2010 and was repaired with a CIPP liner.

In February 2020, the District engaged V.W. Housen & Associates (VWHA) to identify locations where continued corrosion may present risk of failure to the District on AFM 101 and AFM 102. The resulting technical memorandum (Appendix B) includes recommendations to reduce the risk of force main failures over the next five years. In addition, VWHA also evaluated alternatives to improve the APS and BHPS and the associated conveyance systems to meet long-term/buildout pumping needs and address operational and maintenance reliability and concerns, which resulted in the 2021 APS and BHPS Long-Term Alternative Analysis Report (Appendix C).

The District's 5-year Capital Improvement Program for FY24/25-FY28/29 includes the $22.5 million multi-year Project to assess and address deficiencies at the APS and BHPS and the associated conveyance systems. The District has retained Hanson Bridgett to assist with the identification of an alternative project delivery method that is best suited for this project and to develop the associated procurement contract documents.

4 Project Goals

The overall project goal is to conduct an alignment study and evaluate long-term infrastructure investment needs based on previous analysis and updated condition assessment findings. Specific project goals include:

- Conduct condition assessment (i.e., thickness testing) at locations identified in Appendix B to determine if repairs are needed to ensure ongoing operational reliability of AFM 101 and AFM 102 until the Project is completed.
- Identify, evaluate, and recommend potential alignments for replacing AFM 102.
- Evaluate recommended long-term alternatives for improving APS and BHPS and associated conveyance systems and develop a major project to address deficiencies and related concerns.

5 Proposal Schedule

The following key events and dates have been established for the selection of a Consultant:

Table 1 – Project RFP and Consultant Selection Timeline

Event	Date
RFP Issued	Jun 24, 2024
Non-Mandatory Pre-Proposal Meeting and Site Walk	2:00 pm, Jul 10, 2024
Deadline to Submit Written Questions	5:00 pm, Jul 19, 2024
Anticipated Deadline for Responses to Questions	Jul 25, 2024
Proposal Submission Deadline	4:00 pm, Aug 2, 2024
Interviews (if needed)	Aug 6-8, 2024
Award Consulting Service Contract	Sep 11, 2024

Note: All dates are subject to change. District will endeavor to notify Proposers one week in advance of date changes.

6 Pre-Proposal Meeting

A non-mandatory pre-proposal meeting and site walk will be held at the date and time shown in Table 1 at the District's WWTP (located at 2500 Pittsburg-Antioch Hwy, Antioch) in the Board Room at the Treatment Plant Administration Building. During the meeting, the District will present a brief review of the project scope and goals, and receive questions from Proposers related to the Project and this RFP. The District may elect to provide responses to questions received that are deemed substantive in accordance with Section 7 (Proposer Questions and District Responses) below.

7 Proposer Questions and District Responses

All questions regarding the Project and this RFP outside of the pre-proposal meeting and site walk must be submitted in writing to the District on or before the date and time in Table 1 via e-mail to the District's Project Manager, Thanh Vo, at thanhv@deltadiablo.org. Please include the following in the email subject line: "RFP Proposer Questions, Delta Diablo Project No. 20121." Because the District strives to provide consistent information to Proposers, questions received via telephone or submitted to other District staff will not be accepted.

At its sole discretion, the District may elect to release responses to questions received, including during the pre-proposal meeting and site walk, to all known interested parties and post questions

and responses on the RFP listing at www.bidsync.com by the date and time shown in Table 1. The District may elect not to provide responses to questions received after the associated deadline in Table 1.

8 Proposal Submittal

Proposals must be submitted electronically in a portable document format (pdf) via an e-mail attachment (or file sharing service, if needed) to thanhv@deltadiablo.org by the date and time specified in Table 1. Proposals received after this deadline will not be considered or reviewed.

As described in Section 13 (Proposal Format and Submission Instructions), the proposal must consist of **Part 1 – Technical Proposal** and **Part 2 – Fee Proposal**. The Consultant must submit two separate e-mails with pdf file attachments or links to download the files: 1) "Technical Proposal – Proposer's Name, Delta Diablo Project No. 20121" in the e-mail subject line, and 2) "Fee Proposal – Proposer's Name, Delta Diablo Project No. 20121" in the e-mail subject line.

9 Interview Date

Following a detailed review of proposals received, the top-ranked Proposers may be invited to meet with the District's consultant selection team for an oral interview during the period specified in Table 1. Although the District will strive to schedule interviews at times that are mutually acceptable, the District requests that Proposers keep multiple time periods available during the interview period.

10 Project Budget

The current estimated total project cost is approximately $22.5 million. The estimated budget for this predesign and alignment study, including condition assessment via thickness testing, is approximately $400,000.

11 Scope of Work

The following scope of work is conceptual and represents a general outline of the expected services to be provided by the Consultant. It is not intended to be a complete list of services. The District expects consultants to use their knowledge and expertise to present a fully-developed scope of work that cost-effectively addresses the key project elements and considerations. Consultant should incorporate modifications and additions to the proposed scope of work, as needed, to support effective project delivery.

11.1 Task 1 – Project Management

The Consultant shall establish and maintain a project management system that facilitates effective communication between the Consultant and District, tracks the status of document submittals and key decisions, provides detailed monthly updates regarding the scope, schedule, and budget status, and ensures effective quality assurance and quality control (QA/QC). The Consultant shall coordinate and conduct the necessary meetings and/or workshops during the project to facilitate the development of the tasks below. The project schedule shall clearly identify milestones, review periods, and any interdependencies between tasks.

Key Deliverables and Schedule: The Consultant shall prepare monthly invoices and progress reports; meeting agendas, handouts, and presentation materials; meeting and conference call

minutes; an Action Items Decision Log; and an updated project schedule at key project milestones.

11.2 Task 2 – Alternative Analysis

The Consultant shall perform an alternatives analysis that includes the development of up to three (3) preliminary project scopes, cost estimates, and implementation schedule for the following project alternatives as outlined in the 2021 APS and BHPS Long-Term Analysis Report (at a minimum):

- Alternative 1- BHPS using AFM101 and APS using AFM102 to meet buildout pumping needs within the APS and BHPS conveyance system.
- Alternative 2 – BHPS using AFM102 and APS using AFM101 as recommended in the District's 2010 Conveyance System Master Plan to meet buildout pumping needs within the APS and BHPS conveyance system.
- Alternative 3 – TBD by Consultant.

As the District is not confined to these project alternatives, Consultant may substitute or include other alternatives (or sub-alternatives) that better align with Consultant's planned project approach. In conducting the alternatives analysis, Consultant shall engage with District to develop the assessment methodology criteria, which may include (but is not limited to):

- Initial capital and life-cycle costs
- Technology maturity, process control, and reliability
- Regulatory, technical, operational, and financial risks and potential mitigation measures
- Operational and maintenance considerations
- Land area requirements, site layout constraints, and connection to existing facilities
- Project phasing opportunities, constructability, and integration with future improvements
- Potential environmental impact considerations (e.g., energy, emissions, chemical use)

Key Deliverables and Schedule:

Consultant shall prepare a concise draft and final Technical Memorandum No 1 summarizing Task 2 findings and recommendations, conduct multiple associated workshop(s) with District, and support a progress update to District's Board of Directors.

11.3 Task 3 – Alignment Study

The Consultant shall, at a minimum, perform or make provisions for the following key activities:

- Review existing information from the District (e.g. existing force main as-built drawings, pumping system studies/reports, discussions with key staff) and conduct field investigations as needed.
- Conduct a study to determine a minimum of three alignment alternatives for a third Antioch force main (potential replacement for AFM 102).
- Coordinate and prepare preliminary engineering agreement applications on behalf of the District with On Trak Solutions (District preferred sub-consultant) to initiate the review process with the railroads' engineering staff for the proposed corridor.
- Coordinate with potential utilities along the proposed corridors to determine the locations of the facilities.
- Develop design and construction cost estimates for each alignment alternative.

Key Deliverables and Schedule: The Consultant shall prepare a concise draft and final Technical Memorandum No. 2, including drawings of potential alignment, that help summarize findings and recommendations, including associated workshop(s) with District staff.

11.4 Task 4 – Preliminary Design

Following the alignment feasibility confirmation, the Consultant shall perform preliminary design work based on the selected alternative and alignment. Consultant shall perform key predesign activities, including associated fee estimate, to achieve a preliminary design (e.g., 30% completion) for use in an alternative project delivery method (e.g., PDB, CMAR). For the purposes of this RFP and the initial contract scope and fee, the Consultant shall assume preliminary design documentation will be prepared for Alternative 1 in Task 2 and the design of a new pipeline to replace AFM 102. The final scope and fee for this task will be negotiated after completion of Tasks 2 and 3 and a contract amendment will be executed, if necessary.

Key Deliverables and Schedule: The Consultant shall complete any necessary draft and final Preliminary Design Report to include design criteria for the project, pipe material selection recommendations, a description of the alignment and any required trenchless installations, utility conflicts, and constructability concerns.

11.5 Task 5 – Easement Acquisition

The Consultant shall perform initial engagement with property owners to identify requirements for obtaining construction and permanent easements along the preferred pipeline alignment in accordance with the pertinent sections of the Uniform Relocation Assistance and Real Property Acquisition Policies Act. Consultant's fee estimate shall assume engagement with 3 private property owners and the railroads.

Key Deliverables and Schedule: The Consultant shall provide a summary of the easement requirements along the prepare pipeline alignment, including recommendations for procurement.

12 Proposal Format and Submission Instructions

The proposal shall consist of two parts as described below—**Part 1 - Technical Proposal** and **Part 2 - Fee Proposal**. Please refer to Section 6 (Proposal Submittal) for associated proposal submittal instructions.

12.1 Part 1 – Technical Proposal

Part 1 must include an Executive Summary that highlights qualifications and project experience for the firm and project team, and the project team's approach to accomplishing the Scope of Work. Part 1 shall be limited to ten (10) 8.5"x11" pdf pages with a minimum 11-point font size, of which no more than three pdf pages may be 11"x17". The cover letter, table of contents, resumes, and any contract-related information (e.g., litigation, contract exceptions) required in this RFP are excluded from the page limit. Part 1 should include the following (at a minimum):

1. **Cover Letter** - State the firm's general interest in the project, identify the firm's primary point of contact during the RFP process, and clarify the lead consultant if multiple firms are included as part of the proposed project team.

2. **Executive Summary** – An abbreviated, "Executive Summary"-level proposal must be provided with a brief and concise summary of the following proposal elements:
   a. **Business Organization, Firm Qualifications and Experience** - Provide full name, address, telephone, and e-mail address of the firm. Include affiliations with holding companies and/or parent companies. Indicate whether the firm operates as a partnership, corporation, or individual. Provide the name, title, and telephone number of the person in the organization authorized to negotiate contract terms, render binding decisions on contract matters, and sign the final contract agreement.

      Provide a description of the proposing firm(s). Explain the firm's current organizational structure, general background, qualifications, and experience, and describe any special knowledge or capabilities within the firm that are material to this RFP.

      If multiple firms are included in the proposed project team, explain the relationship between the firms. Clearly identify how the firms, if awarded a contract, would enter into the contract (e.g., joint venture, prime and subconsultant).

   b. **Project Team Qualifications and Experience** - Provide the name and title of the project manager who will be the District's main point of contact for the project. Identify the principal staff and support staff who will be assigned to this project and include an organization chart showing key team members listed by name and project responsibility. Provide a maximum two-page resume for each of the key personnel, including descriptions of key project experience, dates, project costs, and duties performed by the individual on the projects. Indicate any projects in which the team members have worked together in the past and the nature of those projects.

      Submit the name(s) of all subconsultant(s) to be utilized on the project and specific staff to be assigned to this project with resumes (maximum of two pages) for key personnel. Describe how each subconsultant will be utilized. Provide a list of similar past projects along with references for each subconsultant.

      Describe the project team's experience in completing similar projects. Provide descriptions of the work performed, including name and location of project, dates when work was performed, total project cost, type and extent of services performed, and team member roles and responsibilities. List owner/client references, including location, contact name, e-mail address, and telephone number.

   c. **Approach to Scope of Work** - Present a narrative overview of the Proposer's understanding of the Project requirements based on the information provided in this RFP. Describe the project team's capability to accomplish the project scope, manage project costs, meet schedule requirements, and ensure high-quality work products and deliverables. Highlight key considerations, concerns, and innovative approaches to manage critical project issues and associated regulatory, financial, technical, and operational risks. Include sufficient detail to demonstrate that the firm understands the magnitude and scope of the project and has developed a plan to accomplish the work. Highlight any key modifications to the scope of work provided in this RFP and recommend additional scope items for consideration, as necessary. Include the proposed project schedule with key milestones, deliverables,

workshops, and other relevant information and demonstrate an understanding of key challenges, constraints, and interdependencies.

3. **Litigation** - Provide litigation history for any claims filed by your firm or against your firm related to the provision of program or project engineering services within the past five (5) years.
4. **Other Information** - This section should contain all other pertinent information the firm wishes the District to consider.
5. **Contract Exceptions** - The District's Standard Consulting Services Contract form will be used as the contracting mechanism for this work and is attached to this RFP (refer to Appendix A). The Consultant must list specific exceptions and recommended replacement language for the District to consider.
6. **Resumes** - Project team resumes, including key subconsultants, must be included.

12.2 Part 2 – Fee Proposal

Part 2 must include the Fee Proposal based on the scope of work in the Consultant's proposal. The elements of the Fee Proposal must include the following:

1. An hourly rate and reimbursement schedule for each classification of firm personnel who will be working on the project and for each classification of anticipated reimbursements. If applicable, wage rates must comply with California labor code.
2. Fees for all required work as outlined in this RFP and any additional services proposed by the Consultant. The Fee Proposal must comprise two main components:
   a. Fees for consultant services by key tasks in the scope of work and subconsultant fees
   b. Reimbursable expenses, including but not limited to reproduction costs, postage, and mileage

13 Minimum Qualifications

The District seeks a project team with expertise to perform the work described herein. Qualifying experience may be demonstrated by the Proposer by meeting the following minimum requirements:

1. Lead Firm: For the firm(s) that is(are) proposed to be responsible for completing the majority of the scope of work, demonstrate that a minimum of five similar and/or related projects to the Project described in this RFP have been completed in the last ten (10) years. Highlight roles of any proposed project team members in completing these reference projects.
2. Project Manager: Demonstrate that the proposed Project Manager has: 1) completed a minimum of two similar and/or related projects in the last seven (7) years, 2) possesses a minimum of five (5) years of project management experience in the wastewater/water sector, and 3) holds a valid professional engineering license in the state of California.
3. Subject Matter Expert (SME): Include project team members with expertise and experience in the following:
   a. Submitting Railroad Encroachment Permits in California
   b. Evaluating alternative project delivery methods (i.e., PDB, CMAR)
   c. Securing required approvals from other applicable agencies throughout the Contra Costa County for similar type of work mentioned in this RFP

All proposed personnel, including subconsultants, shall be knowledgeable of, and comply with, all applicable local, state, and federal regulations, cooperate and consult with District staff during the project period.

14 Selection Process

Proposals will be evaluated using two sets of criteria. Proposals meeting the Mandatory Elements will then be evaluated based on the Technical Elements. Proposals not meeting the Mandatory Elements may not be considered. The District may elect to interview top-ranked firms.

1. Mandatory Elements: The firm follows the instructions set forth in the RFP, submits a complete proposal, including references, and demonstrates that the firm and project team meets or exceeds the minimum qualifications in Section 13 (Minimum Qualifications).
2. Technical Elements: The District will consider the following technical elements when evaluating the proposal:
   - Specialized firm experience
   - Project manager experience
   - SME experience
   - Number and complexity of comparable and similar projects completed by project team
   - Project approach to the RFP scope of work (including schedule)
   - Positive, relevant references
   - Innovative ideas that add value to the project

The District reserves the right to consider additional technical elements that may be identified during the proposal evaluation process.

15 Reference Information

The District is providing the following appendices and background material as links or attachments for use by Proposers in preparing proposals:

Appendix A	District Standard Consulting Services Contract (including insurance requirements)
Appendix B	APS & Conveyance System Improvements Phase 1 Technical Memorandum
Appendix C	2021 APS and BHPS Long-Term Alternative Analysis Report

16 Contact Information

All technical questions shall be submitted to: Thanh Vo, Senior Engineer, at thanhv@deltadiablo.org. Oral statements regarding this RFP by any persons at the District should be considered unverified information unless confirmed in writing.

17 District Information

Delta Diablo
2500 Pittsburg-Antioch Highway
Antioch, CA 94509
Tel (925)756-1900
Fax (925)756-1960

Appendix A

District Standard Consulting Services Contract

DELTA DIABLO
2500 Pittsburg-Antioch Highway, Antioch, CA 94509

CONSULTING SERVICES CONTRACT

PROJECT NAME AND NUMBER:

THIS CONTRACT SHALL BE BINDING ON THE DISTRICT ONLY IF IT IS SIGNED BY AN AUTHORIZED DESIGNEE

This Contract ("Contract") is made by and between Delta Diablo ("District") and, ("Consultant"). The parties agree as follows:

CONSULTANT DATA

Full Business Name:
Address:
City, State, ZIP: ,
Business Telephone:
Business Fax: **Email:**
Federal Tax Identification Number ("TIN"):
Consultant Contact/Title:

District Contact/Title:

Consultant certifies under penalty of perjury that Consultant is a
☐ Sole Proprietor ☐ Corporation ☐ Limited Liability Company ☐ Partnership
☐ Nonprofit Corporation ☐ Government Agency ☐ Other [describe:]

CONTRACT TERMS

Effective Date: **Completion Date:**
Payment Limit: $ **Liquidated Damages: $** **per day**

Payment information will be reported to the Internal Revenue Service under the name and TIN or SSN, whichever is applicable, provided above by Consultant.

1. Scope of Service. District hereby contracts with Consultant, and Consultant accepts such, to perform the professional services as described in Appendix B (Scope of Services), upon the terms and in consideration of the payments stated herein.

2. Report Disclosure Section. Pursuant to Government Code Section 7550, Consultant shall include in all documents or written reports completed and submitted to District in accordance with this Agreement, a separate section listing the numbers and dollar amounts of all contracts and subcontracts relating to the preparation of each such document or written report. This section only applies if the Payment Limit of this Agreement exceeds $5,000. If multiple documents or written reports are the subject or product of this Agreement, the disclosure section may also contain a statement indicating that the total Agreement amount represents compensation for multiple documents or written reports.

3. Insurance. Consultant may not commence work under this Agreement until it has furnished evidence of the insurance prescribed in Appendix A and may not continue to perform any work under this Agreement if the insurance required herein is no longer in effect.

4. Payment. District shall pay Consultant for professional services performed at the rates shown in Appendix C, which include all overhead and incidental expenses, for which no additional compensation will be allowed. Notwithstanding the foregoing, District shall reimburse those incidental expenses specifically itemized in Appendix C, provided that Consultant submits copies of receipts and, if applicable, a detailed mileage log to the District. In no event may the total amount paid to

Consultant exceed the Payment Limit specified on page 1, **Payment Limit**, without District's prior written approval.

a. Billing Statements: Consultant shall submit billing statements in the manner and form prescribed by the District detailing the work performed and listing, for each item of services, the employee categories, hours and rates. Except as otherwise provided in the Scope of Services, Consultant shall submit the billing statements no later than 30 days from the end of the month in which the services described in the billing statement were actually rendered. Except as provided in subsections (b) - (d) below, District will endeavor to pay Consultant within 30 days after receipt of each statement.
b. Documentation: Consultant shall furnish progress reports with each billing statement at no additional charge. Consultant shall include sufficient detail in each progress report, and shall furnish to the District whatever additional information is necessary, to enable the District to determine whether Consultant is performing all tasks described in the Scope of Services pursuant to the schedule set forth in the Scope of Services.
c. Penalty for Late Submission: If District is unable to obtain reimbursement from the state or federal government as a result of Consultant's failure to submit to District a timely billing statement as set forth above, District will not be obligated to pay Consultant for the services included in the late billing statement.
d. Right to Withhold: District may withhold payment to Consultant following written notice to Consultant that: (i) Consultant has failed to fully perform its obligations under this Agreement (including, without limitation, any failure to submit required deliverable items according to the schedule set forth in the Scope of Services); (ii) Consultant has neglected, failed, or refused to furnish information or cooperate with any inspection, review, or audit of its work or records; or (iii) Consultant has failed to sufficiently itemize or document its billing statement.
e. Audit Exceptions: Consultant accepts responsibility for receiving, replying to, and/or complying with any audit exceptions by appropriate county, state or federal audit agencies resulting from its performance of this Agreement. Within 30 days of demand, Consultant shall pay District the full amount of District's obligation to the state and/or federal government resulting from any audit exceptions that are attributable to Consultant's failure to properly perform any of its obligations under this Agreement.

5. Extra Work. Any work or services in addition to the work or services described in the Scope of Services that District deems necessary to properly complete the work or services described in Scope of Services shall be performed by Consultant at the direction of District according to the rates or charges listed in Appendix C. In the event that no rate or charge is listed for a particular type of extra work, Consultant will be paid for the extra work at a rate to be mutually agreed on prior to the commencement of the extra work. In no event will Consultant be entitled to compensation for extra work unless, prior to commencement of the extra work, District has executed a written amendment describing the extra work and payment terms in accordance with Section 25. Amendments.

6. Time for Completion. Consultant shall complete all services covered by this Agreement no later than the end of the term as set forth above. Notwithstanding the foregoing, to the extent the Scope of Services provides for the phasing of services, Consultant shall complete all services for each phase of the project by the deadlines stated in the Scope of Services.

7. Termination by District. At its option, District may terminate this Agreement at any time by written notice to Consultant, whether or not Consultant is then in default. Upon such termination, Consultant shall, without delay, deliver to District all materials and records prepared or obtained in the performance of this Agreement, and District shall pay Consultant, without duplication, all amounts due for the services rendered up to the date of termination.

8. Abandonment by Consultant. If Consultant ceases performing services under this Agreement or otherwise abandons the project prior to completing all of the services described in this Agreement, Consultant shall, without delay, deliver to District all materials and records prepared or obtained in the performance of this Agreement. District shall pay Consultant the amount it determines to be the reasonable value of the services performed up to the time of cessation or abandonment, less a deduction for any damages or additional expenses which District incurs as a result of such cessation or abandonment.

9. Ownership of Documents. All materials and records of a finished nature, such as final plans, specifications, reports, and maps, prepared or obtained in the performance of this Agreement, shall be delivered to and become the property of District. Consultant shall retain, and make available to District in accordance with Section 10. Record Retention and Auditing, all materials of a preliminary nature, such as survey notes, sketches, preliminary plans, computations and other data, prepared or obtained in the performance of this Agreement.

10. Record Retention and Auditing. Except for materials and records delivered to District, Consultant shall retain all materials and records prepared or obtained in the performance of this Agreement, including financial records, for a period of at least five years after Consultant's receipt of the final payment under this Agreement. Upon request by District, Consultant shall promptly make such materials and records available to District, or to authorized representatives of the state and federal governments, at a convenient location within Contra Costa County designated by the District, at no additional charge and without restriction or limitation on their use.

11. Independent Contractor Status. The parties intend that Consultant, in performing the services specified herein, is acting as an independent contractor and that Consultant will control the work and the manner in which it is performed. This Agreement is not intended and may not be construed to create the relationship between the parties of agent, servant, employee, partnership, joint venture or association. Additionally, Consultant is not entitled to participate in any pension plan, workers' compensation plan, health plan, insurance, bonus or similar benefits District provides to its employees. In the event that District exercises its right to terminate the Agreement, Consultant expressly agrees that it will have no recourse or right of appeal under any rules, regulations, ordinances or laws applicable to employees.

12. Breach. If Consultant fails to perform any of the services described in this Agreement in the manner and time frame set forth in the Scope of Services or otherwise breaches this Agreement, District may pursue all remedies provided by law or equity. Disputes relating to the performance of this Agreement are not subject to non-judicial arbitration.

13. Compliance with Laws. In performing this Agreement, Consultant shall comply with all applicable laws, statutes, ordinances, rules and regulations, whether federal, state, or local in origin, including, but not limited to, licensing and purchasing practices, and wages, hours and conditions of employment, including nondiscrimination and prevailing wage rates and their payment in accordance with California Labor Code Section 1775. If any federal or state regulations or laws touching upon the subject of this Agreement are adopted or revised during the term hereof, this Agreement will be deemed amended and Consultant will comply with such federal or state requirements.

14. Assignment. Consultant may not assign or transfer this Agreement, in whole or in part, whether voluntarily, by operation of law or otherwise; provided, however, Consultant may, subject to any required state or federal approval, enter into subcontracts for the portion of the services for which Consultant does not have the facilities to perform so long as Consultant obtains the District's written consent to such subcontracting prior to execution of this Agreement. The District may withhold consent to any proposed subcontract in his or her sole and absolute discretion. Any purported assignment, transfer or subcontract that does not comply with the terms hereof is void.

15. Endorsement on Plans. Consultant shall endorse all plans, specifications, estimates, reports and other items described in Scope of Services prior to delivering them to District, and, where appropriate, indicate his or her registration number.

16. Works Made for Hire. All reports, original drawings, graphics, plans, studies, and other data and documents, in whatever form or format, assembled or prepared by Consultant or Consultant's subcontractors, consultants, and other agents in connection with this Agreement are "works made for hire" (as defined in the Copyright Act, 17 U.S.C.A., Sections 101 *et seq.,* as amended) for District, and Consultant unconditionally and irrevocably transfers and assigns to District all right, title, and interest, including all copyrights and other intellectual property rights, in or to the works made for hire. Unless required by law, Consultant shall not publish, transfer, discuss, or disclose any of the above-described works made for hire or any information gathered, discovered, or generated in any way through this Agreement, without District's prior express written consent. If any of the works made for

hire is subject to copyright protection, District reserves the right to copyright such works and Consultant agrees not to copyright such works. If any works made for hire are copyrighted, District reserves a royalty-free, irrevocable license to reproduce, publish, and use the works made for hire, in whole or in part, without restriction or limitation, and to authorize others to do so.

17. Indemnification. Consistent with California Civil Code section 2782.8, Consultant shall, to the fullest extent permitted by law, indemnify, protect, defend and hold harmless District, and its employees, officials, and agents, from any and all demands, losses, claims, costs, liabilities, and expenses for any damage, injury, or death, including any and all administrative fines, penalties or costs imposed as a result of an administrative proceeding, to the extent they arise out of, pertain to, or relate to the negligence, recklessness, or willful misconduct of Consultant, its officers, employees, agents, contractors, subconsultants, or any persons under its direction or control. If requested by District, Consultant shall defend any such suits at its sole cost and expense. If District elects to provide its own defense, Consultant shall reimburse District for any expenditures, including reasonable attorneys' fees and costs. Consultant's obligations under this section exist regardless of concurrent negligence or willful misconduct on the part of District or any other person; provided, however, that Consultant will not be required to indemnify, including the cost to defend, District for the proportion of liability a court determines does not arise out of, pertain to, or relate to the negligence, recklessness, or willful misconduct of Consultant, its officers, employees, agents, contractors, subconsultants, or any persons under its direction or control. This indemnification clause will survive the termination or expiration of this Agreement.

18. Endorsements. Consultant may not, in its capacity as a Consultant with District, (a) publicly endorse or oppose the use of any particular brand name or commercial product without the prior approval of District's governing body, (b) publicly attribute qualities or lack of qualities to a particular brand name or commercial product in the absence of a well-established and widely accepted scientific basis for such claims or without the prior approval of District's governing body or (c) participate or appear in any commercially-produced advertisements designed to promote a particular brand name or commercial product, even if Consultant is not publicly endorsing a product, as long as Consultant's presence in the advertisement can reasonably be interpreted as an endorsement of the product by or on behalf of District. Notwithstanding the foregoing, Consultant may express its views on products to other consultants, to District's governing body or its officers, or to others who may be authorized by District's governing body or by law to receive such views.

19. Project Personnel. Consultant may only make changes in project personnel and authorized subconsultants with the District's prior written consent, and Consultant shall notify the District in writing at least thirty (30) days in advance of any proposed change. Any person proposed as a replacement shall possess training, experience, and credentials comparable to those of the person being replaced.

20. Inspection. Authorized representatives of District, the State of California and the United States Government may monitor, inspect, review and audit Consultant's performance, place of business and records pertaining to this Agreement.

21. Conflicts of Interest. Consultant covenants that it presently has no interest and that it will not acquire any interest, direct or indirect, that represents a financial conflict of interest under state law or that would otherwise conflict in any manner or degree with the performance of its services hereunder. Consultant further covenants that in the performance of this Agreement, Consultant will employ no person having any such interest. If requested to do so by District, Consultant shall complete a "Statement of Economic Interest" form and deliver it to the District and shall require any other person doing work under this Agreement to complete a "Statement of Economic Interest" form and deliver it to the District. Consultant covenants that Consultant, its employees and officials, are not now employed by District and have not been so employed by District within 12 months immediately preceding this Agreement; or, if so employed, did not then and do not now occupy a position that would create a conflict of interest under Government Code Section 1090. In addition to any indemnity provided by Consultant in this Agreement, Consultant shall indemnify, defend and hold District harmless from any and all claims, investigations, liabilities or damages resulting from or related to any and all alleged conflicts of interest.

22. Nonrenewal. Consultant understands and agrees that there is no representation, implication, or understanding that the services provided by Consultant under this Agreement will be purchased by District. Under a new contract following expiration or termination of this Agreement, and Consultant waives all rights or claims to notice or hearing respecting any failure to continue purchasing all or any such services from Consultant.

23. Professional Competence; Licensure. Consultant represents and warrants that it is (i) professionally competent and able to provide the professional services described in this Agreement by reason of Consultant's personal knowledge and skill, and (ii) currently licensed, and will remain licensed in good standing at all times during the term of this Agreement, as one of the following: (a)an architect pursuant to Chapter 3 (commencing with Section 5500) of Division 3 of the California Business and Professions Code; (b) a landscape architect pursuant to Chapter 3.5 (commencing with Section 5615) of Division 3 of the California Business and Professions Code; (c) a professional engineer pursuant to Chapter 7 (commencing with Section 6700) of Division 3 of the California Business and Professions Code; or (d) a professional land surveyor pursuant to Chapter 15 (commencing with Section 8700) ofDivision3 of the California Business and Professions Code.

24. Notices. All notices under this Agreement must be in writing, and, except as otherwise provided in the Scope of Services, sent by personal delivery (including overnight courier service) or by certified United States Mail, postage prepaid, to the parties at the addresses designated above, unless changed by written notice to the other party. Consultant shall address all notices to District to the District. The effective date of the notice is the date of deposit in the mail or of other delivery, except that the effective date of notice to District is the date of receipt by the District.

25. Amendments. This Agreement may be amended only by written agreement signed by both of the parties.

26. Disputes. Disagreements between District and Consultant concerning the meaning, requirements or performance of this Agreement are subject to final written determination of the District or in accordance with the applicable procedures (if any) required by state or federal government.

27. Choice of Law and Personal Jurisdiction. This Agreement is made in Contra Costa County and is governed by, and will be construed in accordance with, the laws of the State of California. The parties, to the fullest extent permitted by law, knowingly, intentionally, and voluntarily, with and upon the advice of competent counsel, submit to personal jurisdiction in the State of California over any suit, action or proceeding arising from or relating to the terms of this Agreement.

28. No Implied Waiver. No waiver of any provision of this Agreement by District is valid unless it is in writing and signed by District. Waiver by District at any time of any breach of this Agreement may not be deemed a waiver of or consent to a subsequent breach of the same or any other provision of this Agreement. If Consultant's action requires the consent or approval of District, that consent or approval on one occasion may not be deemed a consent to or approval of that action on any later occasion or a consent to or approval of any other action. Subject to Section 26. Disputes above, inspections, approvals or statements by any officer, agent or employee of District indicating Consultant's performance or any part thereof complies with the requirements of this Agreement, or acceptance of the whole or any part of Consultant's performance, or payments therefor, or any combination of these acts, does not relieve Consultant of its obligation to fulfill this Agreement as prescribed or prevent District from bringing an action for damages or enforcement arising from any failure to comply with any of the terms and conditions of this Agreement.

29. Successors and Assigns. Subject to Section 14. Assignment, this Agreement binds Consultant's successors, assigns, heirs, executors and personal representatives.

30. No Third-Party Beneficiaries. This Agreement is intended solely for the benefit of the parties hereto, and no third party has any right or interest in any provision of this Agreement or as a result of any action or inaction of any party in connection therewith.

31. Construction. The section headings and captions of this Agreement are, and the arrangement of this instrument is, for the sole convenience of the parties to this Agreement. The section headings,

captions and arrangement of this instrument do not in any way affect, limit, amplify or modify the terms and provisions of this Agreement. This Agreement may not be construed as if it had been prepared by one of the parties, but rather as if both parties have prepared it. The parties to this Agreement and their counsel have read and reviewed this Agreement and agree that any rule of construction to the effect that ambiguities are to be resolved against the drafting party does not apply to the interpretation of this Agreement.

32. Severability. If any term or provision of this Agreement is, to any extent, held invalid or unenforceable, the remainder of this Agreement will not be affected thereby.

33. Entire Agreement. This Agreement, together with all of the attachments listed below under Attachments, contains all of the terms and conditions agreed upon by the parties regarding the subject matter of this Agreement, and supersedes all previous communications, representations, understandings and agreements, whether verbal, written, express or implied, between the parties.

34. Authorization. Consultant, or the representative(s) signing this Agreement on behalf of Consultant, represents and warrants that Consultant has full power and authority to enter into this Agreement and to perform the obligations set forth herein, and that the representatives signing this Agreement have the authority to execute this Agreement on behalf of Consultant and to bind Consultant to its contractual obligations hereunder.

Attachments: Appendix A - Insurance Requirements for Consultant
Appendix B - Scope of Work
Appendix C - Rate Schedule

I HAVE READ THIS CONTRACT, INCLUDING ALL ATTACHMENTS AND EXHIBITS, IF APPLICABLE. I CERTIFY THAT I HAVE THE AUTHORITY TO SIGN AND ENTER INTO THIS CONTRACT AND AGREE TO BE BOUND BY ITS TERMS.

CONSULTANT

_____
Signature #1

_____
Consultant Printed Name and Title

_____
Date

_____
Signature #2

_____
Consultant Printed Name and Title

_____
Date

DISTRICT

_____
Vincent P. De Lange
General Manager

_____
Date

Unless corporate resolution delegates an individual to sign contracts, a contract with a corporation shall be signed by the President, Vice President or Chairman of the Board (signature 1) **and** the corporation Secretary, Assistant Secretary, Chief Financial Officer/Treasurer or Assistant Treasurer (signature 2).

APPENDIX A

INSURANCE REQUIREMENTS FOR CONSULTANT

Consultant may not commence work under this Agreement until it has furnished evidence of the insurance required herein to the District, and the District has approved it, and may not continue to perform any work under this Agreement if the insurance required herein is no longer in effect. Consultant shall, at no cost to the District, obtain and maintain, for the duration of the contract, the following policies of insurance:

A. **Commercial General Liability** (CGL): Insurance Services Office Form CG 00 01 covering CGL on an "occurrence" basis, including products and completed operations, property damage, bodily injury and personal & advertising injury with limits no less than **$1,000,000** per occurrence. If a general aggregate limit applies, either the general aggregate limit shall apply separately to this project/location (ISO CG 25 03 or 25 04) or the general aggregate limit shall be twice the required occurrence limit.

B. **Automobile Liability:** Insurance Services Office Form Number CA 0001 covering, Code 1 (any auto), or if Contractor has no owned autos, Code 8 (hired) and 9 (non-owned), with limit no less than **$1,000,000** per accident for bodily injury and property damage.

C. **Professional Liability** (Errors and Omissions) Insurance appropriates to the Contractor's profession, with limit no less than **$2,000,000** per occurrence or claim, **$2,000,000** aggregate.

D. **Worker's Compensation** insurance as required by the State of California, with Statutory Limits, and Employer's Liability Insurance with limit of no less than **$1,000,000** per accident for bodily injury or disease. If Consultant has no employees, Consultant may sign and file the following certification in lieu of insurance:

> *"I am aware of the provisions of California Labor Code Section 3700 which requires every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with the provisions of that code before commencing with and during the performance of the work of this contract."*

Certificate of Insurance: Prior to the effective date of this Agreement, Consultant shall furnish to the District certificates of insurance evidencing the coverage required herein and requiring 30 days' written notice to the District of policy lapse, cancellation or material change in coverage. If Consultant renews the insurance policy(ies) or acquires a new insurance policy(ies) or amends the coverage through an endorsement to the policy(ies) at any time during the term of this Agreement, then Consultant shall provide current certificate(s) to the District.

Warranty: Consultant represents and warrants that, as of the effective date of this Agreement, Consultant is not aware of any situation that has occurred that could reduce the limits of liability set forth above for claims made under this Agreement.

Appendix B

APS & Conveyance System Improvements Phase 1 Technical Memorandum

TECHNICAL MEMORANDUM

DATE: May 27, 2020

TO: Ian Bronswick
Delta Diablo Sanitation District

FROM: Tom Bergin, P.E.
Mark Jaudalso

REVIEWED BY: Vivian W. Housen, P.E.

SUBJECT: Antioch PS & Conveyance System Improvements Project Phase I
AFM-101 and AFM-102 Forcemain Corrosion Assessment

1.0 BACKGROUND AND INTRODUCTION

The District owns and operates the Antioch Pump Station ("APS"), adjacent equalization storage, and dual 24-inch forcemains ("AFM-101" and "AFM-102") that convey flows from the adjacent service area, as well as flows that are pumped to the station from Bridgehead Pump Station. The forcemains are comprised of AWWA C-303 bar-wrapped, steel cylinder concrete pressure pipe ("CCPP").

In 2013, the District experienced the first leak from AFM-102, on Pittsburg-Antioch Highway near Verne Roberts Circle. The leak was evaluated and repaired with a cured-in-place pipe ("CIPP") liner. At that time, a second potentially compromised section of AFM-102 on West 7th Street between G and H Streets was also lined as a preventive measure. In 2017, the District experienced a second failure on Pittsburg-Antioch Highway east of the wastewater treatment plant, which was repaired using CIPP liner. In December 2019, pipe adjacent to the 2013 preventive repair failed, leading to an emergency repair using a new HDPE pipe spool. The leaks, which occurred at high points in the forcemain, were the result of corrosion of the pipe steel cylinder and bar-wrap. It is believed that gaseous sulfide was trapped in these locations, and could not be released due to non-functioning or previously-removed air relief valves. The gaseous sulfide corroded the interior mortar lining, steel cylinder, and bar-wrap, leading to each failure.

In February 2020, the District retained V.W. Housen & Associates ("VWHA") and subconsultant V&A Consulting Engineers ("V&A") to identify locations where continued corrosion may present risk of failure to the District on AFM-101 and AFM-102. VWHA and V&A conducted external visual inspections and ultrasonic steel cylinder wall thickness testing at these locations. The purpose of this assessment was to identify locations with substantial internal corrosion, and to design repairs for these areas in order to reduce the risk of forcemain failure for a 5-year timeframe (Phase 1). These Phase 1 repairs would provide additional time for the team to evaluate options to improve long-term operations and reliability of the combined Antioch and Bridgehead Conveyance Systems.

This Technical Memorandum ("TM") discusses the work completed by VWHA pertaining to corrosion assessment of the dual 24-inch forcemains, including findings and recommended improvements. As discussed in a meeting with the District on April 15, 2020, VWHA will defer discussions on hydraulic analysis to a separate TM that will include Bridgehead Pump Station. This TM includes the following sections:

1. Background and Introduction
2. Existing Infrastructure
3. Forcemain Condition Assessment (Visual, Ultrasonic Testing, and Wastewater Sulfide Testing in Wetwell) Conducted by V&A Consulting Engineers
4. Forcemain Repair Recommendations
5. Air Release Valve Recommendations

2.0 EXISTING INFRASTRUCTURE

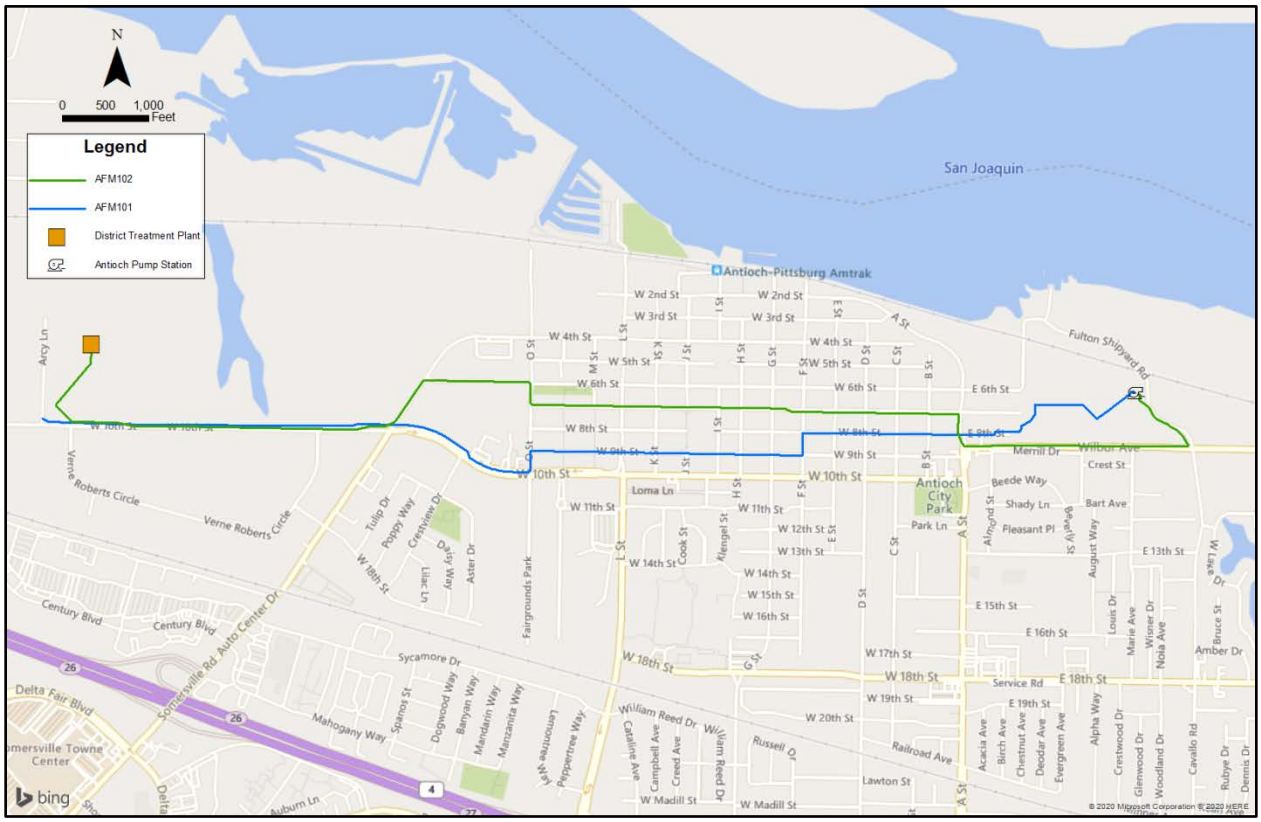
The APS is located along Fulton Shipyard Road just north of Wilbur Avenue and south of the railroad tracks. The APS was obtained from the City of Antioch when the District was formed in 1955. The pump station receives flow from the Bridgehead Pump Station and gravity flow from the adjacent tributary areas. The pump station discharges flow through a dual 24-inch forcemain system. Depending on flow and operating conditions, either one of these forcemains, or both in parallel convey the wastewater flow to the District's Wastewater Treatment Plant ("WWTP") located at 2500 Pittsburg-Antioch Highway in Antioch. The District's APS and forcemain sewer configuration is shown in Figure 1, on the following page.

As shown in Figure 1, the two forcemains have different alignments, profiles, and lengths. AFM-101 was first constructed in 1977 and spans approximately 13,605 feet. The second forcemain, AFM-102, which was constructed in 1998 and spans approximately 15,782 feet. According to District records and discussions with District staff, both AFM-101 and AFM-102 are constructed of AWWA C-303 bar-wrapped, steel cylinder concrete pressure pipe material or CCPP. AFM-102 was manufactured by Ameron International (now Northwest Pipe Company). Information on both forcemains is summarized in Table 1 below. The Ameron pipeline cut sheets that were provided as a submittal during the construction phase of AFM-102 are included as part of Appendix A.

Table 1: Forcemain Information Summary

Parameter	AFM-101	AFM-102
Installation Year	1977	1998
Diameter	24 inch	24 inch
Length (approximate)	13,605 LF	15,782 LF
Type	AWWA C303 CCPP	AWWA C303 CCPP
Steel Cylinder Thickness	12 gauge	3/16 in / 10 gauge / 14 gauge

Figure 1. APS-101 and APS-102 Sewer and Forcemain Configurations



Based on the information provided by Ameron, and partially confirmed through recent field measurements, AFM-102 CCPP appears to be comprised of three different steel cylinder wall thicknesses. The thinner, 14 gauge pipe (0.075") is used in locations without bends, and where bell and spigot joints were specified on the construction drawings. The thicker, 10 gauge (0.135") and 3/16 inch (0.187") pipe sections are used in locations with welded joints, which are located on the construction drawings at horizontal and vertical bends.

Ameron construction submittals were not available for AFM-101. However, ultrasonic wall thickness testing at the AFM-101 inspection location matched a 12 gauge (0.105 inch) wall thickness across the entire sampling area. Also, 12 gauge steel cylinder is mentioned by Winzler & Kelly in a prior document discussing the forcemains.

Field measurements confirmed the presence of 14 gauge and 10 gauge pipe wall thickness on AFM-102. In addition, a pipe spool that was removed from AFM-102 during prior construction activities and stored in the field was confirmed to have 3/16 inch wall thickness.

2.0 FORCEMAIN CONDITION ASSESSMENT

The purpose of the forcemain condition assessment task was to identify locations within AFM-101 and AFM-102 that are likely to have experienced substantial corrosion, and therefore require

replacement. If necessary, based on field testing results, these sections would be replaced during summer 2020, in advance of the 2020-2021 wet weather season.

3.1 Condition Assessment Guidelines

VWHA and the District established the following guidelines for the condition assessment. These guidelines were structured to provide the most reliable data within a short timeline, at a reasonable cost:

- VWHA and V&A would identify locations with the highest potential for corrosion, and rank those locations in order of risk. Corrosion measurements would be taken at the crown of pipe in these locations.
- VWHA and the District would solicit costs for contractors to provide access to testing locations. Preparation for testing, traffic control, and restoration of each site would be completed by the District.
- Based on the cost and time required to provide access, the team would then finalize the inspection list and testing schedule.

3.2 Selection of Inspection Locations

VWHA, together with V&A, met in advance of field testing to discuss potential locations for visual and ultrasonic thickness testing. CCPP pipe is comprised of a thin steel cylinder that is spiral-wrapped with a steel bar that is tack welded to the cylinder. The steel assembly is then coated with mortar inside and outside of the pipe. The purpose of the ultrasonic testing was to measure the steel cylinder thickness in the middle layer of the forcemain pipe, and determine the amount of material loss from internal corrosion. Based on District records, all past failures on AFM-102 occurred at intermediate high points throughout the forcemain alignment at elevations higher than the discharge location. These intermediate high points in the forcemains cause stagnant conditions for wastewater, trapping hydrogen sulfide (H_2S) gas that, if not properly managed, corrodes the walls of the pipe including its steel cylinder. Usually, air relief valves ("ARV") are installed at forcemain high points. As air or gasses build up at the high point, pressure can also increase. A float mechanism opens the valve, which releases the air and then closes after liquid lifts the float mechanism. The profile of AFM-102 includes numerous high points, and the AFM-102 construction drawings show ARVs at these high points. However, available documentation shows that a recommendation was made in the past to eliminate six existing ARVs, and to install 4 new ARVs on AFM-102. This documentation suggests that at one time, the originally designed ARVs were either missing or non-functional. This documentation is included in Appendix B.

In theory, high points that are located below the discharge elevation remain submerged, even during non-operating conditions. Continuously-submerged pipe is usually protected from corrosion, since air is a required component of the corrosion reaction. However, if an air pocket develops within this high point during normal operations, then the air pocket could remain, even if the adjacent pipe sections are submerged. Therefore, the team focused on intermediate high

points that are higher in elevation than the discharge elevation, but also identified some locations that should theoretically be submerged at all times. These locations are shown on Figures 2 and 3, and are discussed below.

Initially, 4 locations on AFM-101 and 8 locations on AFM-102 were selected for testing. On March 11, 2020, VWHA, V&A, and District staff met to review these locations and finalize the testing plan. The testing locations were prioritized further, resulting in nine locations as follows:

- One location on AFM-101 and six locations on AFM-102 are located on intermediate high points with an elevation that is higher than the discharge location, and that have not been repaired by the District. These locations were the main candidates for forcemain testing and received a higher priority. Highest priority locations and the reason for selection are as follows:

    - AFM-101 Sta. 114+25. Intermediate high point. The other high point on the alignment at Sta. 46+44 has been lined previously.

    - AFM-102 Sta. 120+40, 88+31, 70+25, 62+74, 53+86, and 50+44. Intermediate high points. The location at Sta. 120+40 also confirms corrosion measurements taken by the District/CTS in January 2020, and the location at Sta. 70+25 was selected to confirm that there is no further corrosion adjacent to the December 2019 failure location.

- Two additional locations on AFM-102 were selected to confirm steel cylinder wall thickness at the inlet to a siphon (Sta. 101+81) and to determine condition of pipe segments in between two repair locations (Sta. 138+00). These locations were given a lower priority in the early stages of planning.

Since AFM-102 has been more susceptible to failures in recent years due to its profile configuration, this forcemain was assigned more testing locations than AFM-101.

During the March 11, 2020 discussion, the team also concluded that a steel cylinder percent loss of 25% or greater at a given testing location would qualify this pipe for urgent repair. Any pipe with 25% wall loss or greater would be scheduled to receive expanded testing to determine the extent of the required repair. As discussed further below, none of the test locations had measurable pipe wall loss that could be attributed to internal corrosion.

In addition to showing the testing locations, Figures 2 and 3 shows locations of previous repairs, previously televised sections, the location of more recent corrosion testing, and areas of the pipe with welded joints.

Figure 2. AFM-101 Profile and Testing Location Summary

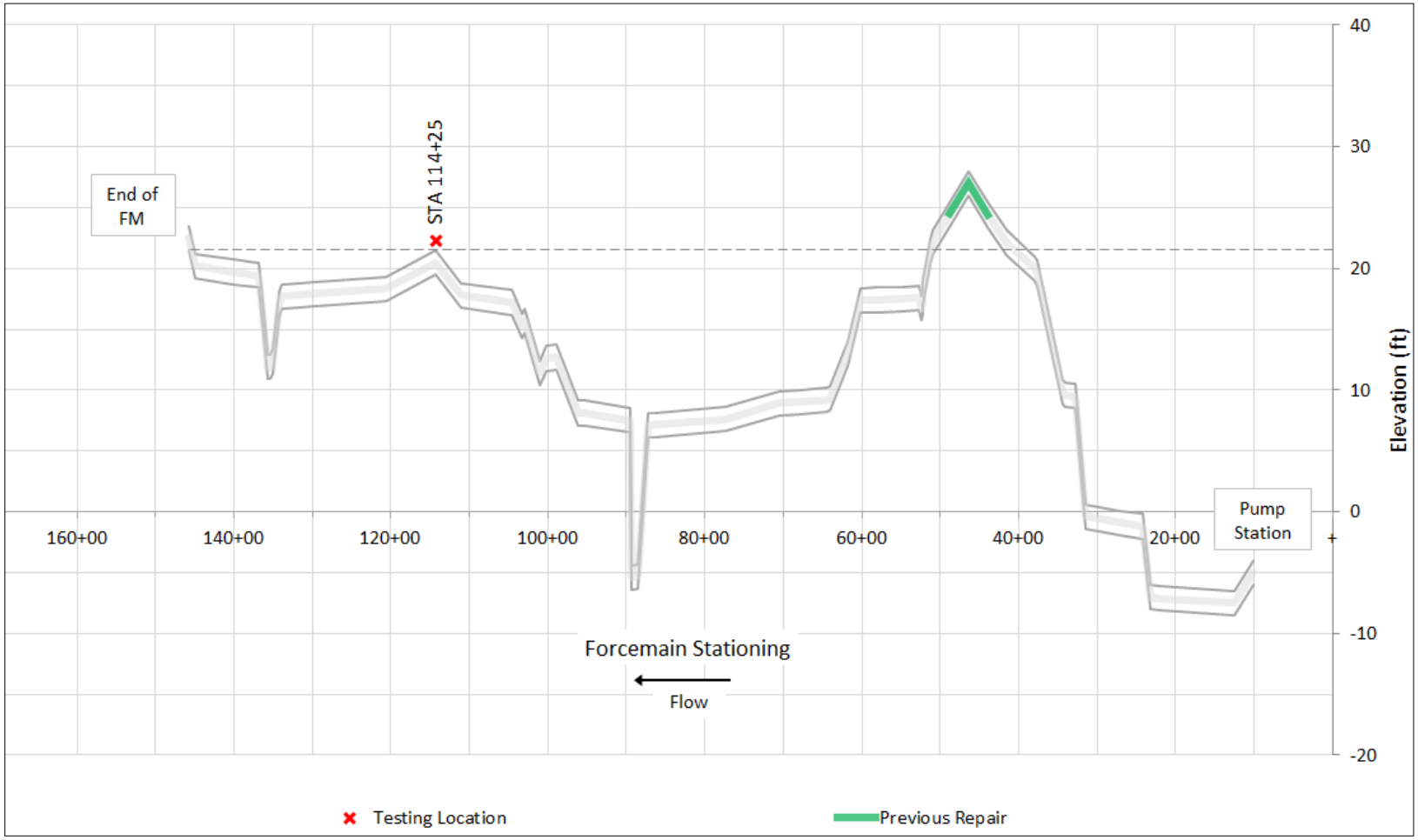
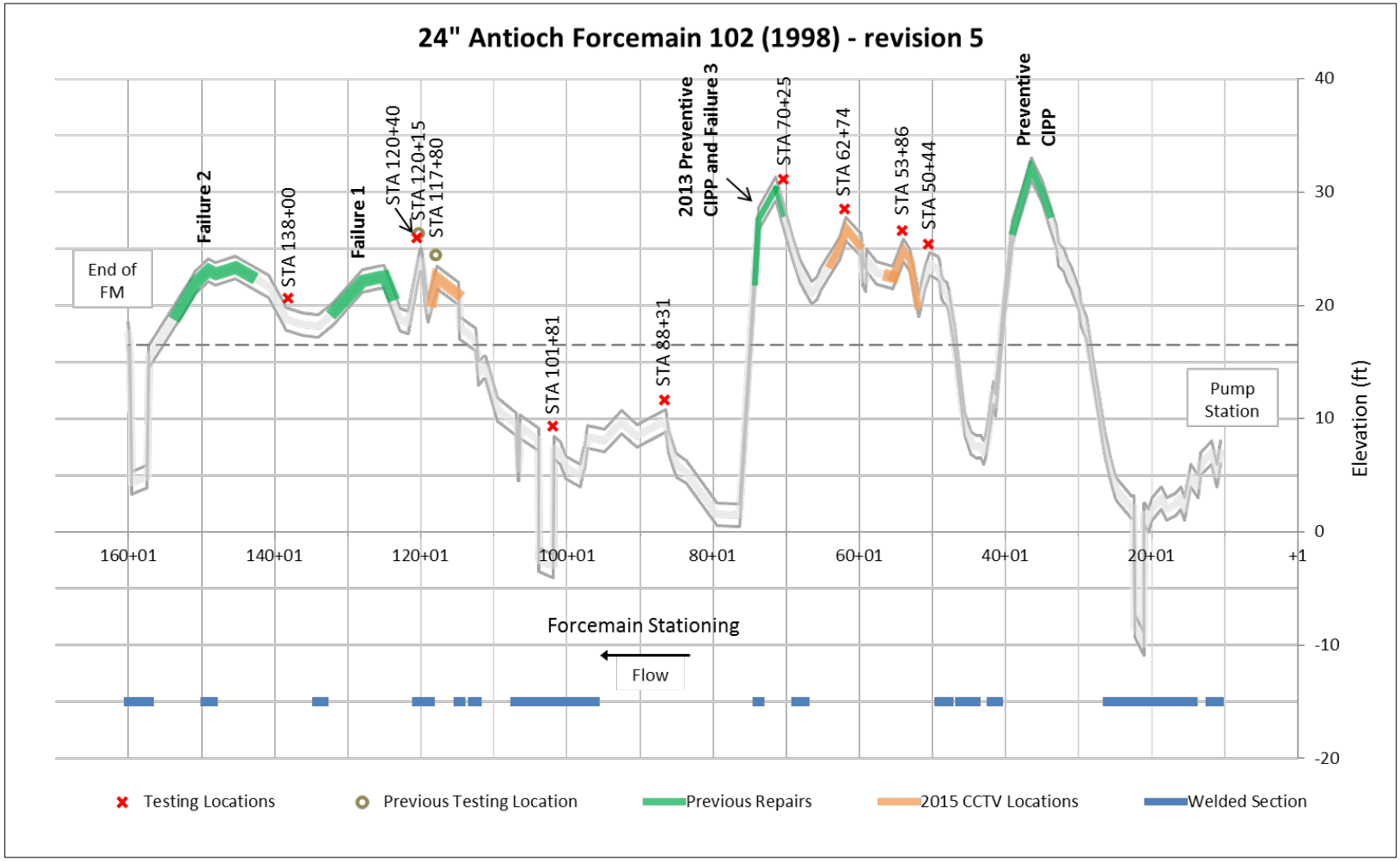


Figure 3. AFM-102 Profile and Testing Location Summary



3.2 V&A Forcemain Assessment

Attached to this Technical Memorandum is the V&A Consulting Engineers "Antioch Force Mains 101 & 102 Condition Assessment Report," included as Appendix C. This report details the approach, testing, findings and conclusions of the visual inspections and ultrasonic wall thickness testing that were completed for this project. The V&A Technical Memorandum ("V&A Report") includes the following sections, which provide additional background on the forcemain assessment:

Section 1: Executive Summary

Section 2: Introduction. This section provides a brief background, summarizes documents reviewed, lists the inspection locations, discusses the approach used for corrosion testing, and discusses wastewater sulfides testing.

Section 3: Approach. This section discusses contractor access provided by the District, visual inspection, ultrasonic wall thickness testing, and sulfides testing.

Sections 4 and 5: Findings and Conclusions, which are summarized below

3.2.1 Findings

Following is a summary of findings, which are presented in further detail in the V&A Report.

Visual Inspections

Prior to the field testing on AFM-101 and AFM-102, V&A evaluated sections of bar-wrapped pipe stored at the District's WWTP. These pipe segments included sections removed from AFM-102 during the December 2019 emergency repairs, as well as replacement pipe used for the repairs. The steel cylinder thicknesses of the pipe sections stored at the WWTP were directly measured with a micrometer to anticipate steel cylinder thicknesses that may be encountered during the ultrasonic thickness testing of AFM-101 and AFM-102. Two different thicknesses were measured at the WWTP storage area: 3/16-inch, and 14-gauge.

The nine testing locations are shown in Table 2, and referenced by Location Number in the V&A Report.

Table 2. Inspection Locations & Visual Inspection Notes

Location	Pipeline	Stationing	Street Reference	External Corrosion	Other
1	AFM-102	138+00	P-A Highway, between Verne Roberts Circle and Arcy Lane	Moderate	
2	AFM-102	101+81	West of 6th and O Street Intersection	None or negligible	
4	AFM-102	88+31	W. 7th Street between M and L Streets	None or negligible	
5	AFM-102	62+74	W. 7th Street at E. Street	None or negligible	
6	AFM-102	53+86	W. 7th Street between C and B Streets	None or negligible	1 Bar Slightly Bent.
7	AFM-102	50+44	W. 7th Street between B and A Streets	None or negligible	
9	AFM-101	114+25	P-A Highway at Verne Roberts Circle	Minor	
13	AFM-102	120+40	P-A Highway west of Auto Center Drive	None or negligible	
14	AFM-102	70+25	W. 7th Street west of G Street	None or negligible	Dent and dimples in steel cylinder, scrapes on bars.

At all but one of the nine inspection locations that were exposed for corrosion assessments, the exterior of the pipe and cement mortar coating appeared to be in good condition. The exposed steel cylinder and bars at 4 locations exhibited a mill finish with no sign of or minimal surface corrosion. At location 6, the reinforcing bar was slightly bent, and at location 14, there was a pre-existing dent in the steel cylinder, approximately one inch in diameter and 3/16 to 1/4 of an inch deep, several dimples in the steel cylinder extending about 40 percent into the steel wall thickness, and scrapes on the reinforcing bars. It is believed that this damage occurred during the December repair project. Photos showing these demarcations are included in the V&A report.

Ultrasonic Thickness Testing

Ultrasonic thickness testing was conducted on the steel cylinder at each of the nine excavation locations. The number of measurements taken at each location determine based on the field technician's ability to access the exposed pipe wall. On average, 25 readings were taken per location, with the actual number ranging from 12 readings at location 7, to 42 readings at location 14. The original pipeline wall thickness appeared to be fully intact in all locations.

Measured thicknesses for AFM-101 location 9 matches 12-gauge steel (0.105 inch). Although documentation could not be found for the AFM-101 installed pipe thickness, 22 readings were taken ranging from 0.104 to 0.112 inches, with an average measurement of 0.106 inches. The

consistency of measurement supports 12-gauge steel having a maximum thickness loss of 0.001 inches or 1 percent.

Measured wall thicknesses for AFM-102 locations 1, 4, 5, 6, 7, 13, and 14 ranged from 0.073 to 0.077. AFM-102 has bell-and-spigot joints in all of these locations, with a 14-gauge wall thickness (0.075 inch). The maximum wall thickness loss measured across all of these locations was 0.002 inches or 3 percent.

Measured wall thickness for AFM-102 location 2 ranged from 0.133 to 0.138 inches, across 37 readings. Location 2 has welded joints, with either a 10-gauge (0.135 inch) or 3/16-inch (0.187 inch) wall thickness. The consistency of measurement supports 10-gauge wall thickness in this location, and the maximum wall thickness loss is 0.002 inches or 1%.

The maximum calculated thickness loss across all locations was 0.002 inches, which is within the practical tolerances of the ultrasonic test methods used, and is likely within manufacturing tolerances for the steel sheet or plate used to manufacture the pipe.

Bar Diameter and Spacing

At each location where the cement mortar coating was removed, the reinforcing bar diameter and spacing, mortar coating thickness, and cover depth over the bars were measured. Bar spacing, bar diameter, and mortar coating thicknesses at the AFM-101 location were not consistent with published data for CCCP pipe. However, shop drawings were not available for AFM-101, and design parameters may have differenced from published data. The diameter and spacing of the bars at the AFM102 excavation locations generally met the requirements from the Ameron shop drawings. However, the specified mortar cover depth over the bars was less than shown on the shop drawings. The differences between measured and published values for both pipes did not raise concerns by V&A, but are listed in the report for information.

Sulfides and Potential for Corrosion

A wastewater sample was obtained from the APS wetwell at 9:15 a.m. on April 7, 2020. The sample was tested for total and dissolved sulfides, as described further in the V&A Report. V&A also reviewed H_2S gas concentrations measured by the District upstream of the APS wetwell. Although present, sulfide concentrations in the wetwell were determined to be on the low end of the spectrum for corrosivity and odor. However, the H_2S gas concentrations measured by the District upstream of the APS are considered very high, confirming that when dissolved sulfides are released from the District's wastewater, the resulting gasses are highly corrosive.

V&A Conclusions

In conclusion, AFM-101 appears to be in good condition at the selected inspection location. There was no measurable wall thickness loss from the steel cylinder, and minimal visible corrosion on the external steel cylinder and reinforcing bars. This pipe has been in service since 1977 (43 years).

Similarly, the AFM-102 pipe appears to be in good condition at the eight inspection locations. The pipe did not show measurable internal or external wall thickness loss from corrosion on the cylinder or reinforcing bars. There was a varying amount of surface corrosion on the exterior of the steel cylinder, depending on location (mostly minimal, with one location having moderate corrosion). Moderate corrosion may indicate that the mortar coating may be losing alkalinity and its ability to protect the steel. This condition does not present an immediate threat to reliability, but should be reviewed again as part of Phase 2 of this project. AFM-102 has been in service since 1998 (22 years).

In addition, one location on AFM102, Location 14, had a pre-existing dent in the steel cylinder. This dent may have caused the mortar lining to delaminate; the condition of the interior mortar lining could not be confirmed through ultrasonic testing. At this location, there were also pre-existing dimples on the exterior of the steel cylinder. If an internal pipe inspection is possible in this location, the District should schedule this inspection to confirm whether the internal lining has remained intact.

The gaseous sulfide measurements provided by the District show a high potential for odors and corrosion at high points within the force mains, if sulfides are released from the wastewater stream and allowed to collect at these high points. Although AFM-102 is the newer pipeline of the two parallel forcemains, AFM-102 has had several failures that have resulted from internal corrosion caused by gaseous sulfide. This demonstrates that service life cannot be determined using pipe material alone, and depends heavily on configuration, construction methods, and system operation.

Without having found signs of wall loss and associated pipe corrosion at the inspected locations, V&A found it difficult to project a corrosion rate forward, which would be needed to project a remaining useful life for either forcemain.

4.0 FORCEMAIN REPAIR RECOMMENDATIONS

After reviewing the results of the field investigations, VWHA, V&A, and the District met to discuss results and next steps. The team agreed that because no apparent corrosion was found at the inspection locations, the need for an urgent (i.e., summer 2020) pipeline relining or replacement project is no longer a priority for the District.

The District is planning to review system operations for the Bridgehead and Antioch Conveyance Systems, and would like the existing system to provide at least five years of reliable operation, until recommendations from this broader analysis can be completed and implemented. In order to provide this level of reliability, VWHA recommends that the District move forward with several repairs related to AFM-102:

1. Install permanent repair coupling at the 2019 failure location, and
2. Reinstall air relief valves that were previously removed from the AFM-102 high points.

4.1 Permanent Repair Coupling

The 2019 AFM-102 repair on West 7th Street between G and H Streets was completed on an emergency basis. The coupling between newly-installed HDPE pipe and existing CCCP/CIPP requires a permanent solution, prior to the 2020-2021 wet weather season. Photographs taken during the emergency repair construction and a review of the AFM-102 as-built drawings have been completed to address a design resolution for a permanent repair at this location.

Construction photographs show a flanged HDPE pipe section connected to steel flanges that were welded directly to the steel cylinder of the CCPP pipe. Based upon the project as-built drawings, ultrasonic thickness field measurements in the vicinity, and the available Ameron CCPP pipe submittal, the steel cylinder at the repair location is 14 gauge thickness. Without the bar wrapping and concrete encasement or a thickened steel ring, the flange connection directly to the 14 gauge cylinder presents a weak point in the existing pipe repair on both sides of the new HDPE spool.

To provide original pipe design strength and repair longevity, a replacement repair should include the following procedures and components:

- Define the approximate length of pipe segment to be repaired. Based on a review of existing documentation, the approximate repair length is 80 feet (approximately 20 feet long on the downstream side and 60 feet long on the upstream side).
- Locate and uncover existing Carnegie gasketed joints at each end of the pipe repair segment. Trim existing CIPP liner as needed to access joint.
- Have special short 24 inch Carnegie-by-Flanged joint fittings manufactured by Northwest Pipe (formerly Ameron). One fitting would be spigot end by flange joint and one would be bell end by flange joint.
- Install above special fittings onto existing CCPP pipe ends at exposed original pipe joint locations.
- Grout inside and outside of Carnegie joints.
- Fabricate 24-inch flanged HDPE pipe spool(s) to fit between above special flanged ends.
- If two flanged spools are used, install a harnessed compression coupling on 24 inch HDPE pipe plain ends to facilitate segment repair.
- Make any repair to corrosion control system

4.2 Reinstatement of Air Release Valves

The installation of air release valves (ARVs) on sewer forcemains is a standard practice. Air release valves are typically located at high points in the pipeline where air, including gaseous sulfides can become trapped. Air pockets within a forcemain can cause water hammer and pressure surges (transients), sulfide corrosion, and increase pumping heads. Entrapped air can

lead to surge pressures in pipelines from 1.6 to 2 times the pipeline operating pressure. The greatest pipe pressures occur upon power loss or termination of pumping.

In some cases, forcemain configuration and operating flow velocities can evacuate some entrapped air. However, in the case of AFM-102, operating velocities are approximately 3 to 4 feet per second, which are not great enough to drive air from high points. Further, the prior failures that have resulted from internal corrosion confirm that corrosive, entrapped air is present within the forcemain.

A previous evaluation of AFM-102 summarized in a Technical Memo dated March 24, 2014, included in Appendix B, showed the pipeline to have a collapse pressure of 612 psi and a pressure rating of 300 psi with transients. The evaluation indicated that the pipeline operating pressures with calculated transients are within the operating design pressure of the pipeline. After evaluating the memo assumptions and reviewing the AFM-102 project Technical Specification, it appears that the March 24, 2014 evaluation overestimated the pressure rating of the forcemain by assuming incorrect properties of construction for AFM-102. AFM-102 project Technical Specification Section 02667, 2.2, B, also included in Appendix B, required the pipe to have a maximum working pressure of 65 psi, a maximum working pressure plus transients of 65 psi, and a test pressure requirement of 100 psi. For AFM-102, with a normal operating pressure of 60 psi, estimated pressure during surge events with trapped air in the pipeline could be as high as 120 psi. This potential transient pressure exceeds the pipeline's original specified test pressure. A detailed surge analysis of AFM-102, as planned in Phase 2 of this project, would provide more accurate anticipated surge pressures for use in developing future design solutions.

Based upon this initial analysis, it is recommended that six air release valves be reinstated at all original AFM-102 project design locations to help mitigate surge pressures, and also minimize the sulfide environment created by entrapped air at high points within the forcemain. It is understood that the District has had maintenance issues with certain ARV models and it is recommended that District use valves that have been installed, operated, and maintained without issues. We understand that the District has had success with A.R.I. brand ARVs in more recent installations. To assist in routine maintenance of ARV's it is recommended that shut off valves between the forcemain and the ARV be in good operating condition (or replaced) to allow servicing of ARV's without shutting down or draining the forcemain.

The estimated construction cost to install upgraded repair couplings and reinstate ARVs on AFM-102 is $180,000. This estimate does not include engineering, administration, or construction management/inspection. The estimate includes a ten percent contingency for unknowns associated with underground construction.

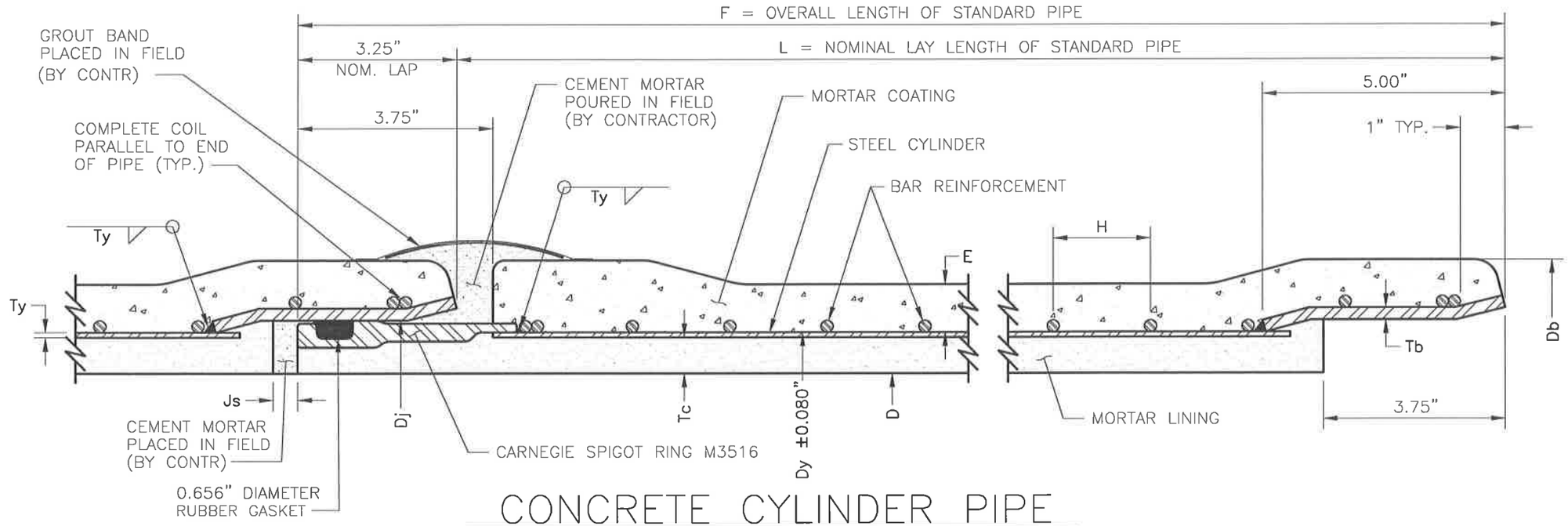
4.3 Next Steps

As discussed during the review meeting held on April 15, 2020, VWHA is proceeding with the preparation of plans and specifications for installation of new repair couplings, and reinstatement of ARVs as discussed above. Submittal of the 75 percent design package is scheduled for June 5, 2020. The remainder of the project schedule is proposed as follows:

- 75% Design Submittal — June 5, 2020
- 75% Design Review Meeting (Approx.) — June 10, 2020
- 90% Design Submittal — June 19, 2020
- 90% Design Review Meeting (Approx.) — June 23, 2020
- Complete Bid Documents — June 30, 2020
- Bid Period (30 Days) — July 30, 2020
- Award Contract — August 12, 2020
- Construction Completed — October 15, 2020

Appendix A

Ameron International AFM-102 Cut Sheets



CONCRETE CYLINDER PIPE

MANUFACTURING DATA

GENERAL

D		Dj	Tb	Tc	E	F
NOM. PIPE DIAMETER IN.	CLASS	NOMINAL JOINT DIAMETER IN.	BELL RING THICKNESS IN.	NOMINAL LINING THICKNESS IN.	MINIMUM COATING THICKNESS IN.	OVERALL LENGTH STD PIPE FT.
24	100	26.25	3/16	3/4	1 7/32	20.27'

STEEL CYLINDER

	Ty	Dy		
Ay/FT. IN^2	CYLINDER THICKNESS OR GA. NO. IN.	OUTSIDE DIAMETER IN.	PLANT TEST PRESSURE PSI	CYLINDER WEIGHT LBS/FT
0.90	14 GA.	25.75	158	20.49

BAR REINFORCEMENT

		H		
ROD DIAM. IN.	As/FT SQ. IN	SPACING C TO C IN.(MAX)	COILS PER FOOT	ROD WT. LBS/FT
7/32	0.24	1.88	6.38	5.55

INSTALLATION DATA

L	Db	Js				
LAY LENGTH FT.	MAXIMUM PIPE O.D. IN.	INSIDE JOINT SPACE IN.	MAXIMUM PULL PER JOINT ANGLE	OFFSET USING MAX PULL FT.	MINIMUM RADIUS FT.	WEIGHT FOR STD LENGTH PIPE LBS
20.00	29.19	0.50	2.18°	0.79	529	4,100

PIPE SPECIFICATION: AWWA C303 & PROJECT PLANS AND SPECIFICATION
STEEL SPECIFICATION: ASTM A570 GRADE 36
REINFORCING ROD SPECIFICATION: ASTM A615, GRADE 40
CEMENT SPECIFICATION: ASTM C150, TYPE II

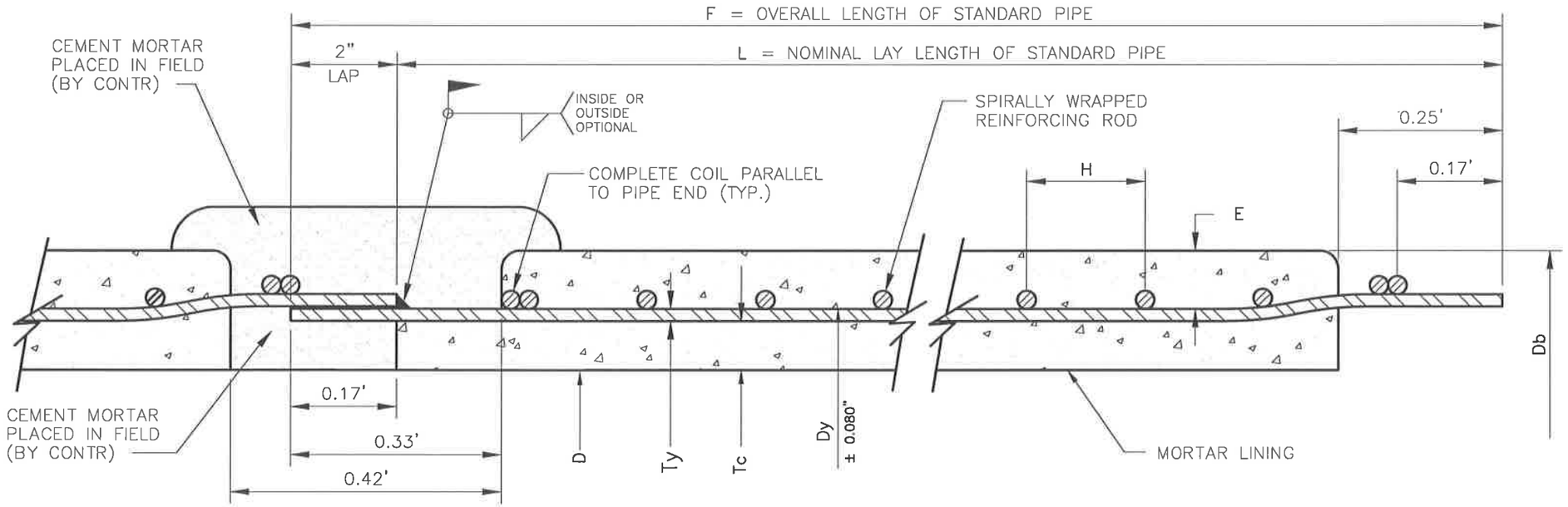
AMERON INTERNATIONAL — WATER TRANSMISSION GROUP

SYMBOL	REVISION	DATE	BY	APPV'D

DWG SCALE: NOT TO SCALE

ANTIOCH FORCE MAIN – PROJECT NO. 2242
DELTA DIABLO SANITATION DISTRICT

DRAWN	LV	02/08/99	TIDELANDS CONSTRUCTIONS CO
CHECKED			C12735 10.0
APPV'D			



CONCRETE CYLINDER PIPE

BELL I.D. TO SPIGOT O.D.
TOLERANCE = 0.000" TO 0.125"

MANUFACTURING DATA

GENERAL						STEEL CYLINDER					BAR REINFORCEMENT				
D			Tc	E	F		Ty	Dy						H	
NOM. PIPE DIAMETER IN.	PIPE CLASS	TOTAL At/FT. IN^2.	NOMINAL LINING THICKNESS IN.	MINIMUM COATING THICKNESS IN.	OVERALL LENGTH STD PIPE FT.	Ay/FT. IN^2	CYLINDER THICKNESS IN.	OUTSIDE DIAMETER IN.	PLANT TEST PRESSURE PSI	CYLINDER WEIGHT LB/FT	As/FT. IN^2	BAR DIAM. IN.	COILS PER FT. NO.	SPACING C TO C IN.	ROD WEIGHT LB/FT
24	100-W	1.85	3/4	1 7/32	20.17	1.61	10 GA.	25.75	286	36.80	0.24	7/32	6.38	1.88	5.55
24	100-F	2.49	3/4	1 7/32	20.17	2.25	3/16	25.75	400	51.20	0.24	7/32	6.38	1.88	5.55

INSTALLATION DATA

L	Db				
LAY LENGTH FT.	MAXIMUM PIPE O.D. IN.	MAXIMUM PULL PER JOINT ANGLE	OFFSET USING MAX PULL FT.	MINIMUM RADIUS FT.	SHIP WEIGHT FOR STD LENGTH PIPE LBS
20.00	28.19	2.22°	0.78	516	4,300
20.00	28.19	2.22°	0.78	516	4,600

PIPE SPECIFICATION: AWWA C303 & PROJECT PLANS AND SPECIFICATION
STEEL SPECIFICATION: ASTM A570 GRADE 36
REINFORCING ROD SPECIFICATION: ASTM A615, GRADE 40
CEMENT SPECIFICATION: ASTM C150, TYPE II

SYMBOL	REVISION	DATE	BY	APPV'D

AMERON INTERNATIONAL — WATER TRANSMISSION GROUP

ANTIOCH FORCE MAIN – PROJECT NO. 2242
DELTA DIABLO SANITATION DISTRICT

DRAWN	LV	02/08/99	TIDELANDS CONSTRUCTIONS CO
CHECKED			C12735 11.0
APPV'D			

Appendix B

GHD Antioch Forcemain Evaluation
1998 AFM 102 - Sect 02667 - Piping and Fittings
AFM-102 ARV Information

Memorandum

24 March 2014

To	Dean Eckerson, DDSD		
Copy to	Iver Skavdal, GHD		
From	Ted Whiton	Tel	707-540-9007
Subject	Antioch Force Main Evaluation	Job no.	84/10858/10

In August 2013 the District experienced a structural failure in one of its Antioch force mains (AFM102). The failure was due to significant crown corrosion at a local high point in the reinforced concrete cylinder pipe (CCP). After inspecting the pipe at several local high points the District installed CIPP liner at two locations totaling 1,100 linear feet. The pipeline was put back into service for the 2013/2014 wet season and the District intends to conduct a more thorough condition assessment in 2014 and line additional segments as needed. Previously the District lined 680 linear feet in AFM101 at its high point due to crown corrosion.

Winzler & Kelly (now GHD) was the designer of record for AFM102. After the pipe failure, the District engaged GHD in evaluating the Antioch force mains to determine probable cause(s) for the crown corrosion and recommend improvements that would allow the District to operate the dual force mains as intended while maximizing the service life of these critical assets.

EXISTING CONDITIONS

The District operates the dual pipelines in parallel with both force mains in operation at all times. The force mains have different alignments and profiles that create different hydraulic conditions in the two pipes. Table 1 provides a summary of the two pipelines. Figures 1 and 2 (attached) show the pipe profiles.

Table 1 – Antioch Force Main Attributes

Attribute	AFM101	AFM102
Year Constructed	1980	2000
Pipe Material	CCP	CCP
Inside Diameter	24"	24"
Length	13,590 lf	15,500 lf
Highest Invert Elevation	26 ft	32 ft
Number of Local High Points	4	9
Number of Active Air Valves	2	4

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Because of the differing attributes between the two force mains the flow split between them also differs, especially during dry weather flows. Based on actual flow measurements taken by the District in 2013 from July 28 through August 2 we were able to approximate the flow split between the two force mains for varying total flow rates as shown in Figure 3 (attached). During dry weather the total flow ranges between 3 and 7 MGD for about 84 percent of the time with an average flow of 5.4 MGD. The corresponding flow range for AFM101 is about 3 to 4 MGD and for AFM102 about 0 to 3 MGD.

In order to achieve a scouring velocity of 3 FPS in a 24-inch force main the flow rate must be at least 6 MGD. Neither force main achieves scouring velocity during dry weather months under normal operating conditions and AFM102 experiences especially low velocities. This leads to solids deposition at low points, increased sulfides in the wastewater as it ages, and more time with column separation at high points where hydrogen sulfide gas is oxidized within the slime layer which produces sulfuric acid, the primary cause of concrete deterioration. It appears that the low flow velocities during dry weather months, especially in AFM102, are the primary cause of crown corrosion that ultimately led to structural failure.

Both force mains were designed with a pig-launcher for cleaning which removes accumulated solids and reduces the slime layer on the inside of the pipe at the high points. The District reports that its current practice is to "pig" the force mains once every other year near the end of the dry season. In addition, the District currently flushes each force main on a quarterly basis for 72 hours by closing the valve to one force main and directing all flow through the force main being flushed. The flushing action helps to scour out accumulated solids from low points in the pipelines.

Options to Extend Service Life

The District could implement several options, alone or in combination, that would help to extend the service life of the Antioch force mains, including:

1. Install CIPP liner in all pipe segments showing signs of crown corrosion;
2. Pig both force mains annually;
3. Utilize a single force main in the dry weather season and fill the unused force main with recycled water while it is out of service; and/or
4. Install automated backpressure valves at the downstream end of the force mains to maintain full pipes at all times.

A summary of the advantages and limitations for each of these options is provided below.

Option 1 – Install CIPP Liner

This option consists of repairing and protecting the pipe segments prone to crown corrosion in both force mains. The District has already installed CIPP at three high points in the pipelines, one in AFM101 and two in AFM102. The District intends to take AFM102 out of service in April 2014 and install a camera at each high point and inspect upstream and downstream for crown corrosion. This same process should be

performed in AFM 101 in April 2015. Any pipe segments showing signs of crown corrosion should be lined as soon as possible.

The installation of CIPP liner in two locations in AFM102 in 2013 was completed as an emergency repair rather than a public bid process. This work was completed at a cost of about $350 per linear foot. The District might realize a lower unit cost with a higher quantity of liner and using a public bid process. The pipe segments that potentially need to be lined include:

- AFM101 Sta.112 – Sta. 123 (1,100 lf)
- AFM101 Sta. 144 – Sta. 146 (200 lf)
- AFM102 Sta. 32 – Sta. 40 (800 lf)
- AFM102 Sta. 49 – Sta. 55 (600 lf)
- AFM102 Sta. 60 – Sta. 64 (400 lf)

These segments total 3,100 linear feet of CIPP liner and at a unit cost of $350/lf would cost about $1.1 million for construction, plus engineering and administrative costs. Because one force main needs to remain in service at all times the work on the two force mains could be completed as two separate projects. This option is the most costly but provides assurance that the lined sections will restore structural integrity of the pipe segments and will protect against further damage from crown corrosion.

Option 2 – Pig Force Mains Annually

Pigging the force mains should be completed annually near the end of the dry weather season to clear the force mains of accumulated solids and to scrub away as much of the slime layer as possible from the pipe interior. This is not a capital project so the cost would come from the District's maintenance budget. The cost of a 24-inch foam pig designed for cleaning municipal force mains is under $1,000. Since the District already pigs one force main each year the added cost is for one more pig each year. This is a low cost option and provides benefits of keeping the force mains clean.

Option 3 – Utilize Single Force Main During the Dry Weather Season

A single force main can handle more than 12 MGD at a flow velocity of 6 FPS, and can easily handle current dry weather flows without the need for a second force main in service. Operating a single force main during dry weather is advantageous to achieve higher velocities to keep the pipe clear of accumulated solids and to reduce aging of the wastewater and subsequent sulfide generation. However, the pipeline that is not in service would need to be completely drained or thoroughly flushed with reclaimed water so that additional crown corrosion would not occur while it is out of service.

Alternatively the District could operate one force main at a time but switch force mains every 24 hours by operating the force main isolation valves at the Antioch Pump Station, which is essentially the same as what is currently done but on a much more frequent basis. This increased frequency would be difficult because the valves are manually operated; adding motor operators and connecting the controls to SCADA would facilitate the alternation of force mains and allow for minimizing when a second force main would be needed

to just when rain is imminent. Adding motor actuators to the force main isolation valves and programming SCADA for remote monitoring and operation would cost less than $500,000 for construction, plus engineering and administrative costs.

Option 4 – Install Automated Backpressure Valves

Crown corrosion in the force mains could also be addressed by installing pressure-sustaining valves at the downstream end of each of the pipelines. For AFM101 a new valve vault would be needed in Arcy Lane and for AFM102 a new valve vault would be needed near the headworks at the treatment plant. The valves would modulate to sustain the pressure in the force mains just upstream of the valves at a constant pressure of 10 PSI. This would ensure that both force mains would remain full at all times which would eliminate the oxidation of hydrogen sulfide gas in the slime layer along the pipe interior. The estimated cost of construction for the valves and vaults is approximately $600,000.

This option has a few disadvantages:

- Existing deterioration from crown corrosion would not be addressed
- The increased pressure would increase power usage at the Antioch Pump Station
- The valves and pressure transducers would require regular maintenance
- The valve vault in Arcy Lane is in a dangerous location for access by O&M staff

Depending on the results of further condition assessments at local high points in the force mains, additional CIPP lining could be required with this option to address deteriorated sections of pipe.

Transient Analysis

GHD modelled the dual force main system under a number of operational scenarios to evaluate predicted high and low transient pressures in each of the force mains. The operational scenarios included:

- Actual peak flow from data provided with single force main in operation
- Actual peak flow from data provided with both force mains in operation
- Existing PWWF (18 MGD) with both force mains in operation
- Buildout PWWF (27 MGD) with both force mains in operation

The model was based on information GHD was able to obtain from the original design of AFM102, information provided by the District regarding the location of CIPP liner, and actual flow and pressure data provided by the District from late July/early August 2013. A conservative approach was taken with respect to the calculated wave speed of the pipe material. It was assumed that all of the combination air/vacuum valves were in service and operational for the model runs so that their effectiveness could be assessed. The predicted low and high transient pressures for the two force mains are provided in Table 2 below.

Table 2 – Predicted Max/Min Transient Pressures in AFM 101 and AFM102

Operational Scenario	AFM101 Max	AFM101 Min	AFM102 Max	AFM102 Min
Actual (10 MGD), AFM101	152 PSI	-14.4 PSI	n.a.	n.a.
Actual (6 MGD), AFM102	n.a.	n.a.	143 PSI	-14.5 PSI
Actual (15 MGD), Both FMs	184 PSI	-17.3 PSI	207 PSI	-17.3 PSI
PWWF (Existing), Both FMs	177 PSI	-17.3 PSI	213 PSI	-17.3 PSI
PWWF (Buildout), Both FMs	213 PSI	-17.3 PSI	251 PSI	-17.3 PSI

Based on information provided by Ameron, the supplier for AFM102, GHD believes the CPP pipe has a pressure rating of at least 200 PSI based on the steel cylinder thickness (0.1046 inch) and reinforcing bar diameter (0.3125 inch). This translates to a calculated collapse strength of 612 PSI and a pressure rating with transients of 300 PSI. The predicted maximum and minimum transient pressures are within the pressure rating limits of AFM102.

The combination air/vacuum valves do not have much of an impact in reducing the maximum transient pressures, especially for the higher flow rates modelled. Instead the air valves allow the pipe to "breathe" when filling and draining and allowing column separation at high points during low flows. The District currently operates the force mains with some of the combination air/vacuum valves out of service and this should not compromise the pipelines as far as transients are concerned.

Recommendations

GHD recommends that the District implement Options 1 and 2 immediately, with lining of AFM102 completed in 2014 and in AFM101 in 2015. Option 3 would also be beneficial over the long term but requires installation of motor actuators on the force main isolation valves at the Antioch Pump Station; this project could wait until the next pump station improvement project at the facility.

Let me know if you have questions or want to meet to discuss our evaluation and conclusions.

Regards,

Ted Whiton
USA West Operations Manager

GHD

Figure 1.

Client DDSD | Job Number 84108858 | Sheet of

Project Antioch Force Main Evaluation | Sheets by T. Whiten | Date 27 Feb 2014

Subject AFM 101 Profile | Checked by | Date

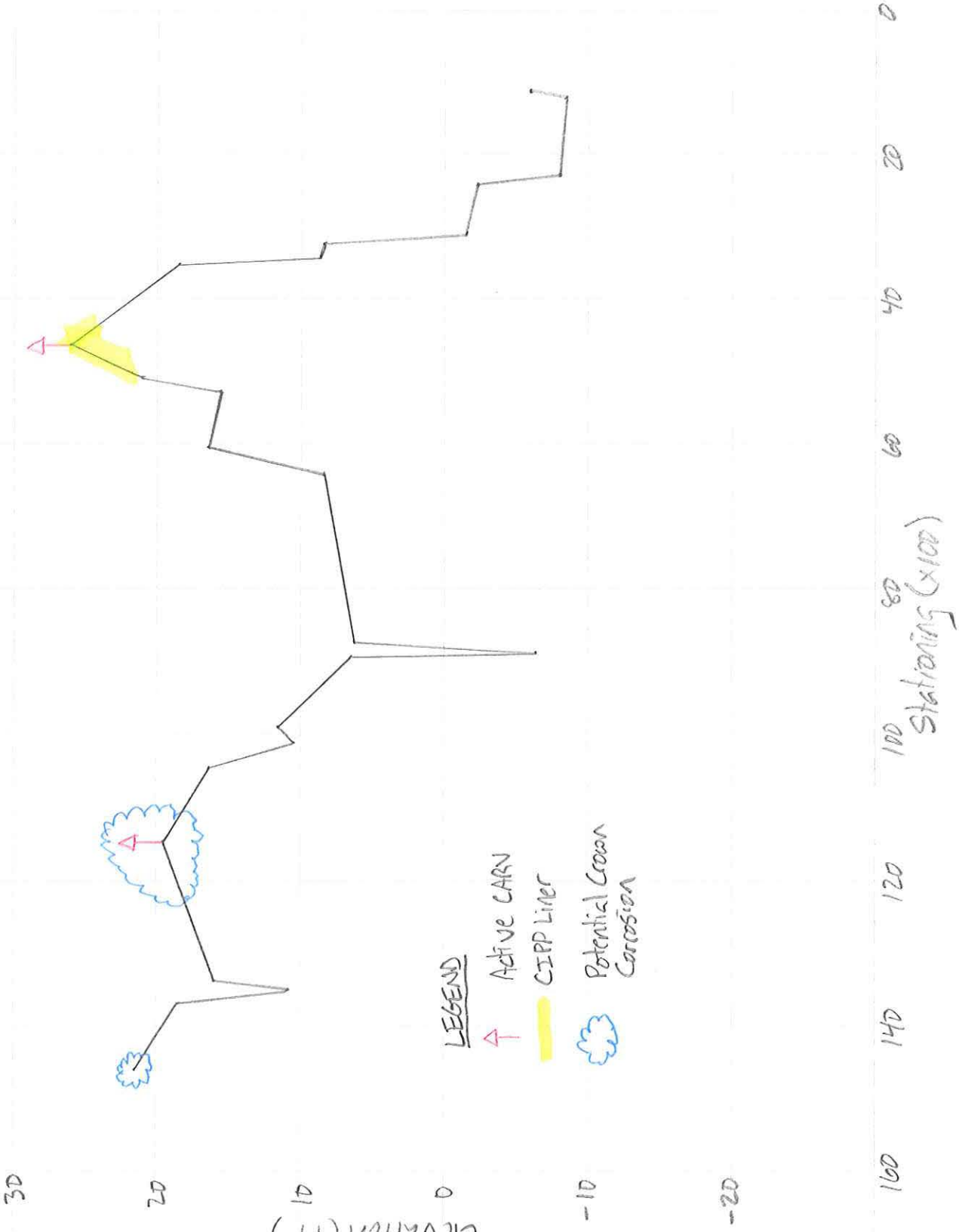


Figure 2.

Client DDSD | Job Number 8410856 | Sheet of

Project Antioch Force Main Evaluation | Sheets by T. Whiten | Date 27 Feb 2014

Subject AFM102 Profile | Checked by | Date

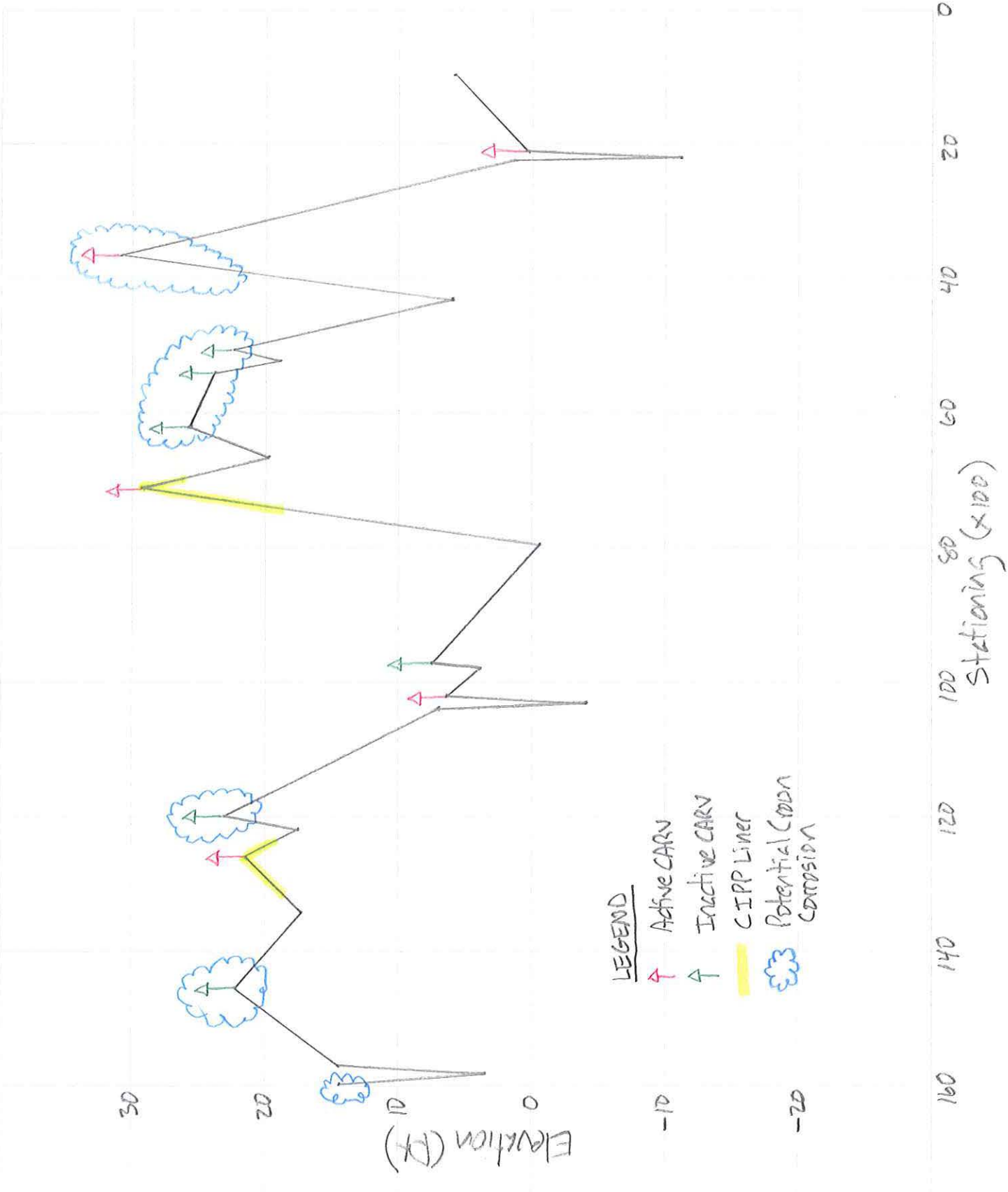
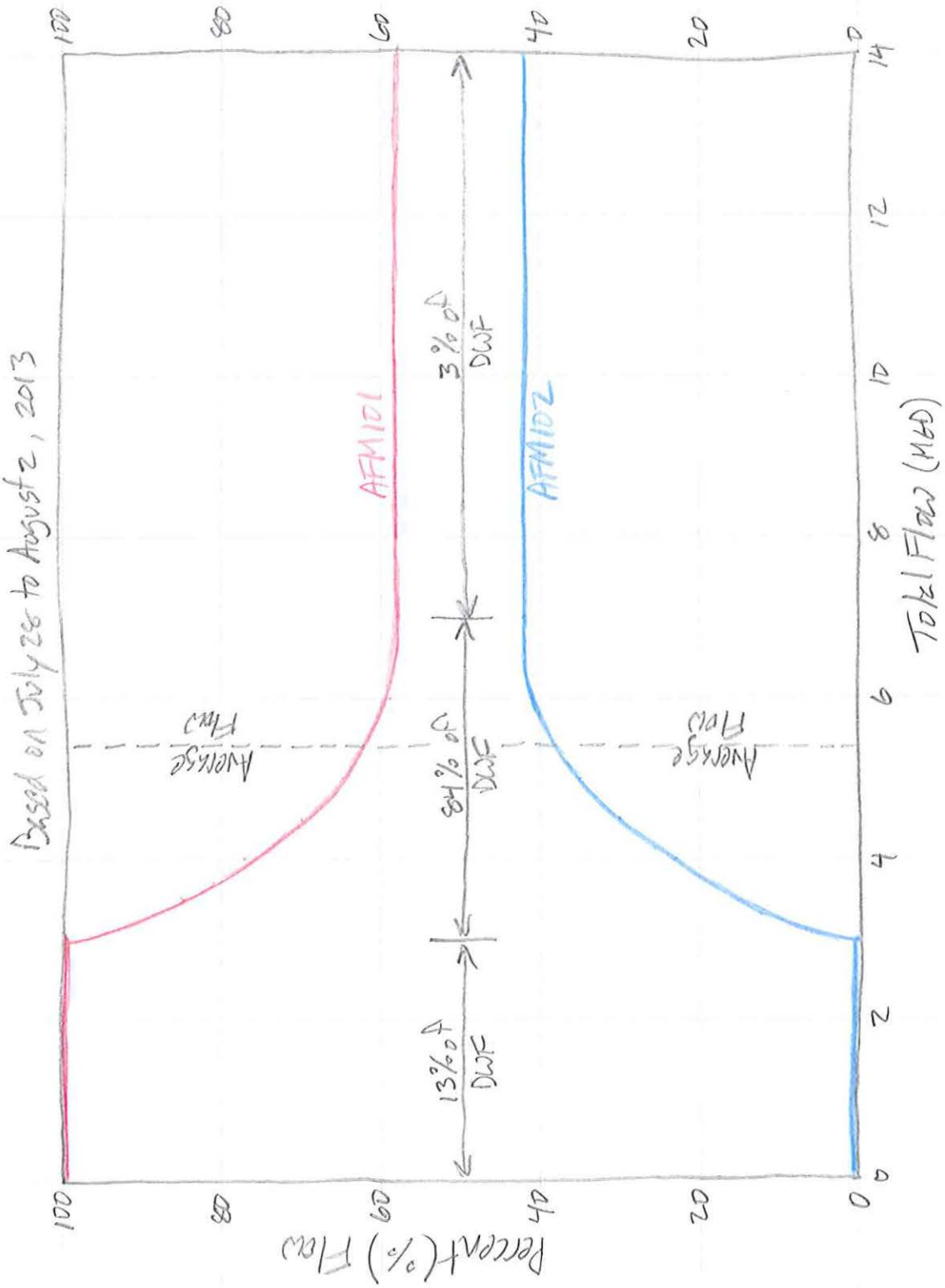


Figure 3.

Client DDSD	Job Number 8410858	Sheet	of
Project Antioch Force Main Evaluation	Sheets by J. Whiton	Date 27 Feb 2014	
Subject Force Main Flow Split	Checked by	Date	



SECTION 02667

PIPING AND FITTINGS

PART 1 GENERAL

1.1 DESCRIPTION

A. Work included: This section includes the supply, installation, and testing of, but is not necessarily limited to:

1. Sewage force main
2. Steel casings
3. Pig launcher piping and drains
4. Oxygen supply piping
5. All other piping items indicated on the Plans, specified herein, or needed for a complete and proper piping installation in accordance with all pertinent codes and regulations.

B. Related work described elsewhere:

1. Section 01530 – Protection and Restoration of Existing Facilities
2. Section 02160 - Shoring and Trench Safety
3. Section 02220 - Trench Excavation and Backfill
4. Section 11200 – Pig Launching Equipment
5. Section 15100 - Valves and Appurtenances
6. Section 16111 - Conduit

1.2 QUALITY ASSURANCE

A. Standards: The materials and work performed in this Section shall conform to the applicable standards of:

1. The American National Standards Institute (ANSI)

2. The American Society for Testing and Materials (ASTM)

3. American Water Works Association Inc. (AWWA)

4. Uniform Plumbing Code (UPC)

B. Qualification of manufacturers

1. The material shall be the product of a supplier regularly engaged in the manufacturing of pipe.

2. All materials shall be new and of current manufacture and shall be guaranteed against defects or workmanship in accordance with the General Conditions.

1.3 SUBMITTALS

A. Submit in accordance with Section 01300, Submittals.

B. Material list: In accordance with the provisions of Section 01300 of the specifications, submit with the shop drawings a complete list of all materials and equipment proposed to be furnished and installed under this portion of the work, giving manufacturer's name, catalog number, and catalog cuts for each item where applicable. Details of bulkhead, flanges, caps or other items required for hydrostatic testing of pipe shall be included in submittal.

C. Submit design calculations certified by a registered California professional engineer (concrete cylinder pipe only).

D. Submit shop drawings including detail drawings and tabulated layout schedule. CONTRACTOR must field verify existing utility locations prior to shop drawing submittal for any given reach of pipeline.

E. Submit certification of conformance with the appropriate standard.

F. Submit CONTRACTOR'S welding procedure specifications for field welded joints.

G. Submit Welder's qualifications for field welded joints.

H. Submit field testing plan including complete layout of testing equipment and proposed sequence of testing.

PART 2 PRODUCTS

2.1 GENERAL

A. These specifications are intended to be standard specifications and they may therefore contain specifications for materials not required for this project or allowed on any or various parts of it. Certain materials which are applicable for only one portion or a small portion may be shown on the plans and not particularly specified herein.

B. All materials shall conform to sizes, capacity, quality and quantities as shown on the drawings or described in these Specifications. Materials shall be from new stock, delivered in good condition. No damaged stock shall be used.

C. Where no method of tests for materials is specified, the latest applicable test specified by ASTM shall be followed.

D. After delivery to the site, all materials shall be carefully unloaded, protected against breakage, rusting, accumulation of foreign matter, disintegration and injury. The CONTRACTOR shall be responsible for all lost or damaged material supplied and work done under this contract.

2.2 REINFORCED CONCRETE CYLINDER PIPE

A. Reinforced Concrete Cylinder Pipe (RCCP) shall be designed, manufactured, tested and inspected in accordance with AWWA C303 – 95, Concrete Pressure Pipe, Bar Wrapped, Steel Cylinder Type. The pipe shall consist of a welded steel cylinder, centrifugally cast concrete or cement-mortar lining, a continuous mill steel reinforcing bar helically wrapped around the cylinder, and cement-mortar coating over the steel cylinder and bar reinforcement.

B. Manufacturer shall design all pipe and fittings for the following conditions:

1. Maximum Working Pressures: 65 psig.

2. Maximum Working Pressure Plus Transient Pressure: 65 psig.

3. Test Pressure: 100 psig.

4. Minimum Static Pressure: - 10 psi.

5. Backfill Loading: 6220 lbs./LF. Pipe calculations shall verify actual design requirements, and be included in submittal.

6. Live Load: 640 pounds/LF.

C. Joint Rings: In accordance with AWWA C303-95.

D. Castings, forgings, and flanges: Steel castings shall conform to ASTM A27 (Grade 70-36, normalized). Forgings shall conform to ASTM A181 (Grade I or II). Flanges shall conform to ANSI/AWWA C207. Flanges 12 inches in diameter or smaller may be slip-on welding flanges conforming to ANSI B16.5.

E. Gaskets: Gaskets for joints shall be continuous rings made of a composition of natural or synthetic rubber free of reclaimed rubber, improper mixing compounds, or any other deleterious compound. The cross-section of gasket shall be circular with a diametrical tolerance of plus or minus 0.016 inch. Surfaces and cross section of gaskets shall be smooth and free from pits, cracks, blisters or other imperfections.

F. Testing Steel Cylinders: In accordance with AWWA C303-95.

G. Fittings: In accordance with AWWA C303-95.

H. Markings: The following shall be stenciled on each pipe section.

1. Pressure Class.

2. ID in inches.

3. Name of Manufacturer.

4. Date of Manufacturing.

2.3 STEEL PIPE

A. Welded and seamless steel pipe shall be liquid epoxy coated and lined per AWWA C210, latest addition, new pipe conforming to AWWA C200-91. Coating and lining shall be performed by the pipe fabricator.

B. Pipe wall thickness shall be designed by the pipe fabricator. Unless shown otherwise on the drawings, designs shall be for a working pressure of 145 psi and a test pressure of 200 psi. In no case shall the wall thickness be less than 3/16".

C. Mitered bends shall be fabricated with a minimum of two miters.

D. Flanges for fittings shall be AWWA C207-94 Class D with gaskets suitable for potable water and the pressures given above.

E. Where restraining harnesses are used, minimum pipe wall thickness is given in the drawings.

2.4 STEEL CASING PIPE

A. Casing pipe locations and diameters shall be as shown on the Drawings.

B. Casing pipe shall be in accordance with AWWA C200. Wall thickness shall be minimum 3/8-inch.

C. Casing insulators and skids shall be manufactured from high quality, high density (linear) injection molded polyethylene, conforming to minimum strengths defined by ASTM D693, D638, and D651. Minimum band width of casing insulator shall be 8 inches. Insulators shall be as manufactured by Calpico, Inc., PSI Industries, Model PE, or equal.

D. Casing End Seals shall be provided at each end of the casing pipe. Each seal shall be provided with stainless steel bands. End seals shall provide a tight, waterproof seal. End seals shall be as manufactured by Calpico, Inc., PSI Industries, Model W, or equal.

2.5 DUCTILE IRON PIPE

A. Where indicated on the drawings, cast iron pipe shall be interpreted to mean ductile iron pipe.

B. Ductile iron pipe shall be designed in accordance with ANSI Specification A21.51 (AWWA C151-76). Joints shall be mechanical joints for underground and flanged for aboveground, or within vaults or at fittings/valves, unless specifically indicated otherwise on the Plans. The CONTRACTOR will be allowed to substitute a Tyton push-on joint, as manufactured by the United States Pipe and Foundry Co., and the Pacific States Piping Foundry Co., or equal, for the mechanical joint. Push-on joints shall be restrained at elbows, fittings, reducers, and increasers. Where shown on the Plans, restrained

push-on joint (TR-Flex) pipe and fittings, as manufactured by U.S. Pipe or approved equal, shall be used. All ductile iron pipe shall be pressure Class 300 unless otherwise called for in the plans or specifications.

C. All pipe and fittings shall be cement lined with Type V cement mortar lining, sulphate and acid resistant cement, per AWWA C-104.

D. Mechanical Joints and push-on joints shall conform to ANSI A21.10 and rubber gaskets shall conform to ANSI A21.11.

E. Flanged joints shall conform to ANSI B16.1, 125 pound flat faced. All flanged pipe shall be thickness class 53 (minimum) and shop fabricated to the exact lengths required so that no field cutting or threading is required. All flanges shall be firmly attached in the shop.

F. Gasket material for flanged joints shall be 1/8-inch thick, cloth-inserted rubber, one piece, full faced with holes to pass bolts. Gasket material shall be free from corrosive alkali or acid ingredients and suitable for use in water lines.

G. Ductile iron pipe used in conjunction with grooved coupling fittings shall have a wall thickness sufficient to permit cutting a groove of the depth required to accommodate the coupling and to maintain the required pressure rating of the pipe.

H. The exterior surface of ductile iron pipe, fittings, and wall pipes for installation underground or in vaults shall have a factory-applied bituminous coating as specified in ANSI A21.51.

I. Fittings for ductile iron pipe shall conform to ANSI A21.10.

J. Coat all mechanical joint bolts with bituminous coating.

2.6 BOLTS FOR ABOVEGROUND DUCTILE IRON

A. Bolts and nuts for aboveground ductile iron couplings shall be low alloy steel (ASTM A 193). The alloy composition shall be such that the bolts are cathodic to the coupling.

B. When bolting steel flanges to cast iron flanges, bolting shall not be stronger than carbon steel per ASTM A 307, Grade B.

2.7 POLYETHYLENE ENCASEMENT

All buried cast iron, ductile cast iron, and mill-type steel pipe, shall be encased in an eight (8) mil polyethylene wrap. All buried fittings and appurtenances shall be double encased in an eight (8) mil polyethylene wrap. Polyethylene wrap shall be manufactured and installed in conformance with ANSI A21.5.

2.8 PVC PIPE (SCH 80)

A. PVC pipe 1/2-inch through 4-inch shall be Type 1, Grade 1 or Class 12454-B, conforming to ASTM D1784 and ASTM D1785. PVC pipe over 4 inch shall be Schedule 80 unless specifically called out otherwise on the plans.

B. Fittings shall be Schedule 80 conforming to ASTM D2467 or ASTM D2464.

C. Provisions for expansion shall be as recommended by the pipe manufacturer.

2.9 GALVANIZED STEEL PIPE

A. Galvanized steel pipe shall be Schedule 40, ASTM A120, Grade A with galvanized 150 pound malleable iron screwed fittings meeting ASTM A197 with dimensions conforming to ANSI B16.3. Unions shall be 300 pound galvanized malleable iron meeting ASTM A197, dimensions conforming to ANSI B16.9. All buried pipe shall be tape wrapped. All exposed pipe shall be coated with a primer and final coat. Pipe surface to receive coating shall be prepared in accordance with pipe manufacturer instructions.

B. All buried pipe, fittings, and valves shall be tape wrapped. For pipelines above grade, the coating shall extend 6 inches above the finished grade elevation. Joints shall be primed and spirally wrapped with a four-inch wide polyethylene backed, butyl rubber, adhesive tape. The joint tape shall be 35 millimeters thick and shall be specifically for hand or machine wrapping of joints. The primer shall be as recommended by the tape manufacturer. The tape shall overlap the pipe coating a minimum of six inches, and each wrap shall have a minimum overlap of two inches.

2.10 COPPER PIPE

Copper pipe shall be seamless copper, conforming to ASTM B88, Type K, unless otherwise noted. Buried pipe shall be tape wrapped per 2.9B.

2.11 FLEXIBLE COUPLINGS AND FLANGE COUPLING ADAPTORS

Couplings shall be of the style and type recommended by the manufacturer and approved by the ENGINEER. Size shall be compatible to the outside diameter of the pipes on which the coupling is installed as shown on the Plans. In many instances the couplings are used to attach pipes of different materials and different outside diameters. Thrust ties shall be installed when called out on the Plans and shall be designed and installed in accordance with the AWWA Manual M11 for Steel Piping. The thrust ties shall be designed for the test pressure as specified. All buried bolts, nuts and washers shall be stainless steel. Lengths for flexible couplings shall be the standard length unless otherwise shown on the plans. Flexible couplings shall be as manufactured by Dresser Industries, R.H. Baker, Inc., or equal.

2.12 BOLTS FOR UNDERGROUND PIPE

Bolts and nuts for underground connections shall be 316 stainless steel, ASTM A 193, Grade B8M hex head with ASTM A 194, Grade 8M hex nuts. Plastic washers and sleeves for dielectric joints shall be provided. CONTRACTOR shall take care to not seize on threads.

2.13 WARNING TAPE

Plastic warning tape shall be acid and alkali-resistant polyethylene film. Warning tapes shall be placed, as shown on the Drawings.

A. Warning tape for the sewer force main shall be green, six-inches wide, and printed continuously with the words: CAUTION BURIED SEWER PRESSURE MAIN BELOW.

B. Warning tape for the fiber optic conduit shall be orange, six-inches wide, and printed continuously with the words: CAUTION BURIED FIBER OPTIC CABLE BELOW. Warning tapes shall be installed at the location shown on the plans.

C. Warning tape for oxygen line shall be red, six-inches wide and printed continuously with the words: CAUTION BURIED OXYGEN LINE BELOW. Warning shall be placed 12-inches above the oxygen piping.

2.14 BLIND FLANGE

A. Blind flange shall conform to the requirements of AWWA C207-94.

B. Blind flanges shall be installed where shown on the Drawings.

2.15 INSULATING FLANGE

A. Insulating flanges shall conform to the requirements of AWWA C207-94.

B. Insulating flanges shall be installed where shown on the Drawings.

2.16 END PLUG

A. End plug shall be placed at the end of the force main, as shown and detailed on the drawing. Connection to the force main shall be by tack welding at sufficient number of points around the pipe to ensure a solid connection. The plug should be sufficient size to fully cover the end of pipe and keep out dirt, dust, water and animals.

2.17 OXYGEN SERVICE

A. Oxygen piping shall be PVC Schedule 80.

2.18 PRESSURE RELIEF VALVE

Pressure relief valve shall be direct-acting, adjustable, spring loaded and designed to permit flow when pressure exceeds the spring setting. The valve shall be diaphragm actuated globe valve.

2.19 OXYGEN SUPPLY AND CONTROL SYSTEM

The oxygen supply for the new pipeline shall be taken from the existing oxygen supply at the Antioch Pump Station, as shown on the Drawings. The control system shall consist of a control panel and all valves and appurtenances as shown on the Drawings. The control system shall be mounted on a pipe rack adjacent to the oxygen tank. The CONTRACTOR shall be responsible for design and installation of complete oxygen systems including, but not limited to, piping, fittings, valves, electrical and controls. CONTRACTOR shall submit shop drawing prior to fabrication showing all components and locations for complete oxygen system.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that all pipe may be installed in accordance with all pertinent codes and regulations, the original design, and the referenced standards.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the ENGINEER.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 HANDLING

A. The CONTRACTOR shall provide and use proper implements, tools and facilities for the safe and proper handling and protection of the pipe, all as recommended by the manufacturer. Pipe shall be handled in such a manner as to avoid damage to the pipe material or any coating and especially to the ends.

B. When damaged pipe cannot be repaired to the satisfaction of the DISTRICT, it shall be removed from the job.

C. Pipe shall be stored in a safe location, protected from the elements where damage therefrom could result.

D. The pipe shall be carefully lowered in the trench to prevent damage. Under no circumstances shall pipe be dropped or dumped into trenches. Remove foreign matter and dirt from the inside of the pipe and keep it clean during and after laying.

E. The CONTRACTOR shall take care to keep from damaging the pipe by heavy loads and unnecessary compactive effort especially for shallow lifts. All damaged pipe shall be replaced. Normally, repairs will not be acceptable.

3.3 INSTALLATION

A. General: Install all pipes in strict accordance with plans, profiles, typical sections and with manufacturers' recommendations as approved by the ENGINEER.

B. Pressure pipe: Pressure pipe shall be laid in accordance with plans and profiles and typical sections. Before new pipe is placed the subgrade material shall be graded so that pipe will rest on firm subgrade material for its full length, as shown in the details on the Drawings.

In general, this should be accomplished by over-excavation, adding stabilization material as required, the inclusion of imported bedding material as shown on the plans. All adjustments to line and grade shall be made by scraping away or filling in the bedding to the body of the pipe and in no case by wedging or blocking. Pipe shall be laid on an unyielding foundation to proper line and grade with uniform bearing under the full length of the pipe with slight hand excavation for the coupling to allow for its thickness.

1. Where soft or spongy conditions are encountered in the trench at pipe subgrade, this foundation situation shall be corrected by the use of imported stabilization material as specified in Section 02220, Trench, Excavation and Backfill.

2. All pipe, especially the ends, shall be carefully cleaned before the pipe is joined. Whenever work ceases for any reason, the end of the pipe shall be closed with a water-tight fitting, plug or cover. The interior of the pipe shall be kept free from dirt, foreign material or debris as the work progresses and the pipe shall be cleaned after completion.

3. Pressure line shall be laid to the line and grade shown on the plans. In instances where grade shows constant uphill grade to structures or air relief valve, the CONTRACTOR shall take all precautions necessary to secure continual smooth alignment to such appurtenances.

3.4 PROTECTION, BARRICADES, ETC.

Pipe strung out along the trench or stored where it can be damaged or where injury may result to children or the public shall have special precautions taken to prevent damage from occurring. Pipe shall not be spread along trenches for extended periods prior to its actual use. Pipe shall be stored in a safe location out of the traveled way and properly barricaded with suitable lights provided to prevent vehicular damage.

3.5 LAYING, BEDDING

A. All buried pipe shall be laid on a prepared bed as herein before specified. After laying, additional bedding material shall be added to a depth of approximately the mid-point of the pipe depending upon diameter, after which it shall be tamped with a suitable tool to secure uniform full length bedding up to the mid-point of the pipe. Additional pipe zone material shall then be placed to the depth shown in the standard details of the plans and compacted by mechanical methods to a relative compaction of 90 percent.

B. Take necessary precautions to prevent uplift and floating of the pipe prior to backfilling.

C. Water in trenches shall be removed by pumping.

3.6 CASING PIPE

A. The method for installing casing pipe at all locations where casing pipe is shown shall be jacking into place. The carrier pipe shall be installed in the casing on insulators or skids which prevent the pipe bells from touching the casing and which align the pipe to meet the grade specified. The final grade of the carrier pipe through the casing pipe shall be reviewed and approved by the ENGINEER. Insulators shall be installed at every pipe joint and at a maximum spacing of 7 feet center to center. An insulator shall be placed within 2 feet of each end of casing pipe.

B. It is the CONTRACTOR's responsibility to locate and design jacking pits and receiving pits, excavation method, number and location of intermediate jacking stations, jacking thrust reaction structure, and all other items required for successful completion of the Work, and to pay all costs associated with securing permits or access to right-of-way or any other related costs.

C. Jacking pits of adequate size shall be excavated, and suitable backstops constructed therein to provide stable backing for hydraulic jacks. All excavations shall comply with California Division of Industrial Safety and Federal OSHA requirements. Following completion of pipe installations, jacking pits shall be backfilled and compacted to pre-existing grade.

D. All earthwork for jacking pits for casing pipes shall be done in accordance with Section 02200, Earthwork, except as modified below.

1. Dimension of pits for casing pipes shall be as required for sheeting and bracing and for proper performance of the Work.

2. All work in jacking pits for casing pipes shall be carried out in strict accordance with the requirements of all concerned regulatory agencies and affected parties. A summary of the permit conditions required is given in Section 01040, Coordination. This list is meant as a guideline and the CONTRACTOR shall be responsible to adhere to all conditions given in the actual permits issued at the time of the Work.

E. Cathodic protection for steel casing pipes shall be as described in Section 02655, Cathodic Protection.

F. Traffic control measures including K-rail and fencing for jacking pits shall be included in the submittals as described and required in Section 01570, Traffic Regulation.

3.7 CUTTING PIPE

A. General: Cut pipe for inserting valves, fittings, closure pieces, and as otherwise required, in a neat and workmanlike manner without damaging the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe.

B. Cast iron and ductile iron pipe: Cut pipe with milling-type cutter, rolling pipe cutter, abrasive saw cutter, or with sledge and cold cutter. Do not flame cut.

C. Dressing cut ends:

1. Dress cut ends of pipe in accordance with the type of joint to be made.

2. Dress cut ends of mechanical joint pipe to remove sharp edges or projections which may damage the rubber gasket.

3. Dress cut ends of push-on joint pipe by beveling, as recommended by the coupling or adapter manufacturer.

3.8 APPURTENANCES

A. General: See plans for location of valves and appurtenances to be installed as a portion of the sewer force main. The CONTRACTOR should note that generally, valves that are clustered are flange by flange with the entire cluster properly bolted together. Valves and other appurtenances having hub ends shall be connected to the pipe by means of rubber rings of the same type used to join the pipe.

B. Joining mechanical joint pipe: Mechanical joint pipe varies slightly with different manufacturers. Install the particular pipe furnished in accordance with the manufacturer's recommendations as approved by the ENGINEER.

C. Joining push-on joint pipe: Join pipe with push-on type joints in accordance with the manufacturer's recommendations as approved by the ENGINEER. Provide all special tools and devices, such as special jacks, chokers, and similar items required for the installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, and no substitutes will be permitted.

D. Joining flanged joint pipe: Prior to connecting flanged pipe, the faces of the flanges shall be thoroughly cleaned of all oil, grease, and foreign material. The rubber gaskets shall be checked for proper fit and thoroughly cleaned. Care shall be taken to assure proper seating of the flanged gasket. Bolts shall be tightened so that the pressure on the gasket is uniform. Torque-limiting wrenches shall be used to insure uniform bearing insofar as possible. If joints leak when the hydrostatic test is applied, the gaskets shall be removed and reset and bolts re-tightened.

3.9 CLEANING

Care shall be taken to keep the pipe clean at all times during the installation. Prior to testing the pipe shall be flushed so that the velocities of five feet per second are obtained sufficient to clean the entire length of pipe.

3.10 TESTS

A. General: Upon completion of this portion of the work, and prior to its acceptance make all required tests and secure all required approvals from agencies having jurisdiction.

B. Hydrostatic testing:

1. General: Conduct pressure and leakage tests on all pipelines. Furnish all necessary equipment and material and make all taps in the pipe as required. The ENGINEER will monitor the tests. All pipe testing is to be hydrostatic. Furnish the following equipment and materials for the tests:

Amount	Description
2	Approved graduated containers
2	Approved pressure gauges
1	Hydraulic force pump approved by the ENGINEER. Suitable hose and suction pipe as required

Gauges for testing shall be calibrated with a standardized test gauge provided by the ENGINEER at the start of each testing day. The calibration shall be witnessed by the ENGINEER.

Conduct the tests on buried pipe after the trench has been completely backfilled. The CONTRACTOR may, if field conditions permit, partially backfill the trench and leave the joints open for inspection and conduct an initial test. The acceptance test shall not, however, be conducted until all backfilling has been completed. Conduct the tests on exposed piping after the piping has been completely installed, including all supports and hangers.

2. Pressure pipe procedure: After the pipe has been laid and backfilled and final compaction has been obtained, the CONTRACTOR shall test pressure pipe. The CONTRACTOR shall submit methods for testing pipe as part of the submittal defined in Paragraph 1.3H. The pipe shall be slowly filled with water so that air is removed and the pipe shall be tested hydrostatically to a pressure of 100 psi for a minimum of one hour. Reaction blocking pipe restraints and the like shall be installed prior to test.

   All exposed pipe, fittings, valves and joints shall be examined during the test for seepage or other defects. Defects noted by this test shall be removed and replaced by the CONTRACTOR with sound material. Afterwards, the test shall be repeated to the satisfaction of the ENGINEER.

   In addition, a leakage test shall be conducted after the pressure test has been satisfactorily completed. The duration of each leakage test shall be two hours and during the test the main shall be subjected to a pressure of 100 psi unless elsewhere specified. Leakage shall not exceed 10 gallons per day per inch diameter per mile for the duration of the test.

   If any test discloses leakage greater than specified, the CONTRACTOR shall at his own expense locate and repair the defective joints until the leakage is within the specified allowance.

3. Requirements for exposed pipelines: All exposed pipelines shall have no visible leakage during the specified test period. Any exposed pipeline with leakage shall be repaired or replaced.

3.11 REPAIRS

A. Only new pipe free from defects shall be installed. Portions of broken pipe or short lengths may be used providing they are properly cut back and used as stubs, or short lengths required at structures for flexible joints.

B. Broken or leaking sections of pipe must be replaced. Repair clamps will not be approved.

3.12 FIELD JOINTS FOR RCCP

A. Field joints: Field joints shall be completed in accordance with Appendix A of AWWA C205.

3.13 FINAL CLEANING

Prior to final acceptance all pipelines installed under this Section shall be flushed out of all accumulated construction debris and other foreign matter removed. Cleaning shall be done in a manner that will keep flushed debris from entering equipment, reservoir, and in a manner approved by the DISTRICT. Flush through hydrants, or other outlets. Try to provide a pipe velocity of 5 feet per second, 2.5 feet per second minimum.

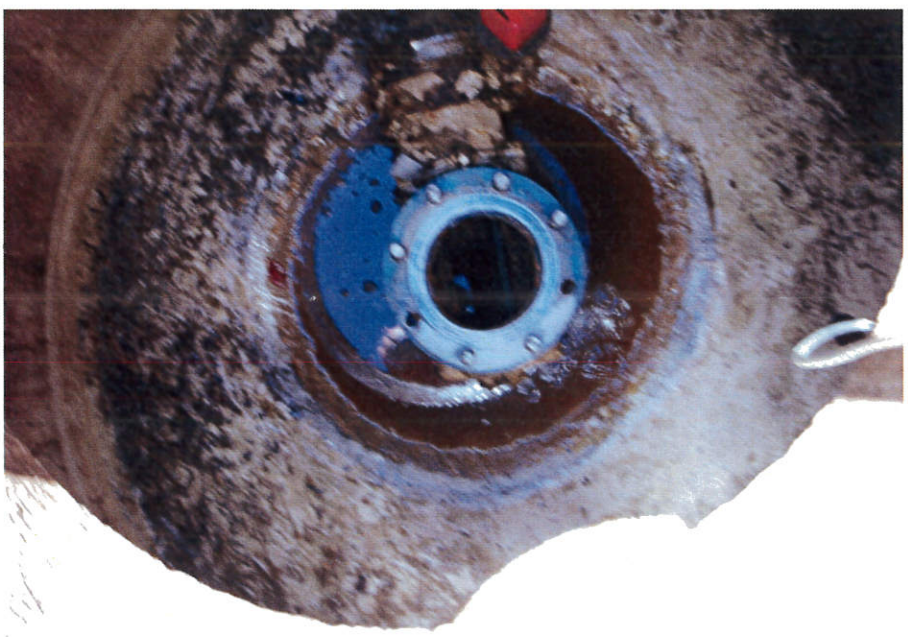
END OF SECTION

* * * * *

ARV INFORMATION FOR AFM102

ASSET #	Station	LOCATION	VAVLE SIZE	ACTIVE?	COMMENTS
ARV3004	21+02	Wilbur Avenue	6"	**Active/WK**	This ARV comes in from the side of the FM and can be tied into a gravity sewer
ARV3005 Manway	36+51	Wilbur Avenue	4"	**Active/WK**	This ARV sits on top of the FM and has a Smart Cover monitoring system.
ARV3006	50+44	Seventh Street	2"	**Active/WK**	This ARV sits on top of the FM and can be tied into a gravity sewer
ARV3007	53+86	Seventh Street	2"	**Active/WK**	This ARV sits on top of the FM and can be tied into a gravity sewer
ARV3008	62+74	Seventh Street	6"	**Active/WK**	This ARV sits on top of the FM and can be tied into a gravity sewer
ARV3009	71+30	Seventh Street	6"	**Active/WK**	This ARV sits on top of the FM and it's tied to the sanitary main to prevent an overflow
ARV3010	97+19	Seventh Street	2"	**Inactive**	This ARV sits on top of the FM and can be tied into a gravity sewer
ARV3011	101+81	Sixth Street	6"	**Active/WK**	This ARV comes in from the side of the FM and has a Smart Cover Monitoring System. Can be tied into a gravity sewer
ARV3012	119+60	Auto Center Drive	6"	**Active/WK**	This ARV sits on top of the FM and can be tied into a gravity sewer
ARV3013 Manway	125+76	West 10th Street	6"	**Inactive**	This ARV sits on top of the FM and has a Smart Cover monitoring system. Can be tied into a gravity sewer
ARV3014	145+40	West 10th Street	6"	**Active/WK**	This ARV sits on top of the FM and has a Smart Cover monitoring system.

ARV3004



- Proposed 6" CARV

- Remove & Cap

ARV3005

ARV3006

ARV3007

ARV3008

ARV3009

ARV3011

ARV3012

Appendix C

Antioch Force Mains 101 & 102 Condition Assessment Report (V&A)

Delta Diablo Sanitation District

Antioch Force Mains 101 and 102 Condition Assessment

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Reviewed by: Glenn Willson, P.E.

Date: April 15, 2020

V&A consulting engineers

V&A Project No. 20-0032

1 Executive Summary

V&A Consulting Engineers (V&A) was retained by V. W. Housen & Associates (VWHA) to assist with condition assessment of the Antioch Force Main system, which is owned and operated by the Delta Diablo Sanitation District (District) in Antioch, California. There are two force mains: Antioch Force Main 101 (AFM101), constructed circa 1980; and Antioch Force Main 102 (AFM102), constructed circa 2000. Past failures on AFM102 indicate that high points along the force main alignments may be susceptible to internal corrosion caused by hydrogen sulfide.

For this project, excavation locations were selected, including high points that have yet to be rehabilitated by the District. The District hired a contractor to perform the excavations and allow V&A to gain access to the crown of the pipe at each location. Nine excavation locations were evaluated. Visual evaluation and ultrasonic thickness testing were performed to determine the condition of the bar-wrapped concrete pressure pipes. Sulfide sampling at the pump station was also conducted to determine the potential corrosivity of the wastewater. The field testing was completed in March and April 2020.

Based on the findings from this condition assessment project, V&A developed the following conclusions, which are discussed in greater detail in Section 5:

1. **AFM101:** AFM101 was evaluated at one excavation. Based on the visual assessment and ultrasonic thickness testing, the pipe is in good condition at this location. Deterioration of the mortar coating may be occurring, but it has not allowed measurable steel thickness loss to occur to date. The condition of the lining is unknown.

2. **AFM102:** AFM102 was evaluated at eight excavations. Based on the visual assessment and ultrasonic thickness testing, the pipe is generally in good condition at these locations. There was minor surface corrosion on the cylinder at some locations, but it has not allowed measurable steel thickness loss to occur to date. The condition of the lining is unknown. One location on AFM102 exhibited a dent in the steel cylinder. This dent could have caused the mortar lining to delaminate, but there was no way to determine the condition of the lining during the field testing.

3. **Sulfides and potential for corrosion:** The wastewater and gaseous sulfide measurements show a high potential for odors and corrosion at high points within the force mains if air pockets are allowed to collect. This is consistent with the previous AFM102 failures, which were determined to be caused by corrosion at high points.

4. **Remaining service life:** There is no way to quantify the remaining service life for the force mains based on the data collected for this project. It is possible that corrosion could be occurring at other locations that were not tested. Also, if the lining is damaged at any of the test locations, particularly Location 14 where a possible damage mechanism was found, corrosion could begin to occur. It is not possible to determine whether or how fast this will occur.

2 Introduction

V&A was retained by VWHA to assist with condition assessment of the Antioch Force Main system, which is owned and operated by the District in Antioch, California. Past failures indicate that high points along the force main alignments may be susceptible to internal corrosion. Excavation locations were selected, including high points that have yet to be rehabilitated by the District. Ultrasonic testing was performed to determine the remaining wall thickness on the steel cylinder of the bar-wrapped concrete pressure pipes. The field testing was completed in March and April 2020.

2.1 Scope of Condition Assessment

V&A's scoped for the condition assessment included reviewing the record drawings and failure history, testing remaining pipe cylinder wall thickness in excavations, providing engineering analysis of the results, and providing as-needed technical assistance. This report presents the findings of the condition assessment.

2.2 Project Background

The Antioch force main system is composed of two separate force mains, the Antioch Force Main 101 (AFM101) and the Antioch Force Main 102 (AFM102). While the force mains share a common discharge header at the Antioch Pump Station (PS), they follow different alignments after the pump station until the pipelines reach the District's wastewater treatment plant (WWTP). Several failures on AFM102 have occurred since 2013. The District repaired the failed sections with cast-in-place pipe (CIPP) lining installations upstream and downstream of each failure location. Table 2-1 summarizes pertinent information on the force mains.

Table 2-1. AFM101 and AFM102 Information

	AFM101	AFM102
Year installed	Circa 1980	Circa 2000
Diameter	24 inches	24 inches
Pipe material	C303 bar-wrapped concrete cylinder pipe	C303 bar-wrapped concrete cylinder pipe
Length, feet	17,739 feet (3.4 miles)	16,000+ feet (3.0 miles)

2.3 Document Review and Planning

V&A reviewed the following documents and information to prepare for and conduct the condition assessment:

- AFM101 record drawings (1977)
- AFM102 record drawings (1998)
- Ameron shop drawings for AFM102 pipe
- Overall alignment profiles (prepared by VWHA, 2020)
- Hydrogen sulfide (H_2S) sampling data (District, August 15, 2019)
- American Water Works Association (AWWA) standard C303, "Bar-Wrapped Concrete Pressure Pipe"
- Ameron "Bar-Wrapped CCP: Product Information and Standard Designs" (2005)
- AFM102 failure history information

The pattern of failures on AFM102 within the last several years showed a tendency for mortar lining failure and for corrosion to occur at high points along the alignment. This is a typical mode of failure for force mains due to entrapped H_2S gas. The previous failures had been repaired, and it was the intent of this project to look for additional locations where a failure may be expected to occur in the future. Also, there have not been any known failures on AFM101, but the same approach was taken at one location on this pipeline to see if it may be experiencing degradation. So, the District, VWHA, and V&A developed a list of locations where similar conditions may be occurring in both force mains, and most of these were excavated for this project. The list of excavation locations for this project is shown in Table 2-2. Location numbers 3, 8, 10, 11, and 12 were not used.

Table 2-2. Force Main Excavation Locations

Location	Pipeline	Stationing	Street location
1	AFM102	138+00	Pittsburg-Antioch Hwy. between Verne Roberts and Arcy Ln.
2	AFM102	101+81	Field west of intersection of 6th & O Sts.
4	AFM102	88+31	W. 7th St. between M and L Sts.
5	AFM102	62+74	W. 7th St. at E St.
6	AFM102	53+86	W. 7th St. between C and B Sts.
7	AFM102	50+44	W. 7th St. between B and A Sts.
9	AFM101	114+25	Pittsburg-Antioch Hwy. at Verne Roberts
13	AFM102	120+40	Pittsburg-Antioch Hwy. west of Auto Center Dr.
14	AFM102	70+25	W. 7th St. just west of G St.

3 Approach

3.1 Access

The District retained a contractor to perform the excavations and to provide traffic control and support for V&A to enter the excavations. The contractor also removed an approximately 6-inch-square area of the cement mortar coating at the crown of the pipe in each test pit. The contractor repaired the mortar coating after V&A completed the testing.

3.2 Visual Assessment

Qualitative visual evaluations were conducted on the exterior of the force main pipe, focusing on the condition of the cement mortar coating, steel cylinder, and reinforcement bars. Observations were documented with digital still photographs. It should be noted that much of the visual assessment data is subjective and is based upon V&A's extensive experience evaluating concrete and metallic structures in the water and wastewater industries.

3.3 Ultrasonic Thickness Testing

Ultrasonic thickness testing is a non-destructive evaluation technique used for the determination of metal wall thickness. High-frequency sound waves are transmitted through one side of a metal wall from a transducer. When the sound waves reach the other side of the metal wall, a fraction of the waves will echo back to the transducer. The metal thickness is determined by recording the time it takes for the sound wave to travel through the metal and return. Point ultrasonic measurements were performed on the steel cylinder of the pipe. Several point measurements were obtained on the exposed steel cylinder areas between the reinforcing steel bars, as shown in Photo 3-1.

Photo 3-1. Typical area of steel cylinder exposed at the crown of the pipes for ultrasonic thickness testing. The wet surface is the couplant used to ensure that the ultrasonic waves pass into the metal.

3.4 Wastewater Sulfide Tests in Wet Well

Sulfide in wastewater can cause odor and corrosion problems. The rankings used when correlating the sulfide concentration with corrosivity or odor vary among engineers; however, Table 3-1 is a generally accepted guide.

Table 3-1. Corrosivity and Odor as a Function of Sulfide Concentration

Corrosivity and odor ranking	Total sulfide in wastewater (mg/L)	Atmospheric H_2S (ppm)
Very high	Greater than 15	Greater than 40
High	8 to 15	8 to 40
Moderate	5 to 8	5 to 8
Low	1 to 5	1 to 5
Negligible	Less than 1	Less than 1

Grab samples of wastewater from the Antioch PS wet well were collected using a bucket and tested on-site for total and dissolved sulfide using a LaMotte Drop Count Sulfide Test Kit. These kits use the Pomeroy methylene blue method for analysis, a titration method that uses colorimetric standards to determine sulfide concentrations. Total sulfide, dissolved sulfide, and hydrogen sulfide can be separated in the titration test. The sulfide concentration is determined using a color dye, which is added to an unreacted sample until its color matches a reacted sample.

V&A also reviewed the H_2S concentrations measured by the District upstream of the Antioch PS wet well.

4 Findings

4.1 Visual Evaluation

4.1.1 Pipe Sections Located at the District's WWTP

Prior to the field testing on AFM101 and AFM102, V&A evaluated sections of bar-wrapped pipe stored at the District's WWTP. The District's representative informed the team that the pipe segments included sections removed from AFM102 as part of the previous emergency repairs and replacement pipe used for the repairs. The steel cylinder thicknesses of the pipe sections stored at the WWTP were directly measured with a micrometer to verify steel cylinder thicknesses that may be encountered during the ultrasonic thickness testing of AFM101 and AFM102.

Photo 4-1 shows a typical section of pipe that has a cylinder thickness of 3/16 of an inch. The contractor that made the repairs stated that this was the type of pipe used to repair AFM102. The record drawings show that, where the pipe was installed with welded joints, the original pipe cylinder could be either 3/16 of an inch thick or 10 gauge (0.135 in.). Photo 4-2 shows a typical section of pipe that was taken from AFM102 where the repairs were made. These sections have a cylinder thickness in the range of 14-gauge steel (0.075 inches nominal).

Photo 4-1. Replacement sections of pipe have a cylinder thickness of approximately 3/16 of an inch. The measured thickness was 0.194 inches, possibly including the rust.

Photo 4-2. Sections of pipe removed from AFM102 have a cylinder thickness of approximately 14 gauge (0.075 inches). The measured thickness was 0.078 inches, possibly including the rust.

4.1.2 AFM101 Excavations

AFM101 was exposed at one excavation: Location 9. From visual evaluation of the area that was exposed, the exterior of the pipe was in good condition. The cement mortar coating appeared to be in good condition. Approximately a 6-inch-square area of mortar coating had been removed by the contractor to allow access to the steel cylinder. The exposed steel cylinder and bars mostly exhibited a mill finish. There was minor surface corrosion but no measurable thickness loss. These observations are shown in Photo 4-3 and Photo 4-4.

Photo 4-3. Exposed pipe surface at Location 9.

Photo 4-4. Exposed steel area at Location 9.

4.1.3 AFM102 Excavations

AFM102 was exposed at eight locations: Locations 1, 2, 4, 5, 6, 7, 13, and 14. From visual evaluation of the area that was exposed at each excavation, the exterior of the pipe was generally in good condition, although there were a few localized defects as described below. The cement mortar coating appeared to be in good condition at these eight excavations.

Approximately a 6-inch-square area of mortar coating had been removed by the contractor at each location to allow access to the steel cylinder. At Locations 2, 4, 5, and 14, the steel cylinder and bars exhibited a mill finish with no, or very little, evidence of corrosion. At Locations 1, 6, 7, and 13, the steel cylinder and bars exhibited the mill finish with minor surface corrosion, except at Location 1 where there was moderate surface corrosion. There was no measurable external thickness loss from corrosion at these locations. At Location 6, one of the reinforcing bars was bent slightly.

At Location 14, there was a dent in the steel cylinder at approximately the southeast corner of the rectangle of mortar coating that was removed. As found, the dent was mostly filled with mortar. The contractor removed a small amount of additional mortar in this corner so that the dent was visible in its entirety. The dent was about 1 inch in diameter and 3/16 to 1/4 of an inch deep. There were also a few dimples in the steel cylinder at Location 14, along with scrapes on the reinforcing bars. The dimples, which appeared to be the result of a tool impact rather than corrosion, were at least 0.030 inches deep, or 40% of the nominal 0.075-inch wall thickness at this location.

The contractor's foreman noted that the mortar coating at Location 14 had actually been removed some time previously, when the pipeline repairs extending downstream from Station 70+50 were made. For this project, the contractor removed the grout that had been used to patch this area. If the dent was created during the prior removal of the original cement mortar coating, this could explain how it was mostly filled with mortar or grout as found. Beyond this hypothesis, however, it was not possible to determine from the available evidence when or how the dent, dimples, or scrapes were created.

The above observations for AFM102 are shown in Photo 4-5 through Photo 4-22.

Photo 4-5. Exposed pipe surface at Location 1.

Photo 4-6. Exposed steel area at Location 1.

Photo 4-7. Exposed pipe surface at Location 2.

Photo 4-8. Exposed steel area at Location 2.

Photo 4-9. Exposed pipe surface at Location 4.

Photo 4-10. Exposed steel area at Location 4. Surface is wet from ultrasonic testing.

Photo 4-11. Exposed pipe surface at Location 5.

Photo 4-12. Exposed steel area at Location 5.

Photo 4-13. Exposed pipe surface at Location 6.

Photo 4-14. Exposed steel area at Location 6. Surface is wet from ultrasonic testing. Note bent bar (arrow).

Photo 4-15. Exposed pipe surface at Location 7.

Photo 4-16. Exposed steel area at Location 7. Surface is wet from ultrasonic testing.

Photo 4-17. Exposed pipe surface at Location 13.

Photo 4-18. Exposed steel area at Location 13.

Photo 4-19. Exposed pipe surface at Location 14, as found. North is to bottom of photo.

Photo 4-20. Exposed steel area at Location 14. Dimples denoted with arrows. Dent (as found) circled with dashed line. North is to left.

Photo 4-21. Dent at Location 14 is about 1 inch in diameter.

Photo 4-22. Dent at Location 14 is about 3/16 to 1/4 of an inch deep.

4.2 Ultrasonic Thickness Testing

Ultrasonic thickness testing was conducted on the steel cylinder at each of the nine excavation locations. The results are presented in Table 4-1. The number of measurements taken at each location was dictated by the evaluator's discretion and the locations where the ultrasonic transducer could make contact with the metal surface. Measurements were taken throughout the available surface area in order to search for potential localized corrosion. As discussed below, no such localized corrosion was found.

Table 4-1. Ultrasonic Thickness Testing Results

			Measured thickness, in.					Max. thickness loss	
Location	Station	No. of readings	Min.	Avg.	Max.	Variation (range)	Nominal thickness, in.	in.	percent
AFM101									
9	114+25	22	0.104	0.106	0.112	0.008	0.105 (12 ga.)*	0.001	1%
AFM102									
1	138+00	25	0.077	0.078	0.080	0.003	0.075 (14 ga.)	0.000	0%
2	101+81	37	0.133	0.135	0.138	0.005	0.135 (10 ga.)*	0.002	1%
4	88+31	25	0.074	0.076	0.078	0.004	0.075 (14 ga.)	0.001	1%
5	62+74	20	0.073	0.075	0.076	0.003	0.075 (14 ga.)	0.002	3%
6	53+86	22	0.074	0.076	0.077	0.003	0.075 (14 ga.)	0.001	1%
7	50+44	12	0.076	0.077	0.078	0.002	0.075 (14 ga.)	0.000	0%
13	120+40	21	0.073	0.077	0.084	0.011	0.075 (14 ga.)	0.002	3%
14	70+25	42	0.074	0.077	0.080	0.006	0.075 (14 ga.)	0.001	1%

*Nominal thickness assumed based on measurements and available wall thicknesses. See text.

For AFM101, records showing the pipe nominal thickness were not available. The measured thickness data at Location 9 appears to match 12-gauge steel (as available from Ameron per general literature), so this was assumed to be the nominal thickness. Although it is possible that the nominal thickness was greater and the thickness has been reduced by corrosion, this is considered unlikely because of the relatively minor variation (range from minimum to maximum thickness) in the measurements.

For AFM102, the Ameron submittals for the force main show three different classes of pipe, one with bell-and-spigot joints and the other two with welded joints. The record drawings show where welded joints were to be used, but not which of the two classes of pipe was to be used where welded joints were specified. So, the pipe class and nominal thickness at Location 2 were assumed based on the close match between the measured data and one of the pipe classes. The minor variation in measured thickness supports this assumption as opposed to a heavier pipe class that has experienced corrosion. The remainder of the test locations on AFM102 were not shown as having welded joints, so the known 14-gauge nominal thickness was used for these locations.

In all, the ultrasonic thickness data indicate that negligible corrosion, if any, has occurred at the test locations. The maximum calculated thickness loss was 0.002 inches, which is minor, is within the practical tolerances of the ultrasonic test methods used, and is probably within the manufacturing tolerances for the steel sheet or plate used to manufacture the pipe. The variation in measured thickness at each location was also minor. It should be noted that the negligible measured thickness loss does not indicate whether the lining is still intact, nor does it indicate whether corrosion may have occurred at other locations along the force mains. An attempt was made to take ultrasonic readings in and around the dent at Location 14, but no readings were possible due to the uneven metal surface. So, the ultrasonic testing does not provide insight into whether the dent has caused failure of the lining.

4.3 Bar Diameter and Spacing

At each location where the cement mortar coating was removed, the reinforcing bar diameter and spacing were measured, as shown in Table 4-2. Because of the remaining mortar that was adhered to some of the bars, it was not possible to measure the diameter or spacing of all bars that were exposed. The table presents the measurements that were possible at each location. Also, the mortar coating thickness and cover depth over the bars was measured at some locations, as presented in the table.

Table 4-2. Bar Diameter, Spacing, and Cover Depth

Location	Station	Bar diameter, in.	Bar spacing, in.	Mortar cover over bars, in.	Mortar coating thickness, in.
AFM101					
9	114+25	0.375 0.378 0.380	1.90 1.85	0.60	1.00
AFM102					
1	138+00	0.214 0.216 0.218	1.55 1.65 1.45	0.90 to 1.15	1.10 to 1.35
2	101+81	0.215 0.215	1.70 1.65 1.50	0.80 to 0.90	1.00 to 1.10
4	88+31	0.221 0.216 0.219	1.85 1.90 1.75	Not measured	Not measured
5	62+74	0.220 0.218	1.90 1.80 1.75	Not measured	Not measured
6	53+86	0.222 0.225	1.85 1.65 1.85	Not measured	Not measured
7	50+44	0.228 0.229	1.75 1.90	Not measured	Not measured
13	120+40	0.215 0.214	1.80 1.70 1.85	0.75 to 0.80	0.95 to 1.00
14	70+25	0.214 0.214	1.65 1.75 1.75	0.90 to 1.05	1.10 to 1.25

Record information such as bar diameter and spacing was not available for the AFM101 pipe. The diameter and spacing for the bars at Location 9 on AFM101 differ from more recent (2005) Ameron literature for pipe with a 12-gauge steel cylinder (classes 200 and 225), as found at Location 9. This literature shows a bar diameter of 0.250 or 0.312 inches and a spacing of 1.33 or 1.40 inches. The

measured spacing is greater, but the bar diameter is larger and may compensate. When the measured bar diameter and spacing are converted to area of steel per unit length, the result is similar to that given for the Class 225 pipe in the 2005 Ameron literature.

The cover depth over the bars at Location 9 on AFM101 does not meet 0.75-inch minimum requirement in the 2005 Ameron literature and recent editions of AWWA C303. The minimum cover depth required for the AFM101 project circa 1977 is unknown, however.

The diameter and spacing of the bars at the AFM102 excavation locations generally met the requirements from the shop drawings (0.219-inch diameter and 1.88-inch spacing for all classes), though there were several instances where the diameter or spacing requirements were not met by a small, probably insignificant, amount.

The shop drawings for AFM102 require 1 inch of mortar cover over the bars. This requirement was generally not met at Locations 1, 2, 13, and 14. However, these locations did meet the 0.75-inch minimum given in the Ameron literature and AWWA C303. The mortar coating thickness was not measured at Locations 4, 5, 6, and 7.

4.4 Sulfides and Potential for Corrosion

A wastewater sample was obtained from the Antioch PS wet well at 9:15 a.m. on April 7, 2020. The sample was tested for total and dissolved sulfides, as described in Section 3.4. V&A also reviewed the H_2S gas concentrations measured by the District upstream of the Antioch PS wet well. The results of the wastewater sulfide concentration and H_2S gas concentrations are summarized in Table 4-3 and Table 4-4, respectively.

Table 4-3. Total and Dissolved Sulfide Test in Antioch PS Wet Well

Date/time of sample	Total sulfides	Dissolved sulfides	Corrosivity & odor ranking
9:15 a.m., 4/7/2020	2.6 mg/L	1.2 mg/L	Low

Table 4-4. Gaseous H_2S Measurements Upstream of Antioch PS Wet Well by District

Dates collected	Max. (ppm)	Avg. (ppm)	Corrosivity & odor ranking
4/2/19 – 4/4/19	342	177	Very high
4/10/19 – 4/12/19	314	174	Very high
4/12/19 – 4/16/19	343	190	Very high

Sulfide concentration in the wastewater from the wet well is considered *low* on V&A's scale for corrosivity and odor; however, this only represents the initial sulfide concentration entering the force main system. It is expected that the sulfide concentration will increase as the wastewater travels through the force mains. The result also indicates that the wastewater in the wet well is septic, which is conducive for generating sulfides in force mains.

The H_2S gas concentrations measured upstream of the wet well by the District are considered *very high* on V&A's scale for corrosivity and odor. This has indirect implications for corrosion in the force main. While sulfides are being released as atmospheric H_2S upstream of the wet well, it is anticipated that a significant concentration of sulfide will remain and will be generated within the force main. If the wastewater can release such high levels of H_2S upstream of the pump station, it can probably continue to do so within the force main.

5 Conclusions

Based on the findings from this condition assessment project, V&A presents the following conclusions:

1. **AFM101:** AFM101 was evaluated at one excavation. Based on the visual assessment and ultrasonic thickness testing, the pipe is in good condition at this location. There was no measurable internal or external thickness loss from corrosion on the steel cylinder or reinforcing bars. There was a small amount of surface corrosion on the exterior of the steel cylinder, so the mortar coating may be losing alkalinity and its ability to protect the steel. The condition of the mortar lining could not be determined.

2. **AFM102:** AFM102 was evaluated at eight excavations. Based on the visual assessment and ultrasonic thickness testing, the pipe is generally in good condition at these locations. There was no measurable internal or external thickness loss from corrosion on the cylinder or reinforcing bars. There was a varying (minimal to moderate) amount of surface corrosion on the exterior of the steel cylinder, depending on location, so the mortar coating may be losing alkalinity and its ability to protect the steel. The condition of the mortar lining could not be determined.

   One location on AFM102, Location 14, exhibited a dent in the steel cylinder. The cause of the dent could not be determined. This dent could have caused the mortar lining to delaminate, but there was no way to determine the condition of the lining to be certain. At this excavation, there were also dimples on the exterior of the steel cylinder, which could reduce the wall thickness remaining before perforation, should the pipe experience internal corrosion.

3. **Sulfides and potential for corrosion:** The wastewater and gaseous sulfide measurements show a high potential for odors and corrosion at high points within the force mains if air pockets are allowed to collect. This is consistent with the previous AFM102 failures, which were determined to be caused by corrosion at high points.

4. **Remaining service life:** There is no way to quantify the remaining service life for the force mains based on the data collected for this project. There was no measurable corrosion to date at the test locations, so no corrosion rate could be calculated and then projected into the future. It is possible that corrosion could be occurring at other locations that were not tested. Also, if the lining is damaged at any of the test locations, particularly Location 14 where a possible damage mechanism was found, corrosion could begin to occur. It is not possible to determine whether or how fast this will occur.

Appendix C

2021 APS and BHPS Long-Term Alternative Analysis Report

Delta Diablo

Antioch and Bridgehead Pump Stations and Conveyance System Improvements Project

Phase II – Long Term Alternatives Analysis

November 2021

DRAFT

Prepared by

V.W. HOUSEN
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Figure 4.4 Antioch Pump Station – Site Plan w/ Proposed Improvements

Figure 4.5 Antioch Pump Station – Combined Diversion PS and Grinder Structure Plans

Figure 4.6 Antioch Pump Station – Diversion Pump Station Plans

Figure 4.7 Antioch Pump Station – Diversion Pump Station Section

Figure 4.8 Antioch Pump Station – Grinder Structure

Figure 4.9 Forcemain/Valving Schematic at Intersection of Fulton Shipyard Road and Wilbur Avenue

DRAWINGS

Drawing E-1 Electrical – One Line Diagram

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SECTION 1
INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The District contracted with V. W. Housen & Associates (VWHA) to complete the Phase II – Long Term Alternatives Analysis for the Antioch and Bridgehead Pump Stations and Conveyance System Improvements Project. The Phase II – Long Term Alternatives Analysis is the first step in implementing improvements to the Antioch Pump Station (APS) and Bridgehead Pump Station (BHPS) and their associated conveyance systems to meet long term/buildout pumping needs and address O&M and reliability issues and concerns. Services were provided by VWHA and its subconsultants: ArcSine Engineering (ArcSine) and TJC and Associates (TJC). ArcSine provided electrical and instrumentation & controls services and TJC provided structural services.

Prior to the Phase II work, the District contracted with VWHA to complete an existing conditions hydraulic analysis of the Antioch and Bridgehead Pump Stations and their conveyance systems (December 2020). The purpose of the analysis was to determine the existing hydraulic operating conditions of the Antioch and Bridgehead pump stations and their associated forcemains.

The Phase II – Long Term Alternatives Analysis included scope of work items to identify the recommended improvements to be implemented at the Antioch and Bridgehead pump stations and within their associated forcemain systems. In addition, VWHA updated the District's wastewater hydraulic model to accurately depict the recommended pump station and associated forcemain improvements.

This report summarizes the analyses completed and identifies the recommended project to meet long term/ buildout pumping needs and address O&M and reliability issues and concerns for the APS and BHPS conveyance systems. This report includes the following sections:

- Section 1 Introduction and Background
- Section 2 APS and BHPS Conveyance System Alternatives Analysis
- Section 3 APS – Diversion Pump Station and Screenings Removal Analysis
- Section 4 Recommended Project
- Appendices

Following the Phase II analysis, the following phases shall be undertaken to implement the recommended improvements: Phase III – Predesign and Surge Analysis, Phase IV – Final Design of Long-Term Improvements, and Phase V - Construction of Long Term Improvements.

1.2 BACKGROUND

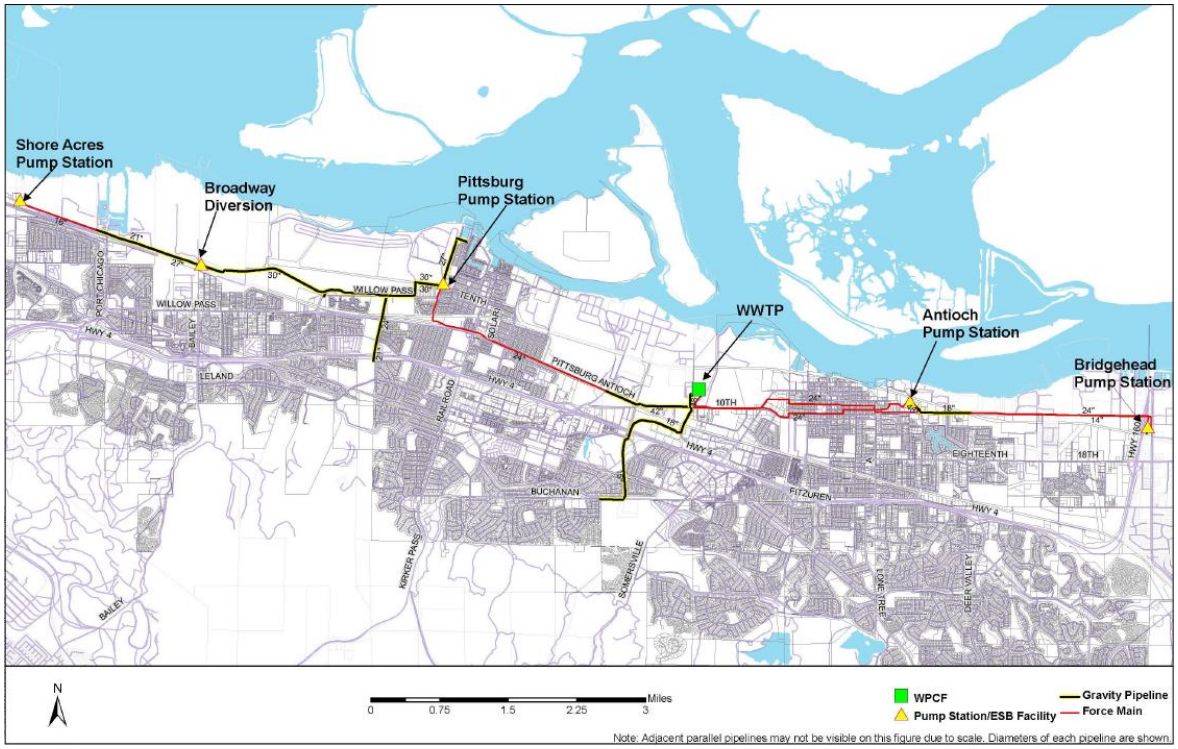
Delta Diablo (District) provides water resource recovery services for the City of Antioch, the City of Pittsburg, and the unincorporated community of Bay Point, serving a population of nearly

200,000. The District was formed in 1955. In 1977, design of the District's regional wastewater treatment facility and conveyance system began under nine separate contracts under the Industrial Shore Subregional Wastewater Facilities project (ISSWF) (CDM/KKA Consultants). Construction of these facilities was completed in 1982.

The District owns and operates five pump stations within the wastewater conveyance system. Four of the pump stations (Bridgehead, Antioch, Pittsburg, and Shore Acres), contain onsite diversion and equalization facilities. Of these stations, Bridgehead, Pittsburg, and Shore Acres Pump Stations include independent diversion pumping facilities. The Antioch Pump Station uses the same pumping facilities to convey flows through the conveyance system and to divert flows to equalization. The fifth station, Triangle Pump Station, does not include diversion facilities.

The conveyance system includes approximately 14 miles of sewer forcemains and 14 miles of interceptors. Figure 1.1 shows the location of the collection system conveyance facilities with the exception of the Triangle Pump Station.

Figure 1.1 Delta Diablo Collection System (Pump Stations and Conveyance Facilities) Map



The Antioch and Bridgehead Pump Stations and their associated conveyance systems are located east of the District's wastewater treatment plant (WWTP) and convey flows from the City of Antioch. The BHPS is located upstream of and currently conveys flow to the APS. BHPS flow currently comingles with incoming APS flow and is repumped to the District's WWTP.

1.2.1 APS and Conveyance System

This section provides background information, flow projections, and describes existing facilities and current operating conditions for the APS and its associated conveyance system.

The Antioch Pump Station is located on Fulton Shipyard Road, directly south of the railroad tracks and north of Wilbur Avenue in Antioch, CA. The APS was obtained from the City of Antioch when the regional wastewater treatment facility began design in 1977. Prior to that time, the APS was owned and operated by the City of Antioch, and pumped wastewater to the Antioch Wastewater Treatment Plant which is no longer in service. The APS was initially modified under two ISSWFP contracts: Contract 2a – Antioch Pump Station Modifications – Phase I and Contract 2b – Antioch Pump Station Modifications – Phase II.

The APS currently receives flow from the BHPS via gravity flow, and also receives gravity flow from the pump station's adjacent tributary area. Flow enters the pump station's wetwell via two separate gravity sewers that combine at the entrance to the wetwell. The station consists of a wetwell/drywell configuration with a total of four vertical wastewater pumps, including two small and two large pumps. The wetwell has two sump areas each providing suction for one large and one small pump. All pumps discharge into a common header which is currently connected to dual 24-inch forcemains that convey flow from the pump station to the west, approximately 2.6 miles to the District's WWTP located at 2500 Pittsburg-Antioch Highway, Antioch, CA.

The two forcemains were constructed at different times and have different alignments, lengths and profiles. Antioch Forcemain 101 (AFM101) was constructed in 1977 under ISSWFP Contract 1 – Antioch Conveyance System. Antioch Forcemain 102 (AFM102) was added in 1998 under the Antioch Forcemain Project (Winzler & Kelly).

Currently station flow can be conveyed through either one or both forcemains to the WWTP. However, per discussions with District staff, it is normal operating practice to use both forcemains at all times. Each forcemain contains a flowmeter vault onsite with an inline magnetic flowmeter to record the flow passing through that forcemain. District staff indicated that neither flowmeter reads accurately and they should be replaced.

During current peak wet weather events, one or both of the small pumps are used to divert flows to the on-site equalization storage basin (ESB). By shaving peak flow, the District can reduce the instantaneous flow that is pumped though the forcemains to the WWTP. The Phase I work did not include hydraulic analysis of the existing diversion system.

The District's 2010 Conveyance System Master Plan states that the pump station has a diversion capacity of 7.8 million gallons per day (mgd) and the APS ESB has a capacity of 1.36 million gallons (MG) with a recommended usable capacity of 80% or 1.09 MG.

The Antioch Pump Station and forcemains were constructed and upgraded under the projects shown in Table 1.1 on the following page.

Table 1.1 Antioch Pump Station – Original and Upgrade Projects

ANTIOCH PUMP STATION
Original construction: • 1951 – City of Antioch – Construction Unit No. 2 Sewer Treatment Plant. (The Pump Station was existing at the time Delta Diablo Sanitation was formed and was formerly a City of Antioch Pump Station used to pump flow to the Antioch Wastewater Treatment Plant.)
Original Delta Diablo projects: • 1977[1] – Industrial Shores Subregional Wastewater Facilities – Contract 1 (Antioch Conveyance System), CDM/KKA Consultants • 1977[1,3] – Industrial Shores Subregional Wastewater Facilities – Contact 2a (Antioch Pump Station Modifications – Phase I), CDM/KKA Consultants • 1977[3] – Industrial Shores Subregional Wastewater Facilities – Contact 2b (Antioch Pump Station Modifications – Phase II), CDM/KKA Consultants
Upgrade projects: • 1986[3] – Antioch Pump Station Improvements, Dodson & Young • 1986 – Downtown Trunk Sewer Improvements – North Lake Drive to Antioch PS • 1989 – Cathodic Protection System, Corrosion Engineering and Research Company • 1997[2] – Antioch Pump Station Modifications, Brown & Caldwell • 1998[2] – Antioch Forcemain, Winzler & Kelly • 1999[2] – Wastewater Treatment Plant Headworks Modifications, G.S. Dodson & Associates • 2002 – Downtown Trunk Sewer Improvements – Phase 1 (PW514-5) • 2006 – Odor Control Facilities – Phase III, CH2M Hill • 2018 – Pump Station Facilities Repair Project – Antioch Pump Station, Schaaf & Wheeler

[1] Drawings from 1977 (Contracts 1 and 2a) projects were used in the development of the forcemain system curves for AFM101.

[2] Drawings from 1997, 1998 and 1999 projects were used in the development of the forcemain system curves for AFM102.

[3] Drawings from 1977 (Contracts 2a and 2b) and 1986 projects were used in the development of the suction and discharge loss curves.

[4] All drawings from projects above were used in the development of the site plan (including information related to incoming gravity sewers) and pump station plans and sections. Field information from site visits was used to augment information on drawings.

1.2.1.1 Flow Projections

Flow projections for flows entering the APS from the District's 2010 Conveyance System Master Plan (RMC) are provided in Table 1.2. Flow projections entering the Antioch Pump Station from the City of Antioch's 2014 Collection System Master Plan (also RMC) are provided in Table 1.3. The City of Antioch Master Plan indicates that the 2014 estimates are generally lower than presented in the District's 2010 Master Plan, and concludes that these differences are due to the use of water billing data and additional flow metering data used in the Antioch Master Plan, as well as a different approach toward development of future flows. Based on discussions

with the District's current Treatment Plant Master Plan Consultant (Hazen & Sawyer), these lower flow projections are consistent with their findings. Hazen & Sawyer used historical plant data to get per capita flows and then population projections to determine future flows. They indicated that the influent WWTP flows are approximately 15% lower than the projections of the District's 2010 Conveyance System Master Plan. Per discussions with District staff on 10/14/2020, it was agreed to move forward using the flow projections from the 2014 City of Antioch Master Plan in Table 1.3 for future work related to the APS and its conveyance system.

Table 1.2 2009 and Buildout APS Influent Flow Projections (2010 District Master Plan)

Delta Diablo 2010 Conveyance System Master Plan Update[1]								
2009 Flows (mgd)			Buildout Flows (mgd)					
With Bridgehead Flows			With Bridgehead Flows			Without Bridgehead Flows		
ADWF	PDWF	PWWF	ADWF	PDWF	PWWF	ADWF	PDWF	PWWF
8.6	13.1	20.4[4]	13.1	20.8[2]	31.7[3]	7.6	12.4	19.5

[1] Information included in table from Delta Diablo Sanitation District's Conveyance System Master Plan Update Final Report, RMC, April 2010

[2] Information included in Conveyance System Master Plan Update shows a flow of 20.1 mgd but also flows of 12.4 mgd for Antioch PS and 8.4 mgd for Bridgehead PS for a total of 20.8 mgd.

[3] Information included in Conveyance System Master Plan Update shows a flow of 26.7 mgd with an overflow occurring in the upstream collection system, but also flows of 19.5 mgd for Antioch PS and 12.2 mgd for Bridgehead PS for a total of 31.7 mgd.

[4] Information included in Conveyance System Master Plan Update shows a flow of 20.2 mgd and 20.4 mgd in different locations.

Table 1.3 2014 and Buildout APS Influent Flow Projections (2014 City of Antioch Master Plan)

City of Antioch 2014 Master Plan[1]								
2014 Flows (mgd)			Buildout Flows (mgd)					
With Bridgehead Flows			With Bridgehead Flows			Without Bridgehead Flows		
ADWF	PDWF	PWWF	ADWF	PDWF	PWWF	ADWF	PDWF	PWWF
7.3	10.4	17.0	11.3	17.8	26.3	6.6	10.3	14.3

[1] Information included in table from City of Antioch's Collection System Master Plan, October 2014 (Table 3-1).

1.2.1.2 Existing Conditions

This section describes existing APS pumps, flow diversion facilities, and forcemains.

APS Pumps

The Antioch Pump Station currently has two 100 horsepower (Hp) electric variable speed (small) pumps and two 400Hp electric variable speed (large) pumps. One small and one large pump draw flow from each wetwell sump.

Small Pumps

The existing two 100 Hp pumps are identical and neither pump includes nameplate information. The small pumps are shown as originally installed under the ISSWF – Contract 2a (Antioch Pump Station Modifications – Phase I) project. The pumps were then relocated within the station under the ISSWF – Contact 2b (Antioch Pump Station Modifications – Phase II) project. Based on discussions with District staff and after reviewing background documents provided, no records exist that show that the pumps have been replaced since that time. However, the District indicated that they are in the process of replacing the pumps in kind due to their age and condition, knowing that the pumps will likely be replaced in the future.

The District's spare parts information indicates that the pumps are 100Hp Fairbanks Morse 10-B5445, 5445BV FB/Morse. The pump suction and discharge diameter appear to be 10-inch diameter and the District's O&M manual states a design point of 4,500 gpm at 60 feet total dynamic head (TDH).

VWHA contacted Fairbanks Morse and provided the information above including current photographs of the pumps. Based on factory records, Fairbanks Morse noted that the two pumps appear to be 10-inch Model B5445-T60. They added that the original operating conditions were noted as 2,800 gpm at 77 feet TDH at 845 rpm and 4,000 gpm at 55 feet TDH at 550rpm, and the pumps were provided with an impeller diameter of 19.85 inches. Fairbanks Morse provided pump curves replicated to the best extent possible, based on the factory record data. Fairbanks Morse noted that the speed of the secondary operating condition of 550 rpm in the data provided appeared incorrect, and should be closer to 800 rpm.

The hydraulic analysis for existing conditions was conducted using the information provided by Fairbanks Morse. After the analysis was completed, the District located and provided a certified performance curve for the pumps. The performance curve information provided matched and confirmed the information provided by Fairbanks Morse. See Appendix A of the Phase I – Existing Conditions Hydraulic Analysis for the certified performance curve provided by the District and the information provided by Fairbanks Morse.

Following discussions with District staff, review of SCADA data, and review of the District's pump station operational parameters/level setpoints for the APS (see Appendix C of the Phase I – Existing Conditions Hydraulic Analysis), one small pump can operate alone during the dry weather season during night time low flow periods and two small pumps operate together at a reduced speed during the majority of the time during the dry weather season. Operations staff noted that on rare occasions during the dry weather season, peak dry weather flows exceed the capacity of two small pumps at full speed and a large pump is required to operate at reduced speed. When a large pump is called to operate, the small pumps turn off. A large pump is also

required to operate during the dry weather season if one of the small pumps fails or is taken out of service, and flows exceed the capacity of the remaining small pump.

The small pumps also serve as the diversion pumps for the facility. During extreme wet weather events, wet weather flows may exceed the capacity of one large pump. When this occurs, one or both of the small pumps are used to pump flow from the wetwell to the ESB, while the large pump continues to pump flow through the forcemains to the WWTP.

Large Pumps

The existing two 400 Hp pumps are identical. The pumps were shown as installed under the ISSWF – Contract 2b (Antioch Pump Station Modifications – Phase II) project. Based on discussions with District staff and after reviewing background documents provided, no records exist that show that the pumps have been replaced since that time. The suction and discharge diameter appear to be 16-inch. The pump nameplate information includes the following:

- Model number: 16MNC 33
- Serial numbers: 79ZUS8193-1 and 79ZUS8194-1
- Design point: 8200 gpm at 130 feet
- Horsepower: 400 Hp
- Speed: 688 rpm

The District's spare parts information states that the pumps are Worthington 16MNC-33 which matches the nameplate information.

VWHA contacted Flowserve (Worthington Pumps) and provided the information above including current photographs of the pumps and nameplates. Based on factory records, Flowserve (Worthington Pumps) provided data pages from the original order write up noting that the pumps were installed in 1979 and pumps were furnished with a variable speed motor mag drive arrangement. Flowserve (Worthington Pumps) provided a pump curve generated from their current selection program. They noted that the current pump curve appears to be flatter than observed from the original order. Therefore, the horsepower shown is higher on the curve provided than the 400 Hp motor that was originally furnished. Flowserve (Worthington Pumps) also noted that the impeller diameter associated with the pump curve originally furnished was 30.43 inches.

The hydraulic analysis was conducted using the information provided by Flowserve (Worthington Pumps). After the analysis was completed, the District located and provided a certified performance curve for the pumps. The information provided matched and confirmed the information provided by Flowserve (Worthington Pumps). See Appendix B of the Phase I – Existing Conditions Hydraulic Analysis for the certified performance curve provided by the District and the information provided by Flowserve (Worthington Pumps).

Following discussions with District staff, review of SCADA data, and review of the District's pump station operational parameters/level setpoints (see Appendix C of the Phase I – Existing Conditions Hydraulic Analysis) for the Antioch Pump Station, one large pump is used to pump dry and wet weather flows any time the existing small pumps cannot keep up with incoming flows. A single large pump is used to pump flow through one or both forcemains. The second large pump serves as standby.

The District's 2010 Conveyance System Master Plan noted that for the work conducted under the Master Plan's hydraulic model, pump curves for the large pumps were derated by 6 percent based on results obtained through District testing. The hydraulic analysis conducted under Phase I raises questions about the need to derate the large pumps. See Phase I - Existing Condition Hydraulic Analysis (December 2020).

Flow Diversion to Equalization Storage

The pump station site contains an ESB. The District's 2010 Conveyance System Master Plan states that the pump station has a diversion capacity of 7.8 mgd and the ESB has a capacity of 1.36 MG with a recommended usable capacity of 80% or 1.09 MG. The Master Plan states that diversion is currently set to occur 13.0 mgd. The existing conditions hydraulic analysis did not review pumping to the ESB. As requested by the District, a separate independent diversion pump station similar to the diversion pump stations installed at the District's other pump station sites, should be provided at the APS.

Antioch Forcemains 101 and 102

The APS has dual 24-inch forcemains: Antioch Forcemain 101 (AFM101) and Antioch Forcemain 102 (AFM102). The off-site portion of AFM101 was constructed under the 1977 ISSWF project, Contract 1- Antioch Conveyance System. The on-site portion of AFM101 was constructed under the 1997 ISSWF project, Contract 2a - Antioch Pump Station Modifications – Phase I.

The off-site portion of AFM102 was constructed under the 1998 Antioch Forcemain Project, with the portion of the forcemain located on the wastewater treatment plant site constructed under the 1999 Wastewater Treatment Plant Headworks Modifications Project (G.S. Dodson & Associates). The on-site portion of AFM102 was constructed under the 1997 Antioch Pump Station Modifications Project (Brown & Caldwell).

The District currently operates both forcemains at all times, except when one forcemain is required to be taken out of service for maintenance. Both forcemains are constructed from AWWA C-303 bar-wrapped steel cylinder concrete pressure pipe (CCPP). The two forcemains have different alignments, profiles, and lengths. Both forcemains contain intermediate high points and air release valves.

AFM101 has several intermediate high points along its alignment and discharges to gravity at a discharge structure located in Pittsburg-Antioch Highway at the entrance to Arcy Lane. The discharge location elevation is lower than one of the intermediate high points.

Forcemain AFM102 has numerous intermediate high points along its alignment and discharges to gravity at the wastewater treatment plant's headworks facility. The discharge location elevation is lower than many of the intermediate high points along the forcemain alignment including four potential hydraulically controlling highpoints. Air release valves were originally installed at all high points. However, since 1998, some of these air release valves have been removed to simplify system maintenance.

1.2.2 BHPS and Conveyance System

This section provides background information, flow projections, and describes existing facilities and current operating conditions for the BHPS and its associated conveyance system.

The Bridgehead Pump Station is located at 5951 Bridgehead Road, Antioch, CA at the intersection of Wilbur Avenue and Bridgehead Road, adjacent to Highway 160 and north of the railroad tracks. The original submersible Bridgehead Pump Station and its 14-inch forcemain were designed and constructed under the Bridgehead Pumping Station (Project No. 9008A) and Bridgehead Forcemain & Gravity Sewer (Project No. 9008B) projects in 1990.

In 2003 and 2006, under the Bridgehead Expansion Project, Phase 1 (Forcemain No. 2 and Related Improvements) (CIP No. 4010) and Bridgehead Expansion, Phase 2 (Pump Station and Related Improvements) (CIP No. 4240) projects, respectively, a new drywell/wetwell station and ESB were constructed and a second forcemain added. The second forcemain is 24-inches in diameter. At that time, the original submersible pump station was converted to a diversion pump station. However, the converted pump station can still be used to convey flows through the 14-inch and/or 24-inch forcemains during the dry weather season, in the event that the main pump station is removed from service for maintenance. A hydraulic analysis of the Bridgehead diversion pump station to pump though the existing 14-inch and/or 24-inch forcemains was not performed under Phase I or Phase II work.

During peak wet weather events, the submersible diversion pump station is used to pump flows to the on-site ESB to shave peak flow. Flow passes to diversion pump station when water levels backup to elevation 2.14 feet. The hydraulic analysis performed under Phase I did not include analysis of the diversion system; however, an analysis was performed under the Phase II work. See Section 2 of this report for additional information. The District's 2010 Conveyance System Master Plan states that the Diversion Pump Station has a capacity of 6.5 mgd and the ESB has a capacity of 1.56 MG with a recommended usable capacity of 80% or 1.25 MG.

The BHPS receives flow via gravity from the adjacent tributary area. Gravity sewer flows enter the site through a 33-inch sanitary sewer which can convey flow to both pump stations. The main pump station consists of a wetwell/drywell type station with a three equally sized pumps. Flows entering the main pump station's wetwell pass through grinders prior to entering the wetwell sump. All three pumps draw suction from the wetwell sump and discharge into a common 24-inch header which exits the pump station building and splits onsite to convey flow to either or both the 14-inch and 24-inch forcemains. Under current conditions, the BHPS flows are repumped by APS along with APS flows to the District's WWTP. Although the station's flow

can be conveyed through either one or both forcemains, per discussions with District staff, only the 24-inch forcemain is used.

The BHPS and forcemains were constructed and upgraded under the projects listed in Table 1.4.

Table 1.4 Bridgehead Pump Station – Original and Upgrade Projects

BRIDGEHEAD PUMP STATION
Original construction: • 1990[1,4] – Bridgehead Pumping Station (Project No. 9008A), G.S. Dodson & Associates • 1990[1] – Bridgehead Forcemain & Gravity Sewer (Project No. 9008B), G.S. Dodson & Associates • 1993[5] – Assessment District No. 27 – Lone Tree Corridor, City of Antioch, CA; PW 555-S1, Sanitary Sewer Outfall from Bridgehead Pump Station to Victory Highway, McGill-Martin-Self, Inc. • 1997[5] – Assessment District No. 27 – Lone Tree Corridor, City of Antioch, CA; PW 555-S2, East Antioch Gravity Sewer – Phase B, Eccid Irrigation pipeline Relocation Interim Water Pipeline (DWD/Brentwood Inter-Tie)
Upgrade projects: • 2003[2] – Bridgehead Expansion Project, Phase 1 (Forcemain No. 2 and Related Improvements) (CIP No. 4010), RMC • 2006[1,2,3,4] – Bridgehead Expansion, Phase 2 (Pump Station and Related Improvements) (CIP No. 4240), RMC • 2012[5] – Verizon Wireless Bridgehead, PG&E Tower #20/22 SAP#:40695969, Contra Costa – DuPont 60kV (PS No. 248129), Verizon Wireless • 2021[1,2] – Bridgehead Pipeline Replacement Project (Project No. 21123), VWHA

[1] Drawings from 1990 (Bridgehead Pumping Station (Project No. 9008A)), 2006 (Bridgehead Expansion, Phase 2 (Pump Station and Related Improvements) (CIP No. 4240)), 1990 (Bridgehead Forcemain & Gravity Sewer (Project No. 9008B)), and 2021 Bridgehead Pipeline Replacement projects were used in the development of the forcemain system curves for the 14-inch BHFM1 for onsite and offsite piping.

[2] Drawings from 2003 (Bridgehead Expansion Project, Phase 1 (Forcemain No. 2 and Related Improvements) (CIP No. 4010)), 2006 (Bridgehead Expansion, Phase 2 (Pump Station and Related Improvements) (CIP No. 4240)), and 2021 Bridgehead Pipeline Replacement projects were used in the development of the forcemain system curves for the 24-inch BHFM2 for onsite and offsite piping.

[3] Drawings from 2006 (Bridgehead Expansion, Phase 2 (Pump Station and Related Improvements) (CIP No. 4240)) project were used in the development of the suction and discharge loss curves.

[4] Drawings from 2006 (Bridgehead Expansion, Phase 2 (Pump Station and Related Improvements) (CIP No. 4240)) and 1990 Bridgehead Pumping Station (Project No. 9008A) projects were used in the development of the suction and discharge loss curves and system curves to the ESB for the Diversion Pump Station.

[5] Drawings from 1993 and 1997 projects for offsite gravity sewers and 2012 project for Verizon Wireless Tower were not used.

1.2.2.1 Flow Projections

Flow projections for flows entering the BHPS from the District's 2010 Conveyance System Master Plan are provided in Table 1.5 and flow projections for flows entering the BHPS from the City of Antioch's 2014 Collection System Master Plan are provided in Table 1.6. The City of Antioch Master Plan indicates that the 2014 estimates are generally lower than presented in the District's 2010 Master Plan, and concludes that these differences are due to the use of water

billing data and additional flow metering data used in the Antioch Master Plan, as well as a different approach toward development of future flows. Based on discussions with the District's current Treatment Plant Master Plan Consultant (Hazen & Sawyer), these lower flow projections are consistent with their findings. Hazen & Sawyer used historical plant data to get per capita flows and then population projections to determine future flows. They indicated that the influent WWTP flows are approximately 15% lower than the projections of the District's 2010 Conveyance System Master Plan. Per discussions with District staff on 10/14/2020, it was agreed to move forward using the flow projections from the 2014 City of Antioch Master Plan in Table 1.6 for future work related to the BHPS and its conveyance system.

Table 1.5 2009 and Buildout BHPS Influent Flow Projections (2010 District Master Plan)

Delta Diablo 2010 Conveyance System Master Plan Update[1]					
2009 Flows (mgd)			Buildout Flows (mgd)		
ADWF	PDWF	PWWF	ADWF	PDWF	PWWF
2.62	3.9	4.4	5.5	8.4[2]	12.2[3]

[1] Information included in table from Delta Diablo Sanitation District's Conveyance System Master Plan Update Final Report, RMC, April 2010.

[2] The Conveyance System Master Plan Update shows a flow of 8.3 mgd and 8.4 mgd in different locations.

[3] The Conveyance System Master Plan Update shows a flow of 12.0 mgd and 12.2 mgd in different locations.

Table 1.6 2014 and Buildout BHPS Influent Flow Projections (2014 City Master Plan)

City of Antioch 2014 Master Plan[1,2]					
2014 Flows (mgd)			Buildout Flows (mgd)		
ADWF	PDWF	PWWF	ADWF	PDWF	PWWF
2.4	3.9	5.6	4.7	7.5	12.0

[1] Information included in table from City of Antioch's Collection System Master Plan, October 2014 (Table 3-1).

1.2.2.2 Existing Conditions

This section describes existing BHPS pumps, flow diversion facilities, and forcemains.

BHPS Pumps

The BHPS has two pump stations on site which include the main drypit/wetpit pump station and the original submersible pump station. The original submersible pump station is currently used as the diversion pump station.

Main Pump Station

The main pump station has a total of three equally sized 300Hp vertical drypit Flowserve Model 10MFC27, 895 rpm electric wastewater pumps which operate on variable speed drives. Two pumps provide reliable pumping for the station and the third pump serves as standby. This

operating condition is confirmed by SCADA data. When the capacity of two pumps is exceeded, excess flow bypasses to the diversion pump station and is conveyed to the ESB. All three pumps draw suction from the wetwell sump and discharge into a common 24-inch header which exits the pump station building and splits onsite to convey flow to either or both the 14-inch and 24-inch forcemains.

The pumps were installed when the new drypit/wetpit station was constructed under the 2006 Bridgehead Expansion, Phase 2 project. The District provided factory test curves dated February 21-22, 2008 for all three pumps. The test curves provide the serial numbers for each pump (0802MS004468-1, 0802MS004468-2, and 0802MS004468-3), impeller diameter of 26.61 and a design point of 4084 gpm (5.88 mgd) at 166 feet TDH. Based on discussions with District staff and reviewing background documents provided, no records exist that the pumps have been replaced since that time.

VWHA contacted Flowserve to obtain the manufacturer's pump curves which show the acceptable operating range (AOR) on the pump curve. See Appendix E of the Phase I – Existing Conditions Hydraulic Analysis (December 2020) for the certified performance test curves provided by the District and manufacturer's pump curve provided by Flowserve.

Per discussions with District staff, pump speed is currently capped at 68 percent to limit flow pumped by the station, in order to reduce pressurization of the shallow manhole at the end of the forcemains and within the downstream 18-inch gravity sewer. Per Drawing G-5 in the 2006 Bridgehead Expansion, Phase 1 and Phase 2 projects, the Bridgehead Pump Station was designed for its current interim operating condition but also for an ultimate operating condition to pump to the WWTP when operating the two duty pumps at full speed. See District's 2010 Conveyance System Master Plan for additional information.

As indicated by the District's pump station operational parameters/level setpoints (see Appendix G of the Phase I – Existing Conditions Hydraulic Analysis (December 2020)) for the Bridgehead Pump Station, all three pumps at the station are allowed to operate, including the standby pump if available, in lead, lag, and follow positions, as long as the water levels have not reached the diversion level. However, upon review of the SCADA data provided by the District, only two pumps operated during the data period prior to diversion to the ESB. The District has not indicated any capacity issues at the pump station. This observation is supported by the SCADA data.

Diversion Pump Station

The Diversion Pump Station was designed and constructed under the Bridgehead Pumping Station project in 1990 to serve as the original Bridgehead Pump Station. When the new drypit/wetpit BHPS and ESB were constructed under the 2006 Bridgehead Expansion, Phase 2 project, the original pump station was converted to the diversion pump station.

Per discussions with Flygt and subsequent field investigations and review of archived records by the District, it was confirmed that the original pumps were replaced. (Note: The information in Appendix F-1 of the Phase I - Existing Conditions Hydraulic Analysis (December 2020) is

incorrect. All four pumps have now been confirmed to be as shown in Appendix F-2) The diversion pump station currently contains three equally sized constant speed 88Hp electric submersible wastewater Flygt pumps, model CP3300-454 with 401mm impellers. Two pumps provide reliable pumping for the station and the third pump serves as standby. The District also confirmed that they have a forth identical diversion pump as a spare that is not installed. They noted that at any given time any three of the four pumps may be installed in the wetwell and the remaining unit remains in storage to serve as an additional spare unit.

The three pumps are located in the same wetwell and each has a check and isolation valve on its discharge piping prior to discharging into a common 14-inch header. The valves and header are located in an adjacent valve vault next to the wetwell. The header exits the pump station's valve vault in two directions. During peak wet weather events, the diversion pump station is used to pump flow to the on-site ESB to shave the peak flow and reduce the flow that is pumped by the main pump station though the forcemains. Flow passively passes to diversion pump station when water levels backup to elevation 2.14 feet. The diversion pump station can also convey flows through the 14-inch and/or 24-inch forcemain, if required. Per District staff this has been done during the dry weather season when the main pump station was removed from service for maintenance.

Per District's pump station operational parameters/level setpoints for the Bridgehead Diversion Pump Station (see Appendix G in Phase I - Existing Conditions Hydraulic Analysis (December 2020)), all three pumps at the station are allowed to operate, including the standby pump if available, in lead, lag, follow positions prior to alarming on high level. However, the District has indicated that three pumps are not allowed to operate together.

Flow Diversion to Equalization Storage

The pump station site contains an ESB on site. The District's 2010 Conveyance System Master Plan states that the pump station has a diversion capacity of 6.5 mgd. The Master Plan states that diversion is currently set to occur when the reliable capacity of the main pump station is exceeded (i.e., both main duty pumps operating at their maximum allowable speed).

The District's 2010 Conveyance System Master Plan states that the ESB has a capacity of 1.56 MG with a recommended usable capacity of 80% or 1.25 MG.

Bridgehead Forcemains

The BHPS has dual 14-inch and 24-inch forcemains for a portion of its alignment. The 14-inch (BHFM1) forcemain was designed and constructed under the 1990 Bridgehead Forcemain & Gravity Sewer project and the 24-inch (BHFM2) forcemain was designed and constructed under the 2003 Bridgehead Expansion Project, Phase I. BHFM1 is constructed of PVC and the BHFM2 is constructed of HDPE. Under normal operating conditions, the District currently only operates the 24-inch forcemain. District staff indicated that they would like to continue to operate only the 24-inch forcemain in the future, if possible. They indicated that if it is required use the 14-inch forcemain in the future they would like to first perform a condition assessment of the forcemain to confirm its current condition.

The forcemains located on the BHPS site were designed and constructed under the associated pump station projects in 1990 and 2006. The two forcemains exit the site at different locations but have parallel alignments and similar lengths and profiles. A portion of BHFM1 on the pump station site is 24-inches in diameter.

Under the 2003 Bridgehead Expansion Project, Phase 1, the final 640 feet of the 14-inch forcemain was abandoned and the two forcemains combined into a common 24-inch HDPE forcemain for a distance of 620 feet prior to discharging into a shallow (3.5 feet deep) manhole. Technically this is where the Bridgehead forcemain ends and transitions to an 18-inch gravity sewer. However, the District indicated that pressurized flow occurs within the discharge manhole and a portion of the downstream 18-inch gravity sewer when flows exceed the capacity of the 18-inch gravity sewer. The 18-inch sanitary sewer just downstream of the existing shallow discharge manhole is supported from the Wilbur Avenue Bridge with a slope of 0.003, which limits its capacity to 3.7 mgd (at approximately 80 percent full) when conveying gravity flow. Under the condition when flows are pressurized through the downstream 18-inch gravity sewer, additional headloss occurs due to the turbulent condition that is produced in the shallow discharge manhole as pressurized flow exits the 24-inch forcemain into the manhole structure and then re-enters the 18-inch gravity sewer. The 2003 Bridgehead Expansion Project, Phase 1, replaced the top of the shallow discharge manhole and installed a 36-inch diameter locking manhole frame and cover to prevent the pressurized flow from lifting and exiting the manhole cover at this location. Per the 1990 Bridgehead Forcemain & Gravity Sewer project, the 18" gravity sewer located on the Wilbur Avenue Bridge is polyethylene-lined ductile iron pipe. The District indicated that the joints on the bridge are restrained.

Shortly after the Phase I - Existing Conditions Hydraulic Analysis work was completed, the District experienced a failure of the 18-inch gravity sewer supported from the Wilbur Avenue Bridge. The condition assessment found that the polyethylene-lining had failed and detached from the ductile iron pipe's interior and was restricting flow. In addition, the exposed interior of the ductile iron pipe had corroded and resulted in a leak. Subsequently, a new 24-inch forcemain has been designed and is currently under construction (Bridgehead Pipeline Replacement Project (VWHA, June 2021)) to connect to the existing 24-inch HDPE forcemain upstream of the Wilbur Avenue Bridge and shallow manhole and to replace the shallow manhole structure, 18-inch gravity sewer on the Wilbur Avenue Bridge and to extend downstream for a distance for discharge into a new manhole.

The only intermediate highpoint and air release valve within the current forcemain system is located just outside the main pump station where the common header splits into the two forcemains. A new combination air release valve will be added within the new 24-inch forcemain which is currently under construction, just upstream of the Wilbur Avenue Bridge (location of prior shallow manhole), since this will be the high point in the new extended forcemain system.

Bridgehead Flowmeters

A 24-inch magnetic flowmeter (FE-612) is located within the main pump station on the station's discharge header and records all flow pumped by the main pump station. A second 24-inch

magnetic flowmeter (FE-602) is located within a vault on the pump station site and records all flows that are conveyed through the 24-inch forcemain. Per District staff, a 14-inch magnetic flowmeter (FE-610) is located on the discharge header of the Diversion Pump Station inside the valve vault. A flowmeter at this location records all flow pumped by the Diversion Pump Station, including flows pumped to either forcemain or the ESB.

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SECTION 2

APS AND BHPS CONVEYANCE SYSTEM ALTERNATIVES ANALYSIS

The approach and recommendations outlined in the 2010 Conveyance System Master Plan for buildout conditions at Antioch and Bridgehead Pump Stations and Conveyance System were reviewed and analyzed. The 2010 Conveyance System Master Plan recommended:

1) Extending the BHPS FM to APS and using forcemain AFM102 to pump buildout flows from BHPS (reduced via diversion) to the WWTP; and

2) Upgrading APS to pump buildout flows (without BPS flows and reduced via diversion) to the WWTP using only forcemain AFM101.

Per the District's request, an alternatives analysis was performed by VWHA to determine which forcemain (AFM101 or AFM102) was best suited for use with which pump station (APS or BHPS) to meet long term/ buildout pumping needs within the APS and BHPS conveyance system. The analysis developed and evaluated the following alternatives:

- Alternative 1: BHPS w/AFM101 and APS w/AFM102
- Alternative 2: BHPS w/AFM102 and APS w/AFM101 (Per 2010 Conveyance System Master Plan)

2.1 FLOWS

As discussed in Section 1, flow projections used in this report for all analysis are those from the 2014 City of Antioch Master Plan.

At this time, the flows pumped by the APS include flow from the BHPS. Table 2.1 includes the 2014 and buildout influent flow projections at the APS with BHPS flows included.

Table 2.1 2014 and Buildout APS Influent Flow Projections with BHPS Flows Included (2014 City of Antioch Master Plan)

APS Flow Projections (with BHPS flows)[1]							
2014 Flows (mgd)				Buildout Flows (mgd)			
With Bridgehead Flows				With Bridgehead Flows			
Minimum	ADWF	PDWF	PWWF	Minimum	ADWF	PDWF	PWWF
3.8	7.3	10.4	17.0	6.2	11.3	17.8	26.3

[1] Information included in table is from City of Antioch's Collection System Master Plan, October 2014 (Table 3-1) and information contained within the City of Antioch's Collection System Master Plan.

Once the systems are separated, the APS will no longer re-pump the flows from BHPS. Table 2.2 includes the 2014 and buildout influent flow projections at the APS without BHPS flows included.

Table 2.2 2014 and Buildout APS Influent Flow Projections (without BHPS Flows) (2014 City of Antioch Master Plan)

APS Flow Projections (without BHPS flows)[1]							
2014 Flows (mgd)				Buildout Flows (mgd)			
Without Bridgehead Flows				Without Bridgehead Flows			
Minimum	ADWF	PDWF	PWWF	Minimum	ADWF	PDWF	PWWF[2]
2.7	4.9	6.5	11.4	4.2	6.6	10.3	14.3

[1] Information included in table is from City of Antioch's Collection System Master Plan, October 2014 (Table 3-1) and information contained within the City of Antioch's Collection System Master Plan.

[2] Under buildout conditions at the APS (with no BHPS flows), the District's 2010 Conveyance System Master Plan recommended diversion to the ESB for flows greater than 12.5 mgd.

Table 2.3 includes the 2014 and buildout influent flow projections at the BHPS.

Table 2.3 2014 and Buildout BHPS Influent Flow Projections (2014 City of Antioch Master Plan)

BHPS Flow Projections[1]							
2014 Flows (mgd)				Buildout Flows (mgd)			
BHPS Flows				BHPS Flows			
Minimum	ADWF	PDWF	PWWF	Minimum	ADWF	PDWF	PWWF[2]
1.1	2.4	3.9	5.6	2.0	4.7	7.5	12.0

[1] Information included in table is from City of Antioch's Collection System Master Plan, October 2014 (Table 3-1) and information contained within the City of Antioch's Collection System Master Plan.

[2] Under buildout conditions at the BHPS, the District's 2010 Conveyance System Master Plan recommended diversion to the ESB for flows greater than 10.8 mgd since that was noted as BHPS's reliable capacity. However, based on the findings of the analysis performed under this project which established a reliable capacity of 10.5 mgd for the BHPS, the recommended diversion trigger to the ESB was lowered to 10.5 mgd. See below for additional information.

2.2 ALTERNATIVES ANALYSIS

The APS and BHPS conveyance system alternatives analysis developed and analyzed the following two alternatives:

- Alternative 1: BHPS w/AFM101 and APS w/AFM102
- Alternative 2: BHPS w/AFM102 and APS w/AFM101 (Per 2010 Conveyance System Master Plan)

2.2.1 Bridgehead Pump Station

Preliminary planning level alignment and profile assumptions were made for the new BHPS 24-inch HDPE forcemain extension to be installed between the new forcemain discharge manhole

currently being designed downstream of the Wilbur Avenue Bridge and the APS site where it will be connected to one of APS's existing forcemains (either AFM101 or AFM102 depending upon the alternative).

An analysis was conducted to confirm if the existing pumps at the Bridgehead Pump Station have sufficient reliable pumping capacity to pump buildout PWWFs (reduced via diversion) to the WWTP. The analysis was also conducted to confirm if both existing BHPS forcemains (14-inch and 24-inch) are required for use or if the flow can be pumped using only the existing 24-inch BHPS forcemain. Per the original construction drawings for the Bridgehead 24-inch forcemain and BHPS (Bridgehead Expansion Phase 1 (2003) Drawing G-5 and Bridgehead Expansion Phase 2 (2006) Drawing G-5) and the 2010 Conveyance System Master Plan, the Bridgehead Pump Station was designed to reliably pump buildout flows (minus diversion to the ESB) to the WWTP when pumping through AFM102 utilizing two duty pumps at full speed without any future upgrades at the station.

2.2.1.1 BHPS Diversion Trigger Analysis

Projected buildout PWWF entering the BHPS is 12.0 mgd (Table 2.3). However, all incoming buildout PWWFs entering the BHPS will not be pumped to the WWTP. A portion of the flow will be diverted and pumped by the Bridgehead diversion pump station to ESB for equalization. After peak flows subside, the flow will then be drained back to the BHPS wetwell and pumped to the WWTP.

A diversion trigger setpoint of 10.8 mgd was established for the BHPS under buildout conditions in the 2010 Conveyance System Master Plan. This trigger was based on the reliable capacity of the BHPS noted in the 2010 Conveyance System Master Plan of 10.8 mgd. VWHA performed a diversion pump station trigger analysis using the District's InfoWorks ICM hydraulic model and confirmed that the existing equalization storage basin (ESB) at BHPS has sufficient storage capacity (volume) to handle buildout diverted flows during the peak design storm based on the diversion trigger established in the 2010 Master Plan. Use of projected PWWFs outlined in the 2014 City of Antioch Collection System Master Plan rather than the higher PWWF projections used in the 2010 Conveyance System Master Plan will also reduce the storage volume required.

However, under the analysis performed on this project, it was determined that the BHPS only has a reliable capacity of 10.5 mgd. Therefore, the recommended diversion trigger to the ESB was lowered to 10.5 mgd. VWHA re-performed the diversion pump station trigger analysis using the District's InfoWorks ICM hydraulic model (From District's 2010 Conveyance System Master Plan) and also confirm that the existing equalization storage basin (ESB) at BHPS has sufficient storage capacity (volume) to handle buildout diverted flows based on a diversion trigger of 10.5 mgd.

VWHA also confirmed that the diversion trigger setpoint is higher than BHPS's projected buildout PDWF to ensure dry weather flows are not diverted to the ESB. Projected buildout PDWF outlined in the 2014 City of Antioch Collection System Master Plan entering the BHPS is 7.5 mgd (Table 2.3).

2.2.1.2 BHPS Diversion Pump Station Capacity Analysis

In addition, to performing the diversion pump station trigger analysis discussed above, VWHA also performed a hydraulic analysis for the existing Bridgehead diversion pump station to determine and confirm its reliable diversion capacity and to confirm its diversion capacity is compatible with the diversion trigger at the BHPS. The Bridgehead diversion pump station must have a reliable capacity greater than or equal to buildout PWWF minus the diversion trigger setpoint (12.0 mgd – 10.5 mgd) of 1.5 mgd.

Development of System Curve and Suction and Discharge Loss Curve

The expected system curve and suction and discharge loss curve for the Bridgehead Diversion Pump Station were developed through evaluation and use of the original and updated pump station, associated forcemain, and ESB drawings and mathematical computations. A system curve for flow versus TDH for the onsite 14-inch forcemain to the ESB was developed using the Hazen-Williams equation for pipe friction head losses (major losses), the method of loss coefficients (k-values) for pipe fittings (minor losses), and static head (static loss) between the Diversion pump station wetwell elevation and the forcemain discharge location (high point) at the ESB. Elevations, specific fittings, and pipeline lengths for each pipe were determined from existing drawings.

The suction and discharge loss curve was developed based on the friction and minor losses within each pump's discharge piping at the pump station. The manufacturer-provided pump curves were used in the analysis and adjusted based on the suction and discharge loss curve to obtain adjusted pump curves.

Table 2.4 provides information used in the development of the system curve, suction and discharge loss curve, and pump curves. Additional information is included in Appendix A.

The pump, system, and suction and discharge loss curves developed for the Bridgehead diversion pump station are shown in Figure 2.1. The hydraulic calculations used to develop the curves are included in Appendix A.

Table 2.4 Bridgehead Diversion Pump Station – Hydraulic Information

Forcemain	
Diameter	14-inch
Length	338.5 feet
Hazen-Williams (C-value)	100[1]
Minor Loss Coefficient (K-value)	5.82
Discharge Highpoint Elevation	38.08 (crown of high point at ESB)
Wetwell Elevation Range	-4.5 to 0 (normal operation)
Static Range[4]	38.08 - 42.58
Pump Discharge	
Diameter	8-inch
Length	22 feet
Hazen-Williams (C-value)	120[2]
Minor Loss Coefficient (K-value)	3.7
Pumps	
No. of Pumps	3 Total (2 Duty + 1 Standby)
Pump Model	Flygt CP3300, 454 impeller (401mm trim), 88 Hp
Drive Type	Constant Speed

[1] Hazen-Williams C-values for Forcemain. Per discussions with District, a C-value of 100 was used for existing non-plastic (non HDPE and PVC) forcemains including but not limited to lined steel or ductile iron pipe and AWWA C-303 bar-wrapped steel cylinder concrete pressure pipe (CCPP). A C-value of 120 was used for existing plastic (HDPE and PVC) forcemains. A C-value of 120 was used for all future forcemains as all future forcemains per District input will be plastic (HDPE and PVC) forcemains.

[2] Hazen-Williams C-values for Pump Suction and Discharge Piping. A C-value of 120 was used for existing and new pump suction and discharge piping regardless of pipe material. It is assumed such piping will have a higher C-value then forcemain piping due to less resistance due to corrosion, grease accumulation, grit/solids accumulation, and air accumulation.

[3] Elevations are based on 1929 NGVD 29

[4] Static range = discharge highpoint elev – wetwell elevation

[5] Information contained in the table is for pumping to the ESB

Findings

The analysis confirmed that the Bridgehead Diversion Pump Station has adequate reliable capacity to divert flow to the ESB under buildout conditions since the Bridgehead diversion pump station has a reliable capacity greater than 1.5 mgd. Table 2.5 outlines the Bridgehead Diversion Pump Station capacity when pumping to the ESB. The Bridgehead diversion pump station has a reliable diversion capacity of 5.6 mgd (2 duty pumps) and a capacity of 2.9 mgd when using one pump.

Table 2.5 Bridgehead Diversion Pump Station Capacity

Pump Parameter	Capacity (mgd)
One pump	2.9
Two pumps (Reliable Capacity)	5.6

[1] Information contained in the table is for pumping to the ESB

The District noted that the oversized diversion pump station allows them to use the pump station to pump flow into the collection system during times when the main pump station is removed from service. A hydraulic analysis was not performed for this situation.

During the course of the work, the District indicated that they need to replace the existing diversion pumps with new pumps due to age under a future maintenance project. Flygt confirmed that the existing pumps/impellers are no longer available. VWHA worked with Flygt to hydraulically select new pumps with similar hydraulic characteristics and capacities for the District's use. Such pumps include Flygt N-impeller pumps NP3301 HT, 330 mm impeller, 85 Hp or NP3202 MT, 376mm impeller, 54 Hp (Note: The NP3202 MT pump will provide less flow into the offsite forcemain system if using the only the 14" forcemain but similar flow if using the 24" forcemain or both the 14-inch and 24-inch forcemains). Replacement of these pumps is not included in this project. The District will work directly with Flygt for replacement. One of the two pump selections may physically work better with the existing piping and wetwell arrangement.

2.2.2 Antioch Pump Station

Under this analysis, new pumps will be selected for the recommended alternative at the APS to reliably pump buildout PWWFs (minus BHPS flows and reduced via diversion) to the WWTP though a single forcemain (either AFM101 or AFM102 depending upon the alternative). The existing large pumps will be required to be replaced at a minimum. However, all four (4) pumps will be replaced if required to meet hydraulic requirements. The analysis will consider using two large pumps and two small pumps per the existing pump station's configuration but will also consider using four equally sized pumps (3 duty and 1 standby). Advantages and disadvantages of each pumping configuration will be developed to determine the recommended pumping configuration.

Once the two alternatives are developed, the findings will be evaluated to identify advantages and disadvantages of each alternative and determine the recommended alternative.

A forcemain profile figure will be developed for each pump station's forcemain to illustrate the forcemain profile showing elevation changes, high and low points, and any hydraulically controlling high points along each forcemains' length.

2.2.2.1 APS Diversion Trigger Analysis

Projected buildout PWWF entering the APS is 14.3 mgd (not including any flow from the BHPS) (Table 2.2). However, all incoming buildout PWWFs entering the APS will not be pumped to the WWTP. A portion of the flow will be diverted and pumped to the ESB for

equalization. After peak flows subside, the flow will then be drained back to the APS wetwell and pumped to the WWTP.

A diversion trigger setpoint of 12.5 mgd was established for the APS under buildout conditions in the 2010 Conveyance System Master Plan. VWHA performed a diversion pump station trigger analysis using the District's InfoWorks ICM hydraulic model (from the 2010 Conveyance System Master Plan) and confirmed that the existing ESB at APS has sufficient storage capacity (volume) to handle buildout diverted flows during the peak design storm based on the diversion trigger established in the 2010 Master Plan. The use of projected PWWFs outlined in the 2014 City of Antioch Collection System Master Plan rather than the higher PWWF projections used in the 2010 Conveyance System Master Plan will also reduce the storage volume required.

VWHA also confirmed that the diversion trigger setpoint is higher than APS's projected buildout PDWF to ensure dry weather flows are not diverted to the ESB. Projected buildout PDWF outlined in the 2014 City of Antioch Collection System Master Plan entering the APS is 10.3 mgd (Table 2.2).

The new Antioch diversion pump station must have a reliable capacity greater than or equal to buildout PWWF minus the diversion trigger setpoint. Therefore, the new Antioch diversion pump station's reliable capacity must be at least (14.3 mgd – 12.5 mgd) 1.8 mgd.

2.2.3 Alternatives

2.2.3.1 Alternative 1 - BHPS w/AFM101 and APS w/AFM102

Alternative 1 analyzes BHPS using forcemain AFM101 and APS using forcemain AFM102 to meet long term/ buildout pumping needs within the APS and BHPS conveyance system.

BHPS with AFM101

System curves and suction and discharge loss curves for the BHPS using forcemain AFM101 to pump all Bridgehead flow (minus any diversion flows) directly to the discharge structure at the intersection of Arcy Lane and Pittsburg – Antioch Highway were developed. The forcemain system included the existing Bridgehead forcemain system which includes both the existing 14-inch and 24-inch forcemains, the new 24-inch DIP forcemain currently under construction over the Wilbur Avenue Bridge, a new future HDPE forcemain between where the forcemain currently under construction ends and the tie-in point to forcemain AFM101 on the APS site, and forcemain AFM101 from that location to the intersection of Arcy Lane and Pittsburg – Antioch Highway. A 30-inch (25.3" inside diameter) HDPE forcemain with a length of 3,481 feet and a k-value of 4.125 was used for the future forcemain between where the forcemain currently under construction ends and the tie-in point to forcemain AFM101 on the APS site. A larger diameter forcemain was used in an attempt to avoid the need to use the 14-inch parallel forcemain segment per District request.

System curves and suction and discharge loss curve for the Bridgehead Pump Station were developed using the original pump station and associated forcemain drawings, estimations and assumptions for the future forcemain, and mathematical computations. The system curves for flow versus TDH for the forcemain system were developed using the Hazen-Williams equation

for pipe friction head losses (major losses), the method of loss coefficients (k-values) for pipe fittings and valves (minor losses), and static head (static loss) between the pump station wetwell wastewater elevation and the forcemain discharge elevation at the intersection of Arcy Lane and Pittsburg – Antioch Highway.

Per discussions with District staff, a C-value of 100 was used for non-plastic (non-HDPE and PVC) forcemains including but not limited to lined steel or ductile iron pipe and AWWA C-303 bar-wrapped steel cylinder concrete pressure pipe (CCPP). A C-value of 120 was used for plastic (HDPE and PVC) forcemains. Per District input all future forcemains will be plastic (HDPE and PVC) forcemains. These C-values are typical for existing forcemains that have been in service for a number of years since C-values decrease over time due to corrosion, grease accumulation, grit/solids accumulation, and air accumulation. Since new piping will eventually age, these C-values were used for all piping regardless of age. A C-value of 120 was used for pump suction and discharge piping regardless of pipe material. It is assumed such piping will have a higher C-value than forcemain piping due to having less grease, grit/solids, and air accumulation.

The suction and discharge loss curve was developed based on the friction and minor losses within each pump's suction and discharge piping at the pump station. The manufacturer-provided pump curves for the existing pumps at the Bridgehead Pump Station were used in the analysis and adjusted based on the suction and discharge loss curve to obtain adjusted pump curves.

A profile of the complete forcemain alignment, including wetwell operating levels and forcemain diameter and length, Hazen-Williams C-value, and minor loss coefficient (k-value) for each forcemain segment is included in Figure 2.2.

Due to potentially controlling high points along the forcemain alignment, system curve development included development of multiple system curves to determine where flow transitions from a pumped state to pressurized gravity flow. This analysis is essential to determine the shape of the actual system curve. BHPS with AFM101 was analyzed for two potential controlling hydraulic conditions as well as for pumping to the end of the forcemain:

- BHPS to Highest Point - to the highest high point at the Wilbur Avenue Bridge;
- A Modified - to the intermediate high point in AFM101 (Sta 46+44.91); and
- B Modified - to the end of the forcemain

The hydraulic analysis determined that the intermediate high point in AFM101 (Sta 46+44.91) was not a controlling high point when using BHPS since the intermediate high point at the Wilbur Avenue Bridge is now the highest point. The high point at the Wilbur Avenue Bridge controls at lower flows and the end of the forcemain controls at higher flows when using just the 24-inch forcemain or when using both the 14-inch and 24-inch forcemains. The high point at the Wilbur Avenue Bridge controls when using only the 14-inch forcemain. Findings from this analysis are provided in Table 2.6. Detailed calculations and additional information are included in Appendix B.

Table 2.6 BHPS w/ Forcemain AFM101 – System Curve Development Results

Segment	Length	Static Range	System Curve Controlling Flow Range (mgd)		
			w/ 14" Only	w/ 24" Only	w/ 14" and 24"
Forcemain AFM101					
BHPS FM to High Point	11,702 feet (14" FM) & 10,973 feet (24" FM)	58.13 – 62.63 feet	All flows for BHPS pumps	0 – 6.1 mgd	0 – 6.3 mgd
A Modified (to AFM101 intermediate high point at Sta 46+44.91)	19,389 feet (14" FM) & 18,660 feet (24" FM)	27.85 – 32.35 feet	N/A (High point "A modified" is not a controlling high point)		
B Modified (to end of forcemain)	29,351 feet (14" FM) & 28,622 feet (24" FM)	23.35 – 27.85 feet	N/A for BHPS pumps	Greater than 6.1 mgd	Greater than 6.3 mgd

[1] Elevations are based on 1929 NGVD 29

[2] Static range uses forcemain crown elevation – wetwell elevation range

For the flow range shown to be controlled by the segment comprised of BHPS FM to high point in Table 2.6, flow is pumped to the high point at the Wilbur Avenue Bridge. Flow beyond this point in the forcemain is then pushed (pressurized gravity) through the forcemain by the hydraulic grade line at that location to the end of the forcemain. When flows exceed the limits shown in Segment – BHPS FM to high point in Table 2.6, the controlling segment then changes to Segment B Modified. At these higher flows, flow is pumped to the end of the forcemain at the intersection of Arcy Lane and Pittsburg – Antioch Highway.

The pump, system, and suction and discharge loss curves developed for the BHPS utilizing forcemain AFM101 are shown in Figure 2.3. The system curves used in Figure 2.3 were developed using the controlling portions of the system curves shown in Table 2.6. The hydraulic calculations used to develop the curves are included in Appendix B.

Figure 2.3 was used to determine the existing capacity of BHPS. The pump and station capacities are also shown in Table 2.7.

Table 2.7 BHPS w/ Forcemain AFM101 – Capacities

Pump Parameter	w/ 14" Only	w/ 24" Only	w/ 14" and 24"
One pump (full speed)	4.0 mgd	8.4 mgd	8.6 mgd
Two pumps (full speed) (Reliable Pump Station Capacity)	4.3 mgd	10.6 mgd	11.1 mgd

The reliable capacity of the BHPS when pumping through AFM101 is 11.1 mgd when using both the 14-inch and 24-inch existing Bridgehead forcemains and the reliable capacity when pumping through AFM101 is 10.6 mgd when using only the 24-inch Bridgehead forcemain. Since District staff indicated that they would like to continue to operate only the 24-inch forcemain in the future, if possible, VWHA confirmed that with a reliable capacity of 10.6 mgd at the BHPS (if the 14-inch forcemain is not used), the existing BHPS diversion system works properly under a projected buildout PWWF of 12.0 mgd (Table 2.3) with a diversion trigger set at 10.6 mgd.

Since the existing pumps at the BHPS can turn down to below current and buildout minimum flows per District staff, the pumps are not anticipated to turn off during normal operation. Therefore, the forcemain high points are not anticipated to drain under normal operating conditions.

VWHA confirmed through the diversion pump station trigger analysis that the existing ESB at BHPS has sufficient storage capacity (volume) to handle buildout diverted flows based on a diversion trigger of 10.5 mgd. VWHA also confirmed that the existing Bridgehead diversion pump station has a reliable capacity much greater than the required 1.4 mgd. (Buildout PWWF (12.0) minus the diversion trigger setpoint (10.6 mgd) of 1.4 mgd). See above for additional information related to the diversion trigger and the capacity analyses performed for the Bridgehead ESB and diversion pump station.

APS with AFM102

System curves and suction and discharge loss curves for the APS using only forcemain AFM102 to pump APS flow (minus any BHPS or diversion flows) directly to the WWTP headworks were developed.

The system curve and suction and discharge loss curve for the APS were developed using the original and updated pump station and forcemain drawings and mathematical computations. The system curve for flow versus TDH for the forcemain system was developed using the Hazen-Williams equation for pipe friction head losses (major losses), the method of loss coefficients (k-values) for pipe fittings and valves (minor losses), and static head (static loss) between the pump station wetwell wastewater elevation and the forcemain discharge elevation at the WWTP headworks.

Per discussions with District staff, a C-value of 100 was used for non-plastic (non-HDPE and PVC) forcemains including but not limited to lined steel or ductile iron pipe and AWWA C-303 bar-wrapped steel cylinder concrete pressure pipe (CCPP). This C-value is typical for existing forcemains that have been in service for a number of years since C-values decrease over time due to corrosion, grease accumulation, grit/solids accumulation, and air accumulation. A C-value of 120 was used for pump suction and discharge piping regardless of pipe material. It is assumed such piping will have a higher C-value then forcemain piping due to less grease, grit/solids, and air accumulation. Since new piping will eventually age, these C-values were used for all piping regardless of age.

The suction and discharge loss curve was developed based on estimated friction and minor losses within each new pump's new suction and discharge piping at the pump station.

A profile of the complete forcemain alignment, including wetwell operating levels and forcemain diameter and length, Hazen-Williams C-value, and minor loss coefficient (k-value) for each forcemain segment is included in Figure 2.4.

Due to potentially controlling high points along the forcemain alignment, system curve development included the development of multiple system curves to determine where flow transitions from a pumped state to pressurized gravity flow. This analysis was essential to determine the shape of the actual system curve. APS with AFM102 was analyzed for four potential controlling hydraulic conditions as well as for pumping to the end of the forcemain:

- A) to the high point at Station Sta 36+51;
- B) to the high point at Station Sta 71+30;
- C) to the high point at Station Sta 120+15;
- D) to the high point at Station Sta 145+39; and
- E) to the end of the forcemain

The hydraulic analysis determined that the intermediate high point in AFM102 at Sta 120+15 was not a controlling high point, but the other high points did control at various flows and the end of the forcemain controls at higher flows. Findings from this analysis are provided in Table 2.8. Detailed calculations and additional information are included in Appendix C.

Table 2.8 APS w/ Forcemain AFM102 – System Curve Development Results

Segment	Length	Static Range	System Curve Controlling Flow Range (mgd)
Forcemain AFM102			
A (to intermediate high point at Sta 36+51)	2,760 feet	36.93–39.43 feet	0 – 2.5 mgd
B (to intermediate high point at Sta 71+30)	6,239 feet	35.4-37.9 Feet	2.5 – 4 mgd
C (to intermediate high point at Sta 120+15)	11,124 feet	28.9-31.4 feet	N/A (High point "C" is not a controlling high point)
D (to intermediate high point at Sta 145+39)	13,648 feet	28.23-30.73 feet	4 – 5.6 mgd
E (to end of forcemain)	15,897 feet	23.9-26.4 feet	Greater than 5.6 mgd

[1] Elevations are based on 1929 NGVD 29

[2] Static range uses forcemain crown elevation – wetwell elevation range

For the flow range shown to be controlled by Segment A in Table 2.8, flow is pumped to the high point at Sta 36+51. Flow beyond this point in the forcemain is then pushed (pressurized

gravity) through the forcemain by the hydraulic grade line at this location to the end of the forcemain. When flows exceeds 2.5 mgd, the controlling segment shifts from Segment A to Segment B, D, or E, depending on the flow. For the flow ranges shown to be controlled by Segments B and D in Table 2.8, flow is pumped to the high points at Stations 71+30 and 145+39, respectively. Flow beyond these locations is then pushed (pressurized gravity) through the forcemain by the hydraulic grade line at that location to the end of the forcemain. For flows higher than 5.6 mgd, shown to be controlled by Segment E in Table 2.8, flow is pumped to the end of the forcemain.

The pump, system, and suction and discharge loss curves developed for the APS utilizing forcemain AFM102 are shown in Figure 2.5. The system curves used in Figure 2.5 were developed using the controlling portions of the system curves shown in Table 2.8. The hydraulic calculations used to develop the curves are included in Appendix C.

VWHA confirmed that with a reliable capacity and diversion trigger of 12.5 mgd at the APS, the existing ESB has sufficient storage capacity (volume) to handle buildout diverted flows. New pumps were selected for the APS to provide reliable operation throughout the entire expected operating range for current and buildout flows (minus BHPS flows and reduced via diversion) to the WWTP with a reliable capacity of 12.5 mgd (diversion trigger setpoint). The existing large pumps were required to be replaced at a minimum since their operation is outside the pump manufacturer's recommended operating range and one existing large pump does not have sufficient capacity to pump buildout PWWF minus diversion of 12.5 mgd. The analysis considered using two large pumps and two small pumps per the existing pump station's configuration but also considered using four equally sized pumps (3 duty and 1 standby). Per District request, Flygt N-impeller drypit submersible pumps were used for pump selection.

A Flygt pump selection for the two large pump and two small pump configuration similar to the existing pump station could not be located. Flygt does not have drypit submersible motors of the required size. A four equally sized pump configuration (3 duty and 1 standby) resulted in selection of Flygt Model NT3312/836 pumps with a 515mm impeller and a 385 Hp motor. Pump information is included in Appendix C. The Flygt pump curve was used in the analysis and adjusted based on the suction and discharge loss curve to obtain adjusted pump curves.

Figure 2.5 illustrates the capacity at the APS with the new pumps which were selected to provide a reliable pumping capacity of 12.5 mgd (min). The pump and station capacities are also shown in Table 2.9. Pumps will be provided with variable frequency drives. One pump is capable of turning down to less than current minimum dry weather flow.

Since the pumps can turn down to below current and buildout minimum flows, the pumps are not anticipated to turn off during normal operation and forcemain AFM102's high points are not anticipated to drain under normal operating conditions. Partial draining of forcemain AFM102 currently occurs at low flows under the station's dual forcemain configuration due to different static conditions of the two forcemains. This will also be eliminated due to conversion to single forcemain operation.

Table 2.9 APS w/ Forcemain AFM102 – Capacities

Pump Parameter	Capacity
One pump (full speed)	10.1 mgd
Two pumps (full speed)	12.0 mgd
Three pumps (full speed) (Reliable Pump Station Capacity)	13.0 mgd

The new Antioch diversion pump station is required to have a reliable capacity of 1.8 mgd. (Buildout PWWF (14.3 mgd) – Diversion Trigger Setpoint (APS Reliable Capacity) (12.5 mgd)). See above for additional information related to the diversion trigger and the capacity analyses performed for the Antioch ESB and new diversion pump station.

2.2.3.2 Alternative 2: BHPS w/AFM102 and APS w/AFM101 (Per 2010 Conveyance System Master Plan)

Alternative 2 analyzes BHPS using forcemain AFM102 and APS using forcemain AFM101 as recommended in the District's 2010 Conveyance System Master Plan to meet long term/ buildout pumping needs within the APS and BHPS conveyance system.

BHPS with AFM102

System curves and suction and discharge loss curves for the BHPS using forcemain AFM102 to pump all Bridgehead flow (minus any diversion flows) directly to the WWTP Headworks were developed. The forcemain system included using the existing Bridgehead forcemain system which includes both the existing 14-inch and 24-inch forcemains, the new 24-inch DIP forcemain currently under construction over the Wilbur Avenue Bridge, and a new future HDPE forcemain between where the forcemain currently under construction ends and the tie-in point to forcemain AFM102 within the intersection of Wilbur Avenue and Fulton Shipyard Road. When forcemain AFM102 was constructed, a blind flange was provided at the intersection of Wilbur Avenue and Fulton Shipyard Road for the future connection of the BHPS.

A 30-inch (25.3" inside diameter) HDPE forcemain with a length of 2,455 feet and a k-value of 2.75 was used for the future forcemain between where the forcemain currently under construction ends and the blind flange location in forcemain AFM102. A larger diameter forcemain was used in an attempt to avoid using the 14-inch parallel forcemain segment in the future per District request.

System curves and suction and discharge loss curve for the Bridgehead Pump Station were developed using the original pump station and associated forcemain drawings, estimations and assumptions for the future forcemain, and mathematical computations. The system curves for flow versus TDH for the forcemain system were developed using the Hazen-Williams equation for pipe friction head losses (major losses), the method of loss coefficients (k-values) for pipe fittings and valves (minor losses), and static head (static loss) between the pump station wetwell wastewater elevation and the forcemain discharge elevation at the WWTP headworks.

Per discussions with District staff, a C-value of 100 was used for non-plastic (non-HDPE and PVC) forcemains including but not limited to lined steel or ductile iron pipe and AWWA C-303 bar-wrapped steel cylinder concrete pressure pipe (CCPP). A C-value of 120 was used for plastic (HDPE and PVC) forcemains. Per District input all future forcemains will be plastic (HDPE and PVC) forcemains. These C-values are typical for existing forcemains that have been in service for a number of years since C-values decrease over time due to corrosion, grease accumulation, grit/solids accumulation, and air accumulation. A C-value of 120 was used for pump suction and discharge piping regardless of pipe material. It is assumed such piping will have a higher C-value then forcemain piping due to less grease, grit/solids, and air accumulation. Since new piping will eventually age, these C-values were used for all piping regardless of age.

The suction and discharge loss curve was developed based on the friction and minor losses within each pump's suction and discharge piping at the pump station. The manufacturer-provided pump curves for the existing pumps at the Bridgehead Pump Station were used in the analysis and adjusted based on the suction and discharge loss curve to obtain adjusted pump curves.

A profile of the complete forcemain alignment, including wetwell operating levels and forcemain diameter and length, Hazen-Williams C-value, and minor loss coefficient (k-value) for each forcemain segment is included in Figure 2.6.

Due to potentially controlling high points along the forcemain alignment, system curve development included development of multiple system curves to determine where flow transitions from a pumped state to pressurized gravity flow. This analysis was essential to determining the shape of the actual system curve. BHPS with AFM102 was analyzed for five potential controlling hydraulic conditions as well as for pumping to the end of the forcemain:

- BHPS to Highest Point - to the highest high point at the Wilbur Avenue Bridge;
- A Modified - to the high point at Station Sta 36+51;
- B Modified - to the high point at Station Sta 71+30;
- C Modified - to the high point at Station Sta 120+15;
- D Modified - to the high point at Station Sta 145+39; and
- E Modified - to the end of the forcemain.

The hydraulic analysis determined that the intermediate high points in AFM102 at Sta 36+51, Sta 71+30, Sta 120+15, and Sta 145+39 were no longer controlling high points when using BHPS since the intermediate high point at the Wilbur Avenue Bridge is now the highest point. The high point at the Wilbur Avenue Bridge controls at lower flows and the end of the forcemain controls at higher flows when using just the 24-inch forcemain or when using both the 14-inch and 24-inch forcemains. The high point at the Wilbur Avenue Bridge controls when using only the 14-inch forcemain. Findings from this analysis are provided in Table 2.10. Detailed calculations and additional information are included in Appendix D.

Table 2.10 BHPS w/ Forcemain AFM102 – System Curve Development Results

Segment	Length	Static Range	System Curve Controlling Flow Range (mgd)		
			w/ 14" Only	w/ 24" Only	w/ 14" and 24"
Forcemain AFM102					
BHPS FM to High Point	11,702 feet (14" FM) & 10,973 feet (24" FM)	58.13 – 62.63 feet	All flows for BHPS pumps	0 – 6.1 mgd	0 – 6.3 mgd
A Modified (to AFM102 intermediate high point at Sta 36+51)	16,576 feet (14" FM) & 15,847 feet (24" FM)	32.88 – 37.38 feet	N/A (High point "A modified" is not a controlling high point)		
B Modified (to AFM102 intermediate high point at Sta 71+30)	20,055 feet (14" FM) & 19,326 feet (24" FM)	31.35 – 35.85 feet	N/A (High point "B modified" is not a controlling high point)		
C Modified (to AFM102 intermediate high point at Sta 120+15)	24,940 feet (14" FM) & 24,211 feet (24" FM)	24.85 – 29.35 feet	N/A (High point "C modified" is not a controlling high point)		
D Modified (to AFM102 intermediate high point at Sta 145+39)	27,464 feet (14" FM) & 26,735 feet (24" FM)	24.18 – 28.68 feet	N/A (High point "D modified" is not a controlling high point)		
E Modified (to end of forcemain)	29,713 feet (14" FM) & 28,984 feet (24" FM)	19.85 – 24.35 feet	N/A for BHPS pumps	Greater than 6.1 mgd	Greater than 6.3 mgd

[1] Elevations are based on 1929 NGVD 29

[2] Static range uses forcemain crown elevation – wetwell elevation range

For the flow range shown to be controlled by Segment – BHPS FM to high point in Table 2.10, flow is pumped to the high point at the Wilbur Avenue Bridge. Flow beyond this point in the forcemain is then pushed (pressurized gravity) through the forcemain by the hydraulic grade line at that location to the end of the forcemain. When flows exceed the limits shown for the segment comprised of BHPS FM to High Point in Table 2.10, the controlling segment then changes to Segment E Modified. At these higher flows, flow is pumped to the end of the forcemain at the WWTP headworks.

The pump, system, and suction and discharge loss curves developed for the BHPS utilizing forcemain AFM102 are shown in Figure 2.7. The system curves used in Figure 2.7 were developed using the controlling portions of the system curves shown in Table 2.10. The hydraulic calculations used to develop the curves are included in Appendix D.

Figure 2.7 was used to determine the existing capacity of BHPS. The pump and station capacities are also shown in Table 2.11.

Table 2.11 BHPS w/ Forcemain AFM102 – Capacities

Pump Parameter	w/ 14" Only	w/ 24" Only	w/ 14" and 24"
One pump (full speed)	4.0 mgd	8.4 mgd	8.6 mgd
Two pumps (full speed) (Reliable Pump Station Capacity)	4.3 mgd	10.5 mgd	11.0 mgd

The reliable capacity of the BHPS when pumping through AFM102 is 11.0 mgd when using both the 14-inch and 24-inch existing Bridgehead forcemains and the reliable capacity when pumping through AFM102 is 10.5 mgd when using only the 24-inch Bridgehead forcemain. Since District staff indicated that they would like to continue to operate only the 24-inch forcemain in the future, if possible, VWHA confirmed that with a reliable capacity of 10.5 mgd at the BHPS (if the 14-inch forcemain is not used), the existing BHPS diversion system works properly under a projected buildout PWWF of 12.0 mgd (Table 2.3) with a diversion trigger set at 10.5 mgd.

Since the existing pumps at the BHPS can turn down to below current and buildout minimum flows per District staff, the pumps are not anticipated to turn off during normal operation, the forcemain high points are not anticipated to drain under normal operating conditions. Partial draining of forcemain AFM102 currently occurs now at low flows under APS's dual forcemain configuration due to different static conditions of the two forcemains. This will also not occur in the future due to conversion to single forcemain operation at both pump stations.

VWHA confirmed through the diversion pump station trigger analysis that the existing ESB at BHPS has sufficient storage capacity (volume) to handle buildout diverted flows based on a diversion trigger of 10.5 mgd. VWHA also confirmed that the existing Bridgehead diversion pump station has a reliable capacity much greater than the required 1.5 mgd. (Buildout PWWF (12.0) minus the diversion trigger setpoint (10.5 mgd) of 1.5 mgd). See above for additional information related to the diversion trigger and the capacity analyses performed for the Bridgehead ESB and diversion pump station.

APS with AFM101

System curves and suction and discharge loss curves for the APS using only forcemain AFM101 to pump only APS flow (minus any diversion flows) directly to the discharge structure at the intersection of Arcy Lane and Pittsburg – Antioch Highway were developed.

System curve and suction and discharge loss curve for the APS were developed using the original and updated pump station and forcemain drawings and mathematical computations. The system curve for flow versus TDH for the forcemain system was developed using the Hazen-Williams equation for pipe friction head losses (major losses), the method of loss coefficients (k-values) for pipe fittings and valves (minor losses), and static head (static loss) between the pump station wetwell wastewater elevation and the forcemain discharge elevation the discharge structure at the intersection of Arcy Lane and Pittsburg – Antioch Highway.

Per discussions with District staff, a C-value of 100 was used for non-plastic (non-HDPE and PVC) forcemains including but not limited to lined steel or ductile iron pipe and AWWA C-303 bar-wrapped steel cylinder concrete pressure pipe (CCPP). This C-value is typical for existing forcemains that have been in service for a number of years since C-values decrease over time due to corrosion, grease accumulation, grit/solids accumulation, and air accumulation. A C-value of 120 was used for pump suction and discharge piping regardless of pipe material. It is assumed such piping will have a higher C-value then forcemain piping due to less grease, grit/solids, and air accumulation. Since new piping will eventually age, these C-values were used for all piping regardless of age.

The suction and discharge loss curve was developed based on estimated friction and minor losses within each new pump's new suction and discharge piping at the pump station.

A profile of the complete forcemain alignment, including wetwell operating levels and forcemain diameter and length, Hazen-Williams C-value, and minor loss coefficient (k-value) for each forcemain segment is included in Figure 2.8.

Due to potentially controlling high points along the forcemain alignment, system curve development included development of multiple system curves to determine where flow transitions from a pumped state to pressurized gravity flow. This analysis was essential to determine the shape of the actual system curve.

APS with AFM101 was analyzed for one potential controlling hydraulic conditions as well as for pumping to the end of the forcemain:

- A) to the intermediate high point at Sta 46+44.91; and
- B) to the end of the forcemain

The hydraulic analysis confirmed that the intermediate high point in AFM101 at Sta 46+44.91 is a controlling high point. Findings from this analysis are provided in Table 2.12. Detailed calculations and additional information are included in Appendix E.

Table 2.12 APS w/ Forcemain AFM101 – System Curve Development Results

Segment	Length	Static Range	System Curve Controlling Flow Range (mgd)
Forcemain AFM101			
A (to intermediate high point at Sta 46+44.91)	3,696 feet	31.9 – 34.4 feet	0 – 2.6 mgd
B (to end of forcemain)	13,658 feet	27.4 – 29.9 feet	Greater than 2.6 mgd

[1] Elevations are based on 1929 NGVD 29

[2] Static range uses forcemain crown elevation – wetwell elevation range

For the flow range shown to be controlled by Segment A in Table 2.12, flow is pumped to the high point at Sta 46+44.91. Flow beyond this point in the forcemain is then pushed (pressurized gravity) through the forcemain by the hydraulic grade line at that location to the end of the

forcemain. When flows exceed the limits shown for Segment A, the controlling segment then changes to Segment B. At these higher flows, flow is pumped to the end of the forcemain.

The pump, system, and suction and discharge loss curves developed for the APS utilizing forcemain AFM101 are shown in Figures 2.9, 2.10, and 2.11. The system curve used in Figures 2.9, 2.10, and 2.11 were developed using the controlling portions of the system curve shown in Table 2.12. The hydraulic calculations used to develop the curves are included in Appendix E.

VWHA confirmed that with a reliable capacity and diversion trigger of 12.5 mgd at the APS as recommended in the District's 2010 Conveyance System Master Plan, the existing ESB has sufficient storage capacity (volume) to handle buildout diverted flows. The new Antioch diversion pump station is required to have a reliable capacity of 1.8 mgd. (Buildout PWWF (14.3 mgd) – Diversion Trigger Setpoint (APS Reliable Capacity) (12.5 mgd)). See above for additional information related to the diversion trigger and the capacity analyses performed for the Antioch ESB and new diversion pump station.

New pumps were selected for the APS to provide reliable operation throughout the entire expected operating range for current and buildout flows (minus BHPS flows and reduced via diversion) to the WWTP with a reliable capacity of 12.5 mgd (diversion trigger setpoint). The existing large pumps were required to be replaced at a minimum since their operation is outside the pump manufacturer's recommended operating range and one existing large pump does not have sufficient capacity to pump buildout PWWF minus diversion of 12.5 mgd. The analysis considered using two large pumps and two small pumps per the existing pump station's configuration but also considered using four equally sized pumps (3 duty and 1 standby). Per District request, Flygt N-impeller drypit submersible pumps were used for pump selection.

The following pump configurations were analyzed:

- Two New Large and Two Existing Small Pumps
- Two New Large and Two New Small Pumps
- Four New Equal Sized Pumps

Two New Large and Two Existing Small Pumps

The two new large and two existing small pump selection required selection of large pumps where one large pump (duty pump) can pump buildout PWWF minus diversion of 12.5 mgd. Flygt Model NT3531/936 pumps with a 700mm impeller and a 645 Hp motor were selected. Pump information is included in Appendix E. The Flygt pump curve was used in the analysis and adjusted based on an estimated suction and discharge loss curve to obtain adjusted pump curves. The existing small pump's pump curve (Fairbanks Morse Model 10B5445-T60 (19.85" impeller) 100Hp) was used in the analysis and adjusted based on its suction and discharge loss curve to obtain adjusted pump curves.

Figure 2.9 illustrates the capacity at the APS with the new large duty pump which was selected to provide a reliable pumping capacity of 12.5 mgd (min). The pump and station capacities are also shown in Table 2.13. All pumps will be provided with variable frequency drives.

Table 2.13 APS w/ Forcemain AFM101 – Capacities

Pump Parameter	Capacity
One existing small pump (full speed)	5.6 mgd
Two existing small pumps (full speed)	7.9 mgd
One new large pump (full speed) (Reliable Pump Station Capacity)	12.8 mgd

One new large pump is capable of turning down to less than current minimum dry weather flow. However, the existing small pumps will be used to efficiently pump low flows. It is anticipated that one small pump will be used until flow exceeds its capacity. Then, if the other small pump is available, both small pumps will pump incoming flows until their combined capacity is exceeded. At that time, the small pumps will turn off and a large pump will pump incoming flows up to its total capacity. When incoming flows exceed the capacity of one large pump, flow will rise and flow in excess of one large pump's capacity will be passively diverted to the new Antioch diversion pump station. Based on the pump station's 2014 and buildout PDWF projections, a large pump will be required to operate each day during peak flow periods once PDWF reaches 7.9 mgd.

Since the pumps can turn down to below current and buildout minimum flows, forcemain AFM101's high points will not drain under normal operating conditions.

Two New Large and Two New Small Pumps

The two new large and two new small pump configuration will utilize the same large pump as selected (Flygt Model NT3531/936 pumps with a 700mm impeller and a 645 Hp motor) under the two new large and two existing small pump configuration since one large pump (duty pump) must pump buildout PWWF minus diversion of 12.5 mgd. Flygt Model NT3301 pumps with 404mm impellers and 85 Hp motors were selected to replace the existing small pumps. Although the existing small pumps were recently replaced, the District indicated that they would like all pumps replaced with Flygt N-impeller pumps on the project due to excessive ragging problems at the station. Pump information is included in Appendix E. The Flygt pump curves were used in the analysis and adjusted based on estimated suction and discharge loss curves to obtain adjusted pump curves.

Figure 2.10 illustrates the capacity at the APS with the new large duty pump which was selected to provide a reliable pumping capacity of 12.5 mgd (min). The pump and station capacities are also shown in Table 2.14. All pumps will be provided with variable frequency drives.

Table 2.14 APS w/ Forcemain AFM101 – Capacities

Pump Parameter	Capacity
One new small pump (full speed)	6.0 mgd
Two new small pumps (full speed)	8.0 mgd
One new large pump (full speed) (Reliable Pump Station Capacity)	12.8 mgd

As noted above, one new large pump is capable of turning down to less than current minimum dry weather flow. However, the new small pumps will be used to more efficiently pump low flows. It is anticipated that one small pump will be used until flow exceeds its capacity. Then, if the other small pump is available, both small pumps will pump incoming flows until their combined capacity is exceeded. At that time the small pumps will turn off and a large pump will pump incoming flows up to its total capacity. When incoming flows exceed the capacity of one large pump, flow will rise and flow in excess of one large pump's capacity will be passively diverted to the new Antioch diversion pump station. Based on the pump station's 2014 and buildout PDWF projections, a large pump will be required to operate each day during peak flow periods once PDWF reaches 8.0 mgd.

Since the pumps can turn down to below current and buildout minimum flows, forcemain AFM101's high points will not drain under normal operating conditions.

Four New Equal Sized Pumps

The four equally sized pump configuration (3 duty and 1 standby) pump selection required selection of pumps where three new pumps (duty pumps) can pump buildout PWWF minus diversion of 12.5 mgd. Flygt Model NT3312/766 pumps with a 480mm impeller and a 280 Hp motor were selected. Pump information is included in Appendix E. The Flygt pump curve was used in the analysis and adjusted based on an estimated suction and discharge loss curve to obtain adjusted pump curves.

Figure 2.11 illustrates the capacity at the APS with the new pumps which were selected to provide a reliable pumping capacity of 12.5 mgd (min). The pump and station capacities are also shown in Table 2.15. All pumps will be provided with variable frequency drives.

Table 2.15 APS w/ Forcemain AFM101 – Capacities

Pump Parameter	Capacity
One pump (full speed)	9.6 mgd
Two pumps (full speed)	11.9 mgd
Three pumps (full speed) (Reliable Pump Station Capacity)	12.9 mgd

One pump is capable of turning down to less than current minimum dry weather flow. This will prevent AFM101's high points from draining under normal operating conditions.

When incoming flow exceeds the capacity of three pump, flow will rise and flows in excess of three pump's capacity will be passively diverted to the new Antioch diversion pump station. Based on the pump station's 2014 and buildout PDWF projections (see Table 2.2), one or two pumps will be able to handle PDWFs. This will provide the District with a minimum of two standby pumps during the dry weather season.

2.3 RECOMMENDATION

The findings of the APS and BHPS Conveyance System Alternatives Analysis were presented and discussed with District staff at the APS and BHPS Conveyance System Alternatives Analysis Meeting on June 17, 2021. The meeting was used to solicit District input and obtain consensus on the recommended alternative and pump configuration to convey buildout flows (reduced via diversion) from APS and BHPS to the WWTP.

2.3.1 APS and BHPS Long Term Conveyance System Alternative Recommendation

The findings of the APS and BHPS long term conveyance system alternative analysis concluded the following advantages and disadvantages for each alternative as outlined in Tables 2.16 and 2.17.

Table 2.16 Alternative 1 - Advantages and Disadvantages

Alternative 1 BHPS w/AFM101 and APS w/AFM102
Advantages
BHPS • No upgrades are required at the BHPS (Main PS, Diversion PS and ESB have reliable capacity) and the 14-inch forcemain is not required for use. (Same advantage as under Alternative 2) APS • Flygt N-impeller pump selection is available (Same advantage as under Alternative 2) *Note: No advantages have been identified over Alternative 2*
Disadvantages
BHPS • Results in an additional 1,026 feet of new 30-inch (25.3-inch ID) HDPE forcemain to extend the existing Bridgehead forcemain to the connect to forcemain AFM101 rather than forcemain AFM102. The new BHFM will extend up Fulton Shipyard Road and across the APS site to connect to forcemain AFM101. APS • Results in added congestion on APS site. • Use of APS with AFM102 maintains the three existing controlling high points within AFM102. • Flygt N-impeller pump selections for new pumps at APS w/ AFM102 are available only for equal sized (385 Hp) pumps. • Pump horsepower, pump physical size, pump wt., pump cost, and electrical (VFD and generator) costs will be higher for new equipment at APS. New equal sized pumps will be 385Hp each. (rather than 280Hp under Alternative 2)

Table 2.17 Alternative 2 - Advantages and Disadvantages

Alternative 2 BHPS w/AFM102 and APS w/AFM101 (Per 2010 Conveyance System Master Plan)
Advantages
BHPS • No upgrades are required at the BHPS (Main PS, Diversion PS and ESB have reliable capacity) and the 14-inch forcemain is not required for use. (Same advantage as under Alternative 1) • Results in 1,026 feet less new 30-inch (25.3-inch ID) HDPE forcemain to extend the existing Bridgehead forcemain to the connect to forcemain AFM102 rather than forcemain AFM101. BHFM will tie-in to the blind flange location on AFM102 at the intersection of Wilbur Avenue and Fulton Shipyard Road rather than extending up Fulton Shipyard Road and across APS site to connect to forcemain AFM101. • Use of BHPS with AFM102 results in elimination of existing controlling high points within AFM102. APS • Results in less congestion on APS site. • Allows APS to use AFM101 which results in only one intermediate controlling high point (rather than three intermediate controlling high points if using AFM102) • Pump horsepower, pump physical size, pump wt., pump cost, and electrical (VFD and generator) costs are lower for new equipment at APS. • Flygt N-impeller pump selection is available (Same advantage as under Alternative 1) • Flygt N-impeller pump selections for new pumps at APS w/ AFM101 are available for both small (85Hp) and large (645Hp) pumps and equal sized (280 Hp) pumps which should minimize pump ragging.
Disadvantages
• None

Based on the findings of the APS and BHPS long term alternatives analysis and advantages/disadvantages outlined in Tables 2.16 and 2.17, it was recommended and consensus was reached with District staff during the APS and BHPS Conveyance System Alternatives Analysis Meeting on June 17, 2021 to proceed with Alternative 2 and convey wastewater flows directly the WWTP from BHPS using forcemain AFM102 and from APS using forcemain AFM101. This recommendation is in accordance with the District's 2010 Conveyance System Master Plan.

2.3.1.1 Alternative 2 - APS Pump Selection

Under Alternative 2 with APS using forcemain AFM101, the main pump station pumps can be replaced with either: two new large (645 Hp) and reuse of the existing small (100 Hp) pumps, two new large (645 Hp) and two new small (85 Hp) pumps, or four new equal sized (280 Hp) pumps (three duty, one standby) to reliably pump the entire range of current and buildout flows

of 12.5 mgd (PWWF minus BHPS flows and reduced via diversion) to the WWTP. The pump, system and suction and discharge loss curves for all three pump selection options are presented in Figures 2.9, 2.10, and 2.11.

During the APS and BHPS Conveyance System Alternatives Analysis Meeting on June 17, 2021, pump selection was discussed. Although the existing small pumps were recently replaced, the District indicated that they would like all pumps replaced with Flygt N-impeller pumps on the project due to excessive ragging problems at the station. In addition, District staff indicated that they would like to consider both vertical and horizontal installation for the new pumps in the existing drywell. VWHA worked with Flygt to obtain dimensional cut sheets and met with District staff and Flygt representative on site at the Antioch Pump Station on July 29, 2021 to review potential layouts for the two large pump/two small pump and four equal sized pump vertical and horizontal installations. During the site visit it was determined that the existing drywell stairs were in conflict with the new pump layout configurations. District staff indicated that the stairs should be reconfigured and a spiral staircase provided.

Tables 2.18 and 2.19 outline the advantages and disadvantages identified for each pump configuration.

Table 2.18 APS Two Large/Two Small Pump Configuration - Advantages and Disadvantages

Two Large/Two Small Pump Configuration
Advantages
• None
Disadvantages
• Existing bridge crane cannot be used to remove large pumps. Large pumps will require removal via roof skylights with crane by others. Existing skylight openings are not of sufficient size for removal of large pumps. Skylight/roof modifications are required. A large pump weighs 6.3 tons. Existing bridge crane has a capacity of 5 tons. • Less flexibility (operational and O&M). • More difficult to install/remove large pumps. • The large and small pump option will result in higher installed HP (1460 HP) than the equal sized pump option (1120HP). • The large and small pump option will be more expensive than the equal sized pump option. The cost will be approximately $250,000 more for just the pumps. The VFDs and electrical will also be more expensive. The total additional cost is expected to be approximately $500,000 more. • Existing drywell stairs are in conflict with new pump layout configurations. • Horizontal pump installation is not compatible with existing drywell arrangement. (Same disadvantage as under equal sized pump option)

Table 2.19 APS Four Equal Sized Pump Configuration - Advantages and Disadvantages

Four Equal Sized Pump Configuration
Advantages
• Equal sized pumps provide for more flexibility (operational and O&M). Based on the pump station's 2014 and buildout PDWF projections, one or two pumps will be able to handle PDWFs. This will provide the District with a minimum of two standby pumps during the dry weather season. • The equal sized pumps will be easier to install/remove. An equal sized pump weighs 2.5 tons while a large pump weighs 6.3 tons. • The equal sized pump option will result in lower installed HP (1120HP) than the large and small pump option (1460 HP). • The equal sized pump option will be less expensive than the large and small pump option. The cost will be approximately $250,000 less for just the pumps. The VFDs and electrical will also be less expensive. The total cost savings is expected to be in the $500,000 range. • Existing bridge crane can be used to remove pumps. • Equal sized vertical pumps fit better in the drywell. The equal sized pumps will be easier to install/remove. Equal sized pump are 7.1 feet tall while a large pump is 9.7 feet tall.
Disadvantages
• Existing drywell stairs are in conflict with new pump layout configurations. • Horizontal pump installation is not compatible with existing drywell arrangement. (Same disadvantage as under small/large pump option) *Note: No disadvantages have been identified over the large and small pump option*

Based on physical site constraints and the advantages/disadvantages outlined in Tables 2.18 and 2.19, the District confirmed that the new installation should include four equal sized vertical pumps. See Figures 2.12 and 2.13 for APS pump room/wetwell lower level floor plan and section for new pump layout utilizing four equal sized vertical Flygt NT3312/766, 480mm impeller, 280 Hp pumps.

Figures 2.12 and 2.13 show a new spiral staircase provided per District direction. It should be noted that spiral staircases are not OSHA compliant since you can't get a stretcher down/up them. During the design phase, the District should confirm if this is acceptable or if additional options should be explored for reconfiguring the drywell staircase.

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SECTION 3
ANTIOCH PUMP STATION
DIVERSION PUMP STATION AND SCREENINGS REMOVAL ANALYSIS

The section develops and presents improvements at the APS to implement 1) a separate on-site APS Diversion Pump Station and 2) an upstream grinder facility.

3.1 DIVERSION PUMP STATION

District staff has requested that a separate diversion pump station similar to those provided at the District's other pump stations (upstream structure with spill over weir and submersible pumps) is provided at the APS to improve operations. The diversion pump station will divert a portion of the incoming PWWF flow to the ESB for equalization. After peak flows subside, the flow will then be drained back to the APS wetwell and pumped to the WWTP.

Based on the diversion trigger setpoint established in the 2010 Conveyance System Master Plan for the APS under buildout conditions and confirmed under the APS diversion trigger analysis (see information presented in Section 2), the APS will have a diversion trigger of 12.5 mgd. The new Antioch diversion pump station will divert incoming flows above 12.5 mgd to the ESB. The new Antioch diversion pump station must have a reliable capacity greater than or equal to buildout PWWF (14.3 mgd (not including any flow from the BHPS) (Table 2.2)) minus the diversion trigger setpoint (APS main pump station's reliable capacity). Therefore, the new Antioch diversion pump station's reliable capacity must be at least (14.3 mgd – 12.5 mgd) 1.8 mgd.

During the APS and BHPS Conveyance System Alternatives Analysis Meeting on June 17, 2021, District staff indicated that in addition to a minimum reliable pumping capacity of 1.8 mgd, the new Antioch diversion pump station's firm capacity (all pumps) should be sized for a minimum of 4.2 mgd to allow the diversion pump station to be able to pump all flow to the ESB under buildout minimum flow conditions. This will allow the main pump station to cease pumping to the WWTP under minimum flow conditions to allow the District to perform O&M at the Antioch Pump Station, if required.

3.1.1 Diversion Pump Station Hydraulics

The new Antioch diversion pump station will be built upstream of the existing wet well splitter box/influent structure on the APS site. All incoming flow will be combined into a single 48-inch gravity sewer upstream of the new diversion pump station. The existing drawings show the slope of the existing incoming 48-inch gravity sewer at 0.00033 which can convey the projected buildout PWWF of 14.3 mgd without surcharging the sewer. The overflow weir level in the diversion pump station should be set at the crown of the 48-inch gravity sewer (Elev -2.7). The setpoints for the new main pumps in the APS should be set below this level (proposed wetwell operating range is between Elev -6.4 and Elev -3.9) to allow the station's pumps to reach full speed and reliably pump 12.5 mgd prior to the water level rising to the weir elevation. The length of the weir should be designed to allow diversion flows to pass over the weir without exceeding the operating floor elevation within the wetwell (Elev -1.6).

Implementation of the diversion pump station at the APS requires surcharging the incoming gravity sewer and upstream collection system. Prior to implementing the new diversion pump station, the District shall confirm that sewer levels at an Elevation of -2.45 (estimated water level over the weir during diversion) at the diversion pump station on the APS site will not cause upstream sewer overflows with in the upstream collection system under buildout PWWF conditions.

VWHA was not able to confirm that the surcharge condition discussed above does not create a sanitary sewer overflow using the District's existing model. The information in the Delta Diablo collection system model only includes the large influent interceptors and one or two pipe segments upstream in some locations and information does not match District collection system drawings. Therefore, VWHA is unable to tell from the model what will occur in District's upstream collection system or in any upstream City-owned pipelines.

Woodard & Curran (formerly RMC) prepared both the District's 2010 Conveyance System Master Plan and the 2014 City of Antioch Master Plan and modeled both the City's system and Delta Diablo's system. The District confirmed that they will contact Woodard & Curran and have them confirm that construction of the proposed diversion pump station at the APS site will not cause overflows in either the District's or City's collection system under PWWF buildout conditions. The low points in the collection system where potential overflows would result should be identified by the District. The lowest manhole rims could be surveyed during the predesign phase when the APS site is surveyed.

3.1.2 Development of System Curve and Suction and Discharge Loss Curve

System and suction and discharge loss curves for the new Antioch Diversion Pump Station to pump flow directly to the ESB were developed.

System and suction and discharge loss curves for the new Antioch diversion pump station were developed using new pump discharge and forcemain piping, original drawings of the Antioch ESB and mathematical computations.

A system curve for flow versus TDH for the new onsite 14-inch forcemain to the ESB was developed using the Hazen-Williams equation for pipe friction head losses (major losses), the method of loss coefficients (k-values) for pipe fittings (minor losses), and static head (static loss) between the diversion pump station wetwell elevation and the forcemain high point discharge location at the ESB. Elevations, specific fittings, and pipeline lengths for each pipe were determined using existing drawings. A C-value of 100 was used for the new and existing forcemain piping between the new diversion pump station and the ESB since it is assumed that the piping on site will be lined steel or ductile iron pipe.

The suction and discharge loss curve was developed based on the friction and minor losses within each pump's discharge piping at the new diversion pump station. A C-value of 120 was used for the suction and discharge piping within the wetwell and valve vault.

Pump selection was based on the District direction to use Flygt N-impeller pumps. Pump selection was based on reliably pumping a minimum of 1.8 mgd and 4.2 mgd when using all pumps. A three pump system was selected based on discussions with District staff. Flygt model

NP3153 MT, 434 impeller (227mm trim), 20 Hp pumps were selected. The Flygt provided pump curves were used in the analysis and adjusted based on the suction and discharge loss curve to obtain adjusted pump curves.

Table 3.1 provides information used in the development of the system curve, suction and discharge loss curve, and pump curves. Additional information is included in Appendix F.

The pump, system, and suction and discharge loss curves developed for the new Antioch diversion pump station are shown in Figure 3.1. The hydraulic calculations used to develop the curves are included in Appendix F.

Table 3.1 Antioch Diversion Pump Station – Hydraulic Information

Forcemain	
Diameter	14-inch
Length	182 feet
Hazen-Williams (C-value)	100[1]
Minor Loss Coefficient (K-value)	3.75
Discharge Highpoint Elevation	34.83 (crown of high point at ESB)
Wetwell Elevation Range	-11.6 to -3.6 (normal operation)
Static Range[4]	38.43 – 46.43
Pump Discharge	
Diameter	8-inch
Length	38.57 feet
Hazen-Williams (C-value)	120[2]
Minor Loss Coefficient (K-value)	4.55
Pumps	
No. of Pumps	3 Total (2 Duty + 1 Standby)
Pump Model	Flygt NP3153 MT, 434 impeller (227mm trim), 20 Hp
Drive Type	Constant Speed

[1] Hazen-Williams C-values for Forcemain. Per discussions with District, a C-value of 100 was used for existing and new non-plastic (non HDPE and PVC) on-site pipelines including but not limited to lined steel or ductile iron pipe.

[2] Hazen-Williams C-values for Pump Suction and Discharge Piping. A C-value of 120 was used for existing and new pump suction and discharge piping regardless of pipe material. It is assumed such piping will have a higher C-value then forcemain piping due to less resistance due to corrosion, grease accumulation, grit/solids accumulation, and air accumulation.

[3] Elevations are based on 1929 NGVD 29

[4] Static range = discharge highpoint elev – wetwell elevation

[5] Information contained in the table is for pumping to the ESB

3.1.3 Findings

Findings of the hydraulic analysis using Flygt model NP3153 MT, 434 impeller (227mm trim), 20 Hp pumps confirmed that the new Antioch Diversion Pump Station will have adequate reliable capacity to divert flow to the ESB under buildout conditions and greater capacity than requested when using all pumps. Table 3.2 outlines the Antioch Diversion Pump Station capacity when pumping to the ESB. The Antioch diversion pump station has a reliable diversion capacity of 3.0 mgd (2 duty pumps) and a total capacity of 4.6 mgd when using all pumps.

Table 3.2 Antioch Diversion Pump Station Capacity

Pump Parameter	Capacity (mgd)
One pump	1.4
Two pumps (Reliable Capacity)	3.0 (1.8 mgd required)
Three pumps (Total Capacity)	4.6 (4.2 mgd required)

[1] Information contained in the table is for pumping to the ESB based on wetwell setpoints.

3.1.4 Pump Station Layout

The proposed layout for the new Diversion Pump Station is shown in Figures 3.2 and 3.3. It is located just upstream of the existing pump station's wet well splitter box/influent structure on the APS site. It consists of a wetwell and a valve vault with submersible pumps on guide rails. The structure is located at grade. The wetwell top slab is envisioned to be H20 rated with hatches provided for pump removal. The valve vault is provided with bollards and grating to allow valve stems to be accessed from above through the grating platform. Incoming station flow will pass through the station on the way to the APS wetwell. When flow exceeds the APS main duty pumping capacity (12.5 mgd), flow will back up into the incoming gravity sewer and spill over the weir in the diversion pump station. Flows in excess if the main pump station (12.5 mgd) will be pumped by the diversion pump station to the ESB.

The APS Diversion Pump Station and Screenings Removal Analysis Meeting was held with District staff on August 31, 2021 to present the findings and discuss the recommendations for the Antioch Diversion Pump Station. The meeting solicited District input and obtained consensus on the recommendation.

See Figure 3.5 for the proposed layout of the gravity sewers, new diversion pump station, and new grinder facility on the APS site.

3.2 GRINDER STRUCTURE

A separate grinder facility was requested by District staff to improve O&M at the APS. The grinder facility will be located on the APS site upstream of the new APS diversion pump station within the gravity sewer system to grind all screenings entering the APS site. The analysis evaluated constructing the new grinder facility at the same time as construction of the new diversion pump station (single structure) or constructing the new grinder facility at a later time (if needed) since the new APS main pumps and diversion pumps may not clog and be able to

pass rags to the WWTP for removal. Per District direction, the new APS main pumps and diversion pumps will be Flygt n-impeller pumps.

The new grinder structure design criteria was developed with District staff and includes:

- Grind all screenings entering the APS site.
- Two Grinders
    - One grinder shall have a capacity equal to buildout PDWF (10.3 mgd).
    - Two grinders shall have a total capacity greater then buildout PWWF (14.3 mgd) (prior to diversion).
- A weir with passive bypass channel (no manual bar rack) shall be provided and capable of handling buildout PWWF (prior to diversion) of 14.3 mgd to handle incoming flows if one or both grinders fail during periods with flow greater than PDWF.
- Grinders will be designed to be installed, removed, and replaced from grade without manned entry into structure.
- Grinders will be designed with upstream stop gates to be installed, removed, and replaced from grade without manned entry into structure for use when a grinder is removed for service.
- The grinder structure is not envisioned for routine manned entry (Class 1, Division 1) and will not include permanent gas detection or ventilation.

3.2.1 Grinder Facility Hydraulics and Layout

The new Antioch grinder structure will be built upstream of the new APS diversion pump station. All incoming flow to the APS site should be combined into a single 48-inch gravity sewer upstream of the new grinder structure. The existing drawings show the slope of the existing incoming 48-inch gravity sewer at 0.00033 which can convey the projected buildout PWWF of 14.3 mgd without surcharging the sewer. Since the water level over the weir in the diversion pump station is estimated at Elev -2.45 during buildout PWWF, the grinder facility, including grinder selection, weir height, etc. must be designed based on this worst case downstream water level.

VWHA worked with JWC Environmental to select grinders to meet the flow requirements and minimize headloss (surcharging of upstream gravity sewers). JWC Channel Monster Flex Model CFM6030-M2.0E grinders were selected. Figure 3.4 shows plans, section, flow/capacity, grinder information, and hydraulic information for the proposed grinder structure using the selected grinders. The grinders and their associated upstream slide gates are provided on guide rail systems for removal/installation from the hatch above. The top of the structure is at grade and is envisioned to be H-20 rated. The grinder structure will be a Class 1, Division 1 area and is not envisioned to be entered on a routine basis; however, an intermediate grating level is shown inside the structure to facilitate manned entry. Table 3.2 also provides the flow/capacity, grinder information, and hydraulic information for the proposed grinder structure using the selected grinders. Additional information on the proposed grinders is included in Appendix G.

Table 3.2 Antioch Grinder Facility – Hydraulic Information

Flow/Capacity	
Buildout PWWF	14.3 mgd
Buildout PDWF	10.3 mgd
Grinder Capacity (each)	10.3 mgd
Grinder Information	
Manufacturer/Model[1]	JWC Channel Monster Flex Model CFM6030-M2.0E
Grinder Channel Width	42 inches
Weight (each)	4,000 lbs.
Horsepower (each)	5Hp (grinder motor) + 1Hp (solids diverter motor) = 6Hp
Hydraulic Information	
Hydraulic Information at PDWF with One Grinder in Service	
Downstream Water Depth[2]	31 inches
Grinder Headloss[3]	6 inches
Upstream Water Depth[2,3]	37 inches (upstream sewer not surcharged above crown)
Hydraulic Information at PWWF when Diverting Downstream (Both Grinders in Service)	
Downstream Water Depth[2]	52 inches
Grinder Headloss[3]	2.5 inches
Upstream Water Depth[2,3]	54.5 inches **(Note: Upstream sewer surcharged above crown by 6.5 inches at Grinder Structure)** **(Surcharged Water Surface Elev -2.15 at APS site)**
Weir Height[4]	56 inches
Water Elevation over Weir with both Grinders out of Service (Worst Case)	13 inches (69 (56+13) inches above floor) **(Note: Upstream sewer surcharged above crown by 21.0 (69-48) inches at Grinder Structure)** **(Surcharged Water Surface Elev -0.95 at APS site)**

[1] Other manufacturers (or equals) shall be contacted during the design phase.

[2] Hydraulic Information is based on downstream hydraulics and facilities (including gravity sewers (diameter and slope), Diversion Pump Station, and other existing and new design parameters)

[3] Hydraulic Information is based on JWC Channel Monster Flex Model CFM6030-M2.0E

[4] Set weir height above upstream water depth (54.5 inches) to prevent premature grinder bypassing

Implementation of a grinder facility at the APS requires surcharging the incoming gravity sewer and the upstream collection system. Prior to implementing the new grinder facility, the District shall confirm that sewer levels at an Elevation of -0.95 (estimated water level over the grinder structure weir during buildout PWWF with both grinders out of service (failure)) at the grinder structure on the APS site will not cause upstream sewer overflows within the upstream collection system under buildout PWWF conditions.

VWHA was not able to confirm that this surcharge can be accommodated by the upstream system using the District's existing model. The information in the Delta Diablo collection system model only includes the large influent interceptors and one or two pipe segments upstream in some locations and information does not match District collection system drawings. VWHA is unable to tell from the model what will occur in District's upstream collection system or in any upstream City-owned pipelines.

Woodard & Curran (formerly RMC) prepared both the District's 2010 Conveyance System Master Plan and the 2014 City of Antioch Master Plan and modeled both the City's system and Delta Diablo's system. The District confirmed that they will contact Woodard & Curran and have them confirm that construction of the proposed grinder structure at the APS site will not cause overflows in either the District's or City's collection system under buildout PWWF conditions. The low points in the collection system where potential overflows would result should be identified by the District. The lowest manhole rims could be surveyed during the predesign phase when the APS site is surveyed.

3.2.2 Grinder Facility Options

Per District direction, VWHA developed and evaluated the following options for construction of the new grinder structure:

1) Option 1 - Construct the new grinder structure at the same time as construction of the new diversion pump station (Build as one structure).
2) Option 2 - Construct the new grinder structure at a later time (if needed).
    - Option 2a - Build as one structure. Provide starters walls and slab for new grinder structure expansion and larger diversion pump station when diversion pump station is constructed to accommodate future grinder structure addition at a later date.
    - Option 2b - Build as separate structure in future (at later date).

3.2.2.1 Option 1 - Construct the new grinder structure at the same time as construction of the new diversion pump station (Build as one structure)

Option 1 is shown in Figures 3.5 and 3.6. Figure 3.5 shows the APS site with the new facilities and illustrates combining the incoming 36-inch, 12-inch and 48-inch gravity sewers into a common 48-inch gravity sewer to convey all flow through the new common grinder structure/diversion pump station. The existing forcemain intertie between AFM101 and AFM102 will be relocated around the new common structure. Figure 3.6 shows the top plan of the new common grinder structure/diversion pump station with a common intermediate wall. To align the two structures east walls, additional space was added inside the diversion pump station.

The estimated construction cost for Option 1 (grinder structure portion only) is $1.03M (includes added costs for diversion structure). The detailed construction cost estimated is included in Appendix G.

Advantages and disadvantages for Option 1 are included in Table 3.3.

Table 3.3 Grinder Structure (Option 1) - Advantages and Disadvantages

Grinder Structure (Option 1) - Advantages and Disadvantages
Advantages
• Saves some $s over building in future. Lowest cost if need grinder structure. • Eliminates potential second construction project at a later date
Disadvantages
• Highest cost if grinder structure is not needed. • Build facility (with increased O&M costs) that may not be needed. • Build larger diversion pump station to accommodate grinder structure.

3.2.2.2 Option 2 - Construct the new grinder structure at a later time (if needed)

Option 2 includes two sub-options for constructing the new grinder structure at a later time. They include constructing the new grinder structure either as 2a) an extension of the existing diversion pump station to create a common structure or 2b) constructing the new grinder structure as a separate stand-alone structure.

Option 2a - Build as one structure. Provide starters walls and slab for new grinder structure expansion and larger diversion pump station when diversion pump station is constructed to accommodate future grinder structure addition.

Option 2a is also shown in Figures 3.5 and 3.6. Figure 3.5 shows the APS site with the new facilities and illustrates combining the incoming 36-inch, 12-inch and 48-inch gravity sewers into a common 48-inch gravity sewer to convey all flow through the new common grinder structure/diversion pump station. The existing forcemain intertie between AFM101 and AFM102 will be relocated around the new common structure. Figure 3.6 shows the top plan of the new common grinder structure/diversion pump station with a common intermediate wall. To align the two structures east walls, additional space was added inside the diversion pump station. Under this option, the gravity sewer realignment and larger diversion pump station will be built under the initial project with starter walls and slab for the future grinder structure addition. The grinder structure addition will then be built at a later date if it is determined that it is needed.

The estimated construction cost for Option 2a (grinder structure portion only) is $1.43M (includes added costs for diversion structure and starter walls and slab). The detailed construction cost estimated is included in Appendix G.

Advantages and disadvantages for Option 2a are included in Table 3.4.

Table 3.4 Grinder Structure (Option 2a) - Advantages and Disadvantages

Grinder Structure (Option 2a) - Advantages and Disadvantages
Advantages
• Defer expenditures until time when/if structure is needed (verses construction under initial project). • Cost savings for use of common wall and eliminates differential settlement considerations of two structures (verses construction of separate structure at later date) • Fits better on site (verses construction of separate structure at later date)
Disadvantages
• Potential second construction project at a later date (verses construction at this time) • Additional cost for starter walls under initial project which may not be needed in future (verses construction of separate structure at later date) • Additional cost for diversion pump station to accommodate grinder structure attachment. (verses construction of separate structure at later date) • Bypass pumping (dry weather flows) will be required throughout construction duration of new facility. (Added cost over construction of separate structure at later date) • $400,000 in additional cost if grinder structure is deferred and then needed later. (verses construction under initial project)

Option 2b - Build as separate structure in future (at later date)

Option 2b is shown in Figure 3.7. Figure 3.7 shows the APS site with the new facilities and illustrates combining the incoming 36-inch, 12-inch and 48-inch gravity sewers into a common 48-inch gravity sewer to convey all flow through the separate grinder structure and diversion pump station. The existing forcemain intertie between AFM101 and AFM102 will be relocated around the new structures. The diversion pump station will be built on the initial project and the grinder structure will be built at a later date if it is determined that it is needed.

The estimated construction cost for Option 2b (grinder structure portion only) is also $1.43M. The detailed construction cost estimated is included in Appendix G.

Advantages and disadvantages for Option 2b are included in Table 3.5.

Table 3.5 Grinder Structure (Option 2b) - Advantages and Disadvantages

Grinder Structure (Option 2b) - Advantages and Disadvantages
Advantages
• Defer expenditures until time when/if structure is needed (over construction under initial project) • Save initial cost for starter walls at this time which may not be needed in future (verses construction of common structure at later date) • Cost savings for diversion pump station if not required to accommodate grinder structure attachment. (verses construction under initial project and construction of common structure at later date) • Bypass pumping (dry weather flows) will be only be required for short tie-in durations and bypass gravity piping can be used around new structure for a majority of the construction period. (Added cost over construction of common structure at later date)
Disadvantages
• Potential second construction project at a later date (verses construction under initial project) • Additional cost for not using common wall and differential settlement considerations of two structures (verses construction under initial project and construction of common structure at later date) • Larger site footprint (verses construction under initial project and construction of common structure at later date) • $400,000 in additional cost if grinder structure is deferred and then needed later. (verses construction under initial project)

3.2.3 Grinder Facility Recommendation

The findings of the grinder structure analysis including costs and advantages and disadvantages were presented at the APS Diversion Pump Station and Screenings Removal Analysis Meeting on August 31, 2021. District staff reached consensus and indicated that they would like to proceed with Option 1 and construct the grinder structure with the diversion pump station under the initial project. However, they indicated that the grinders should be deferred (not purchased or installed) until it is confirmed grinders are needed. District staff noted that the facility should be built with all items in place, including the grinder frames and their guide rail systems and associated electrical infrastructure to facilitate future installation of the grinders without taking the grinder structure out of service in the future when the grinders are added. This would eliminate future bypass pumping of the station's incoming flows.

The estimated construction cost of Option 1 (the grinder structure only - see above) is $1.03M. It is estimated that approximately $340,000 of this cost can be deferred until the grinders are purchased and installed. If they are never installed, this cost can be avoided.

As discussed above, implementation of the grinder structure (with grinders installed) will result in surcharging of the upstream collection system.

Prior to proceeding with design and construction of the facilities, the District shall confirm that surcharged sewer levels at an elevation -0.95 (both grinders fail under buildout PWWF conditions with downstream diversion) within the grinder structure at the APS site will not cause upstream sewer overflows under buildout PWWF conditions.

During discussions with District staff at the APS Diversion Pump Station and Screenings Removal Analysis Meeting on August 31, 2021, District staff indicated that if the worst case surcharging of elevation -0.95 within the grinder structure at the APS site, under the condition when both grinders fail under buildout PWWF conditions with downstream diversion occurring, is shown to result in an upstream sewer overflow, but that an overflow will not occur when surcharging to an elevation -2.15 within the grinder structure at the APS site, under normal operation with both grinders in service during incoming buildout PWWF conditions with diversion occurring at the diversion pump station, an automated bypass gate (recommendation of District staff) in the weir wall location can be implemented rather than the passive weir for use in the event of grinder failure. Opening of the gate would be triggered by higher than normal upstream water levels, which must be confirmed does not result in an upstream overflow during buildout PWWFs. This approach could be implemented to reduce the worst case upstream water levels and possibly allow the grinder structure to be constructed when it otherwise could not be implemented. It should be noted that this approach comes with added risk as the bypass will no longer be passive, as with the weir design, and will rely upon proper operation of the gate. Under this approach, the gate should be provided on standby power.

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SECTION 4
RECOMMENDED PROJECT

4.1 RECOMMENDED PROJECT

The Phase II – Long Term Alternatives Analysis for the Antioch and Bridgehead Pump Stations and Conveyance System Improvements Project was performed as the first step to implementing improvements to the APS and BHPS and their associated conveyance systems to meet long term/ buildout pumping needs and address O&M and reliability issues and concerns. This section provides information on the recommended project components, presents construction sequencing and constraints, develops a planning level project construction cost estimate, and develops a planning level project design and construction schedule.

The recommended project includes repairs to forcemain AFM102, upgrades at the APS, and improvements within the BHPS's conveyance system.

4.1.1 AFM102 Repairs/Modifications

Due to the concerns about increased O&M and long-term risk associated with the intermediate high points within existing forcemain AFM102, the District requested that Phase II include an evaluation of the feasibility and cost associated with eliminating some of the intermediate high points. The evaluation should also determine any associated hydraulic improvements that would result from this effort.

This work included the following:

- Review of Forcemain AFM102 profile, including potential reasons for the installation of intermediate high points along the alignment, such as accommodating existing topography and avoiding utilities.
- Evaluation of the feasibility of eliminating intermediate high points along the forcemain profile. The evaluation includes a description of required changes to the forcemain and/or other utilities, associated construction cost, and potential construction challenges and constraints. If such changes improve the forcemain hydraulics by eliminating or improving conditions at any controlling high point(s), this is also discussed.

Under the Conveyance System Alternatives Analysis conducted herein (See Section 2), Forcemain AFM102 will be used by the BHPS in the future to pump flows directly from the BHPS to the WWTP headworks. Due to the high controlling highpoint at the Wilbur Avenue Bridge, in this future configuration, the existing high points within forcemain AFM102 will no longer serve as controlling highpoints and will not impact system hydraulics (See Figure 2.6). In addition, since the existing pumps at the BHPS can turn down to below current and buildout minimum flows (per District staff), the pumps are not anticipated to turn off during normal operation. As a result, the AFM102 forcemain high points are not anticipated to drain under normal operating conditions. Partial draining of forcemain AFM102 currently occurs now at low flows under the APS dual (AFM101 and AFM102) forcemain configuration due to differing static conditions of the two forcemains. This draining will not occur in the future when BHPS utilizes AFM102 and it is used under a single forcemain operation.

Since forcemain AFM102 is not continuously rising, air can become trapped if not expelled and can result in reduced capacity and corrosion within the numerous intermediate high points along its alignment.. Air release valves should be used at high points to expel air. However, in the past, the District has eliminated some air valves at high points due to their need for increased maintenance, as an air valve that is not maintained can fail and not function properly. The elimination of forcemain draining in the future will reduce the amount of air that will accumulate at the high points from that point forward.

A draft technical memorandum (TM) was prepared and submitted on May 12, 2021. The draft TM findings were presented and discussed with District staff at the AFM102 High Point Evaluation Meeting on May 26, 2021 to solicit District input and obtain consensus on the recommended forcemain repairs and modifications to be implemented. The final TM is included in Appendix H.

The recommended improvements and associated costs are outlined below.

Five locations are susceptible to future corrosion, and are recommended for lining or replacement as follows.

- Site 1: Install a protective liner within approximately 60 feet of pipe on Wilbur Avenue west of Orchard Street that is currently unprotected (directly east of the existing lined section). The estimated cost for this work is $40,000. Alternatively, this section of pipe could be replaced. However, joining a new pipe to the existing pipe may be infeasible because the existing pipe toward the west has corroded and lost a significant amount of wall thickness, making the joining of new and existing pipe problematic. If feasible, the estimated construction cost to replace the section is $94,000.

  Removing this high point completely would require the installation of approximately 2,000 lineal feet of new pipe to a maximum depth of 36 feet. However, most of this length is not vulnerable to corrosion, and with the above project, the entire vulnerable section will have been lined. Removing only the vulnerable (i.e., lined) length of pipe requires the installation of approximately 500 lineal feet of pipe to a maximum depth of 12 feet, and a new air valve for an estimated construction cost of $618,000.

- Site 2: Install a permanent replacement spool at the site of the December 2019 repair located on 7th Street West of G Street. The length of the repair spool may be up to 80 feet as needed to assure a reliable connection with the existing pipe. The estimated construction cost is $94,000.

  Removing this high point completely would require the installation of approximately 780 lineal feet of new pipe. Removing the vulnerable (i.e. lined or repaired) length of pipe requires installation of approximately 140 lineal feet of pipe and a new air valve for an estimated construction cost of $501,000.

- Sites 3 and 4. Install approximately 460 lineal feet of preventive CIPP liner on Somersville Road between 6th Street and the Pittsburg-Antioch Highway, and continuing west approximately 300 feet on the Pittsburg-Antioch Highway and reinstate the existing

air valve, which is out of service. The estimated construction cost for this project is $203,000.

Removing this high point would require the installation of at least 1,500 lineal feet of new pipe (length may be greater to avoid existing utilities) for an estimated construction cost of $1.8 million. Removing only the vulnerable section of high pipe does not appear feasible in this location due to conflicting utilities. During the meeting held on May 26, 2021, District staff expressed preference for removal of the high point at this location.

- Site 5: Install approximately 570 lineal feet of CIPP liner in two locations on Pittsburg-Antioch Highway east of the wastewater treatment plant. The estimated construction cost for this work is $218,000. Alternatively, the two sections of pipe could be replaced. However, joining the new pipe to the existing pipe on each side may be infeasible because the existing pipe has corroded and lost a significant amount of wall thickness, making the joining of new and existing pipe problematic. If feasible, the estimated construction cost to replace the two sections is $676,000.

  Removing the high point would require the installation of approximately 1,900 lineal feet of new pipe for an estimated construction cost of $2.2 million.

The projects described are conceptual in nature, and should be confirmed through additional field investigations including utility surveys and geotechnical investigations. All improvements/repairs shall be designed for anticipated operating and surge pressures.

All improvements/repairs to forcemain AFM102 should be made prior to reconfiguring the current APS and BHPS and conveyance system since it will be more difficult if not infeasible to remove AFM102 from service once BHPS relies on it to convey flow to the WWTP.

Although the intent is to continue to use AFM102 for pumping from BHPS, the District indicated that at a future date a new forcemain may be constructed to replace AFM102 to increase system reliability and provide increased redundancy. The proposed pipe lining projects and the installation of a permanent repair at Site 2 are recommended regardless of whether a new forcemain is constructed in the future. Alleviating the high points is as discussed above is considered optional, and not recommended due to cost if the existing AFM102 is replaced with a new future forcemain.

The District requested that VWHA develop a planning level construction cost estimate for District future planning use for the cost to replace AFM102 with a new HDPE forcemain. The estimated construction cost to replace AFM102 with a new HDPE forcemain is approximately $16.7M (24-inch FM = 28-inch HDPE (ID=23.85-inch) at 14,931 LF). If AFM102 is replaced with a new forcemain, existing AFM102 could then be used as a spare forcemain for use by APS if AFM101 is required to be removed from service or by BHPS if the new forcemain is removed from service. A cost of $40/in-diameter was used to develop the preliminary budgetary cost estimate.

4.1.2 APS Improvements

Improvements to the APS to meet long term/ buildout pumping needs include upgrading the APS to convey wastewater flow (minus BHPS flow and diversion flow) directly to the WWTP from

APS using only forcemain AFM101. The improvements include replacing the existing main pumps and upgrading the electrical and I&C equipment at the station, including replacing the standby generator. In addition, improvements to the APS to address O&M and reliability issues and concerns include constructing a dedicated diversion pump station and grinder structure on the APS site.

4.1.2.1 APS Main Pump Replacement

The main pumps at the APS will be replaced with four (three duty and one standby) equal sized vertical Flygt Model NT3312/766 pumps with a 480mm impeller and 280 Hp motors. Three duty pumps will be capable of reliably pumping buildout PWWF minus diversion of 12.5 mgd. All pumps will be provided with variable frequency drives. One pump is capable of turning down to less than current minimum dry weather flow. This will prevent AFM101's high points from draining under normal operating conditions.

When incoming flow exceeds the capacity of three pumps, flow will rise and flows in excess of three pumps' capacity will be passively diverted to the new Antioch diversion pump station. Based on the pump station's 2014 and buildout PDWF projections (Table 2.2), one or two pumps will be able to handle PDWFs. This will provide the District with a minimum of two standby pumps during the dry weather season.

See Figures 4.1 and 4.2 for APS pump room/wetwell lower level floor plan and section for new pump layout utilizing four equal sized vertical Flygt NT3312/766, 480mm impeller, 280 Hp pumps. The pumps can be installed/removed using the existing 5-ton bridge crane.

Figures 4.1 and 4.2 show a new spiral staircase provided per District direction. Spiral staircases are not OSHA compliant since you can't get a stretcher down/up them. During the predesign phase, the District should confirm if this is acceptable or if additional options should be explored for reconfiguring the drywell staircase.

4.1.2.2 APS Site Improvements

The existing APS site is shown in Figure 4.3. APS site improvements are shown in Figure 4.4.

Diversion Pump Station and Grinder Structure

The proposed submersible diversion pump station and attached grinder structure including gravity sewer modification and new forcemain piping to the ESB are shown in Figure 4.4.

The proposed diversion pump station and grinder structure will be built as a single structure (See Figure 4.5) and will be located on the APS site just upstream of the existing pump station's wet well splitter box/influent structure. The grinder structure will be built upstream of the new APS diversion pump station to allow all screenings entering the APS site and pass through the grinders before entering the diversion or main pump stations to protect the pumps from ragging.

All incoming flow to the APS site, including flow entering through the existing 12-inch, 36-inch and 48-inch gravity sewers must be combined into a common gravity sewer prior to entering the new grinder structure/diversion pump station. The three gravity sewers will be combined into a single 48-inch gravity sewer upstream of the new facilities. The existing drawings show the

slope of the existing incoming 48-inch gravity sewer as 0.00033. A common 48-inch gravity sewer with a slope of 0.00033 will be used to convey the projected buildout PWWF of 14.3 mgd.

The diversion pump station consists of a wetwell and a valve vault with three Flygt model NP3153 MT, 434 impeller (227mm trim), 20 Hp pumps installed in the wetwell on guide rails. The top of the structure is located at grade. The wetwell top slab shall be H-20 rated with hatches provided for pump removal. The valve vault is provided with bollards and grating to allow the valve stems to be accessed from above through the grating platform to minimize entry into the valve vault to operate the valves. The diversion pump station plan and section are shown in Figures 4.6 and 4.7. Incoming station flow will pass through the diversion pump station on the way to the APS wetwell. When flow exceeds the APS main duty pumping capacity (12.5 mgd), flow will back up into the incoming gravity sewer and spill over the weir into the diversion pump station's wetwell. Flows in excess if the main pump station (12.5 mgd) will be pumped by the diversion pump station to the ESB.

The new grinder structure is shown in Figure 4.8. It contains two JWC Channel Monster Flex Model CFM6030-M2.0E grinders each with a capacity equal to buildout PDWF. Two grinders will be capable of handling buildout PWWF. A passive weir is located upstream of the grinders to convey flow around the grinders in the event of grinder failure. The weir will be utilized if both grinders fail when flows are in excess of buildout PDWF. The grinders and their associated upstream slide gates are provided on guide rail systems for removal/installation via the hatches above. The top of the structure is at grade and shall be H20 rated. The grinder structure will be a Class 1, Division 1 area and is not envisioned to be entered on a routine basis; however, an intermediate grating platform is shown inside the structure to facilitate manned entry.

The District indicated that the grinder structure should be built at the same time as the diversion pump station with all items in place, including the grinder and slide gate frames and their associated guide rail systems and all associated electrical infrastructure, but the grinders should be deferred (not purchased or installed) until it is confirmed that grinders are needed to handle ragging issues.

As indicated earlier, the District shall confirm prior to proceeding with implementation of the diversion pump station and/or the grinder structure at the APS that surcharging of gravity sewers upstream of the APS due to implementation of the new diversion pump station and/or grinder structure will not result in upstream sewer overflows within the collection system under buildout PWWF conditions. See Section 3 for additional information on the APS diversion pump station and grinder facility.

Standby Power

The existing APS 500kW standby diesel engine generator and its associated above grade fuel tank and load bank will replaced with a new 1000kW standby diesel engine generator located on the APS site.

The existing 500kW standby diesel engine generator was installed in 1977 and is not adequately sized to handle the new station loads. The new standby generator will be required to be Tier 4 due to its size and new air board requirements.

The new larger standby diesel engine generator with associated Tier 4 after treatment components will not fit into the existing generator room and shall be installed on site within a secure acoustical weather enclosure rated for sound attenuation of 72 dBA at 23 feet with a load bank and 24-hour subbase diesel fuel tank. The overall dimensions of the generator enclosure provided by Cummings are 31.5 feet long by 9.5 feet wide by 15.5 feet high. The generator enclosure should be mounted on a concrete pad and provided with aluminum access platforms on each side of the generator to facilitate access to the enclosure doors. The generator enclosure, concrete pad and access platforms are shown on Figure 4.4 to the west of the ESB.

The existing generator room will be used to accommodate the new electrical equipment.

Surge Protection

Surge protection facilities are anticipated to be required at the APS to protect existing forcemain AFM101. A surge analysis was not included in the current phase of work, but a surge analysis and design of surge protection facilities should be included in future predesign/design work.

4.1.2.3 APS Electrical and Instrumentation and Controls (I&C) Improvements

Electrical and I&C improvements are required at the APS to accommodate the new 280Hp pumps, new generator, new diversion pump station, and new grinder structure. ArcSine visited the APS with District electrical/I&C staff on September 15, 2021 to identify the required electrical/I&C improvements required at the APS and also to identify obsolete electrical/I&C equipment that has reached its useful life that should be replaced. It was anticipated that most existing electrical and I&C equipment at the APS will be replaced under this project.

The electrical/I&C scope of work performed under this project was high level and intended to identify planning level improvements for the project, including a planning level construction cost estimate for District budgeting purposes.

A planning-level one-line diagram is included on Drawing E-1. The bold items represent electrical work which is included.

Electrical improvements include:

- New 480-volt electric service and distribution
- New automatic transfer switch
- New engine-generator, estimated at 1,000kW to handle station critical loads including three duty 280-hp sewage pumps, (one) 20-hp diversion pump, and the new grinders. (See above under standby power for additional information on generator.)
- New motor control centers and VFDs
- New power distribution

Motor control for air compressors and other packaged-type equipment are expected to be reused.

The extent to which instrumentation and controls are rehabilitated/replaced is the subject of some discretion. For planning purposes, the following is assumed:

Table 4.1 APS – Instrumentation and Control Work

I&C Equipment	Reuse Existing	New
Main control panel with Programmable Logic Controller (CP-1)		✓
Level control panel (assume replacement bubbler system)		✓
Hardwired backup control system (part of CP-1)		✓
Backup level switches		✓
Flow monitoring		✓
Pressure monitoring		✓
Air compressor control	✓	
Sluice gate control	✓	
Hydropneumatic system control	✓	
Gas detection		✓
Video system	✓	
Communications system	✓	New Network Switches
Supervisory system	Modify Existing	
Intrusion alarm system		✓
Fire alarm system		✓

Forcemain AFM101's 16-inch diameter flowmeter located in the forcemain AFM101 flowmeter/pig launcher vault to the west of the pump station building on the APS site will be replaced on the project. The District indicated that the current flowmeter does not read accurately. The District also noted that the flowmeter on AFM102 at the APS located in forcemain AFM102's flowmeter vault to the east of the pump station building on the APS site also does not read accurately, but since APS will no longer use AFM102, the flowmeter does not require replacement.

While this preliminary effort did not include physically laying out the equipment, it is believed that the new electrical equipment can be made to fit within the existing electrical and generator rooms based on the following:

- The new engine driven generator will be placed outside on the APS site in a sound enclosure. (See above under standby power for additional information on the generator and its location)
- A new PG&E transformer will likely be required. During design the details shall be coordinated. The new transformer is envisioned be placed on or near where the existing transformer is located.
- The new service entrance (SE-1) could fit inside the building; however, for planning purposes, it is assumed that it will be located in a new freestanding outdoor enclosure in the location of the existing fuel tank and load bank to be demolished (adjacent to the existing transformer). This would provide a degree of segregation for PG&E access, and would improve construction sequencing.

- The ATS, switchboard, motor control centers, and VFDs will all be located in the existing electrical and generator rooms.
- A new station PLC control panel is envisioned. It will be located either in the existing electrical or generator room.

4.1.2.4 Additional Design Items

See below for additional design considerations related to the APS and Conveyance System.

4.1.3 BHPS Conveyance System Improvements

Improvements to the BHPS conveyance system to meet long term/ buildout pumping needs include extending the existing Bridgehead forcemain to the blind flange on forcemain AFM102 at the intersection of Fulton Shipyard Road and Wilbur Avenue. BHPS will pump all flow directly to the WWTP Headworks and no longer convey flows through the APS.

4.1.3.1 Bridgehead Forcemain Extension

The new Bridgehead forcemain extension will be within Wilbur Avenue. No utility investigation or potholing work was included in the current phase of work. Potholing and utility investigations should be performed during the future predesign/design phases to support the design and construction of the new forcemain extension, including locating the existing forcemain tie-in points and existing parallel and crossing utilities.

The hydraulic analysis included herein assumed the new forcemain between the new 24-inch ductile iron forcemain currently being installed (downstream of the Wilbur Avenue Bridge) under the Bridgehead Pipeline Replacement Project (Project No. 21123) (VWHA) and the blind flange connection point on forcemain AFM102 at the intersection of Fulton Shipyard Road and Wilbur Avenue would be 30-inch diameter HDPE, 2,455 feet (max) in length, have an internal diameter of 25.3 inches (min) and have a minor loss coefficient (k-value) of 2.75 (max). A 30-inch diameter HDPE forcemain was used in the analysis to provide a larger internal diameter to reduce headloss and allow the 14-inch BHFM to not be used (per District request). The new forcemain will need to be provided with 24-inch flanges on each end to connect to the existing 24-inch flanges.

Figure 4.9 provides a schematic of the forcemain and valving required at the intersection of Fulton Shipyard Road and Wilbur Avenue to accommodate forcemain AFM101 and AFM102 interconnection and a future 3rd forcemain to replace AFM102. A future 3rd forcemain would allow AFM102 to remain in use as a redundant forcemain for use with APS or BHPS if their respective forcemains are required to be removed from service for O&M or in an emergency situation such as a forcemain failure. Prior to a 3rd forcemain being constructed, the piping/valving configuration shown in Figure 4.9 interconnects AFM101 and AFM102 which will allow all flow from both pump stations to be directed into either AFM101 or AFM102 under an emergency situation. This interconnection was requested by the District to provide additional system flexibility in an emergency. However, the system does not have sufficient capacity for APS and BHPS to pump all flow through only one forcemain and a hydraulic analysis has not been performed to confirm such operation is feasible or recommended. The recommended operation under such an emergency situation is to pump into the in-service forcemain with one

pump station at a time while diverting to storage (ESB) with the other station and vice versa until the out of service forcemain can be re-instated. (See additional information below related to "AFM101 and AFM102 Forcemain Intertie and Potential Future Third Forcemain".

The piping and valving shown in Figure 4.9 shall be designed with District pigging operations in mind.

4.1.3.2 Additional Design Items

See below for additional design considerations related to the BHPS and Conveyance System.

4.1.4 Additional Design Considerations

4.1.4.1 APS Diversion Pump Station and Grinder Structure Upstream Gravity Sewer System Surcharge/Overflow Analysis

As indicated earlier, the District shall confirm prior to proceeding with implementation of the diversion pump station and/or grinder structure at the APS that surcharging of gravity sewers upstream of the APS due to implementation of the new diversion pump station and/or grinder structure will not result in upstream sewer overflows within the collection system under buildout PWWF conditions.

4.1.4.2 Surge Protection

Surge analysis was not included in the current phase of work. A surge analysis should be conducted for both the APS and BHPS and their associated buildout conveyance systems (pumps and forcemain systems) to determine any surge protection improvements to be implemented. Surge analysis and design of surge protection facilities shall be included in future predesign/design work. It is anticipated that surge protection is required at the APS to protect existing forcemain AFM101. A surge tank was designed and installed at the BHPS on the 24-inch forcemain when the current pump station was constructed and the existing pumps were installed under the 2006 Bridgehead Expansion, Phase 2 (Pump Station and Related Improvements) (CIP No. 4240) project (RMC). At that time, the pumps were sized to pump to the WWTP through AFM102 in the future so the surge protection facilities at the BHPS may be adequate to protect the Bridgehead forcemains, but an analysis should be performed. Table F-6 of the District's 2010 Conveyance System Master Plan shows future surge pressures for forcemains AFM101 and AFM102 exceeding the forcemains' surge pressure rating. The current condition of the existing forcemains should be considered when performing the surge analysis.

4.1.4.3 APS Structural Analysis

Structural/seismic analysis of existing structures at the APS has not been included in the current phase of work. If required or requested by the District, such work should be included in future predesign/design work. Such work may include: ASCE 41, Seismic Evaluation and Retrofit of Existing Buildings.

4,1.4.4 14-inch BHPS Forcemain Condition Assessment

The District has indicated some concern with using the existing 14-inch BHPS Forcemain. Although the 14-inch BHPS Forcemain is not currently used under normal operation and is not required to be used in the future based on the analysis included herein, the District may wish to

perform inspection and/or a condition assessment of BHPS's existing 14-inch forcemain if they wish to use it in the future.

4.1.4.5 AFM101 and AFM102 Forcemain Intertie and Potential Future Third Forcemain

The District requested that forcemains AFM101 and AFM102 be intertied for use in an emergency. Although the forcemains can be plumbed (intertied) to allow either pump station (BHPS or APS) to pump flow into either forcemain under an emergency situation, sufficient capacity will not be provided to allow both pump stations to use a common forcemain.

In addition, a hydraulic analysis has not been performed to confirm if such operation is feasible or recommended. The recommended operation under such a situation would be to pump into the in-service forcemain with one pump station at a time while diverting to storage (ESB) with the other station. (See additional information above under Bridgehead Forcemain Extension related to the piping/valving configuration for the interconnection of AFM101 and AFM102 at the intersection of Fulton Shipyard Road and Wilbur Avenue).

Per discussions with District staff a third forcemain could be constructed in the future to parallel AFM102 (constructed of HDPE with profile improvements incorporated) and replace AFM102 from the intersection of Fulton Shipyard Road and Wilbur Avenue to the WWTP headworks. The existing AFM102 could then be used as a spare forcemain for use by APS if AFM101 is required to be removed from service or by BHPS if the new forcemain portion parallel to AFM102 is removed from service. This would add additional redundancy and flexibility to the APS and BHPS conveyance system.

4.1.4.6 Geotechnical Investigation

No geotechnical work was included in the current phase of work. Geotechnical investigations shall be performed during the future predesign/design phases to support the design and construction of the new facilities, including but not limited to new piping, diversion pump station, grinder structure, generator, and surge protection facilities at the APS; BHPS forcemain extension; and forcemain AFM102 improvements (if required). If new surge protection facilities are required at the BHPS site, geotechnical investigations shall also be performed for such facilities.

4.1.4.7 Survey and Land/Easement Acquisition

No survey or land/easement acquisition work was included in the current phase of work. Survey shall be performed during the future predesign/design phases to support the design and construction of the new facilities, including but not limited to a topographical site survey at the APS, including manhole inverts and rims, and property line and easements; topographical site survey for BHPS forcemain extension; and survey of the lowest MH rim elevations in the collection system upstream of the APS. Land/easement acquisition shall be performed as required to support the design and construction of the new facilities.

4.1.4.8 Pothole and Utility Investigation

No pothole or utility investigation work was included in the current phase of work. Potholing and utility investigation shall be performed during the future predesign/design phases to support the

design and construction of the new facilities, including location and elevation of existing pipeline tie-in locations and the location of existing utilities.

4.1.4.9 Cathodic Protection, Permitting, or Environmental Work

No cathodic protection, permitting, or environmental work was included in the current phase of work. Such work, as required, shall be performed during the future predesign/design phases to support the design and construction of the new facilities.

4.1.4.10 Odor Control

Odor control facilities were not included in the current phase of work. Odor control for new facilities at APS, including the new diversion pump station and grinder structure (if requested by the District) should be included in future predesign/design work.

4.2 CONSTRUCTION COST ESTIMATE

A preliminary level construction cost estimate was developed for the Antioch and Bridgehead Pump Stations and Conveyance System Improvements Project for District budgeting. The preliminary level construction cost estimate includes the recommended improvements outlined herein to meet long term/ buildout pumping needs and address O&M and reliability issues and concerns. The preliminary level construction cost includes the following project components:

1) AFM102 Repairs/Modifications. Recommended forcemain AFM102 repairs and modifications to be implemented are included in the final AFM102 High Point Evaluation TM included in Appendix H. The estimated construction cost of the associated improvements/repairs is $2,152,000 for the proposed repair options (Year 2021) and $2,351,548 at time of construction (Year 2024, escalation at 3% per year) and is included in Table 4.2. If additional construction is completed to remove specific forcemain high points in lieu of completing localized repairs, the estimated construction cost will be $4.9 million (Year 2021).

2) APS Improvements. A detailed preliminary level construction cost estimate for the APS improvements is included in Appendix I. Estimate includes 5 percent mobilization/demobilization, 18 percent Bond, Insurance and Overhead, 30 percent contingency, and is escalated to the mid-point of construction (Year 2025). The cost estimate includes a placeholder of $400,000 for surge protection at the APS site. The estimated construction cost is $15,725,000 (Year 2025, escalation at 3% per year) and is included in Table 4.2. The construction cost can be reduced by $340,000 if the grinders are deferred and not installed under the initial project.

3) Bridgehead Forcemain Extension and AFM101/AFM102 Intertie. The estimated construction cost to extend the Bridgehead forcemain to the tie-in location on forcemain AFM102 at the intersection of Wilbur Avenue and Fulton Shipyard Road, including forcemain and valving required at the intersection to accommodate forcemain AFM101 and AFM102 interconnection and connection to a future third forcemain to replace AFM102 (See Figure 4.9) is $3.55M at time of construction (Year 2024, escalation at 3% per year). A cost of $40/in-diameter plus $300,000 for tie-in connections and valves was used to develop the preliminary budgetary cost estimate. The cost is also included in Table 4.2.

Table 4.2 Recommended Project – Preliminary Construction Cost Estimate

Project Component	Preliminary Construction Cost[4]
1) AFM102 Repairs/Modifications[1]	$2,352,000
2) APS Improvements[2]	$15,725,000
3) Bridgehead Forcemain Extension and AFM101/AFM102 Intertie[3]	$3,550,000
TOTAL CONSTRUCTION COST	**$21,627,000[4]**

[1] Recommended forcemain AFM102 repairs and modifications to be implemented are included in the final AFM102 High Point Evaluation TM included in Appendix H. Costs are escalated time of construction (Year 2024) using 3% per year.

[2] A detailed preliminary level construction cost estimate for the APS improvements is included in Appendix I. Estimate includes 5 percent mobilization/demobilization, 18 percent Bond, Insurance and Overhead, 30 percent contingency, and is escalated to the mid-point of construction (Year 2025, 3% escalation per year). The cost estimate includes a placeholder of $400,000 for surge protection at the APS site. The construction cost can be reduced by $340,000 if the grinders are deferred and not installed under the initial project.

[3] Extend Bridgehead forcemain to the tie-in location on forcemain AFM102 at the intersection of Wilbur Avenue and Fulton Shipyard Road (30" HDPE (ID=25.3"), Length = 2,455 LF), including forcemain and valving required at the intersection to accommodate forcemain AFM101 and AFM102 interconnection and connection to a future third forcemain to replace AFM102 (See Figure 4.9). $40/in-diameter plus $300,000 for tie-in connections and valves was used to develop the preliminary budgetary cost estimate. Costs are escalated time of construction (Year 2024, 3% escalation per year).

[4]Estimated construction cost is the Contractor's estimated bid price and all costs have been escalated to time of construction using 3% per year. Cost does not include ESDC, CM, District staff time, special inspections and testing, etc. The project cost estimate does not include future replacement of AFM102.

4.3 CONSTRUCTION SEQUENCING AND CONSTRAINTS

Construction of the Antioch and Bridgehead Pump Stations and Conveyance System Improvements Project will require improvements to be sequenced, dry weather season work, and bypass pumping. Detailed construction sequencing and constraints shall be developed during the design phase and included in the Contract Documents.

The following preliminary construction constraints have been developed for the project.

- Prior to replacement of the APS main pumps, BHPS flows shall be conveyed to the APS and both AFM101 and AFM102 shall be used by the APS.
- All AFM102 Repairs/Modifications shall be constructed during the dry weather season and prior to sending BHPS flows directly to forcemain AFM102.
- All BHPS flows shall be conveyed to the WWTP via forcemain AFM102 prior to startup and testing of the new main pumps at APS. (Transition shall occur during dry weather season when using bypass pumping at the APS with flows through only AFM101)
- The conversion of BHPS flows from APS to AFM102 (tie-ins of the BHFM extension) shall occur during the dry weather season and be designed and sequenced to allow the transition to occur during diversion of all incoming BHPS flow or during short duration shutdowns.

- During the dry weather season, incoming minimum flow through PDWF shall be reliably pumped at all times. APS flows shall include BHPS flows prior to the BHPS flow being diverted through forcemain AFM102.
- During the wet weather season, incoming minimum through PWWF shall be reliably pumped with diversion capabilities in place. APS flows shall include BHPS flows prior to the BHPS flow being diverted through forcemain AFM102.
- Primary and standby power shall be provided at all times, except during times of bypass pumping or short duration shutdowns (time station can be removed (flows held) from service during the dry weather season).
- Bypass pumping shall only be allowed during the dry weather season and shall be manned 24/7 (unless system can be automated for standby pump operation and remote alarms provided to District's satisfaction). Bypass pumping is envisioned to occur during Dry Weather Season 1 for a duration of 4 months and during Dry Weather Season 2 for a duration of 6 months.
- Bypass pumping shall be provided with redundant/standby pump and standby power (if electric). Diesel engine driven pumps shall be provided with a minimum of 24 hours of fuel and shall be sound attenuated and be capable of suction lift required (not surcharge upstream water levels to cause spill and to provide freeboard with safety factor).

The following preliminary construction sequence has been developed to allow the project to be constructed with constraints in place.

4.3.1 Dry Weather Season 1 Work

- Construct AFM102 Repairs/Modifications (Complete work by end of Dry Weather Season 1)
- Construct BHFM Extension (Do not make connections. BHPS flow to continue to APS until Dry Weather Season 2). This work is not dry weather dependent. Complete work before start of Dry Weather Season 2.
- Construct New Gravity Sewers and Build Diversion Pump Station/Grinder Facility Structure (Complete work by end of Dry Weather Season 1)
    - Step 1. Construct New Gravity Sewers (except for 48-inch in location of new grinder structure and diversion pump station. Plug new 48-inch gravity sewer upstream of new grinder structure) and manholes while keeping all existing gravity sewers in service and continuing to convey flow to the APS wetwell.
        - The new tie-in manholes on the 36-inch and 48-inch gravity sewers shall be constructed around the existing gravity sewers to allow the existing gravity sewers to remain in service and unaffected. The 12-inch gravity sewer shall be temporarily relocated around the new manhole. No flow shall be within the new gravity sewers at this time. (This work may be constructed prior to dry weather season 1).

- Set-up bypass pumping (APS + BHPS flows) from new manhole upstream of the new grinder structure location to allow pumping of PDWF into the hatch location at the APS wetwell splitter box/influent structure. Existing main APS pumps will pump flow to WWTP via AFM101 and AFM102 (when not out of service for repairs/modifications). Cut out existing gravity sewer in new tie-in manholes and connect 12-inch gravity sewer to new tie-in manhole to allow all flow to pass to location of new manhole upstream of new grinder structure location. Start and test bypass pump. Plug and abandon 12-inch and 48-inch gravity sewers. Temporarily plug 48-inch gravity sewer at wetwell splitter box/influent structure. Allow flow to continue through 36-inch gravity sewer to APS wetwell until dry weather season 2. This will minimize bypass pumping during Dry Weather Season 1 and allow higher combined APS and BHPS flows to be conveyed into the APS prior to dry weather season 2.

- Step 2.
  - Construct new diversion pump station and grinder structure and connect to 48-inch gravity sewer. All facilities shall be constructed including grinder and stop gate frames and pump, grinder and stop gate guide rail systems, except 1) diversion pumps may be installed at later date (prior to end of Dry Weather Season 2) and 2) Grinders may be deferred until District determines grinders are needed (if needed). Electrical equipment in the APS electrical/generator rooms to support the operation of the facilities will be installed during Dry Weather Season 2. Relocate and reconnect 16-inch interconnection piping on APS site. Do not disconnect existing pumps from ESB or connect new Diversion Pump Station's 14-inch forcemain to ESB until Dry Weather Season 2.
  - Once structures are completed, temporary plugs in 48-inch gravity sewer upstream and downstream of new diversion pump station/grinder structure may be removed and bypass pumping stopped. All flow will then enter the pump station through the existing 36-inch gravity sewer and new 48-inch gravity sewer (passing through the new diversion pump station and grinder structure).

4.3.2 Dry Weather Season 2 Equipment Delivery Deadline

All Dry Weather Season 2 equipment shall be delivered by April 1st prior to Dry Weather Season 2 to allow Dry Weather Season 2 work to commence. This includes new APS main pumps and associated piping and valves, APS diversion pumps, new standby generator, and all electrical/I&C equipment.

4.3.3 Temporary Standby Generator

A temporary standby generator, matching the size of the existing standby generator (500 kW), shall be provided prior to Dry Weather Season 2 (approximately 3 months) to allow the existing

generator and its associated fuel tank and load bank to be demolished prior to Dry Weather Season 2. This will aid in installation of the new service entrance equipment and ready the generator room in advance for the new electrical equipment.

4.3.4 Dry Weather Season 2 Work

- Step 1. Connect BH FM Extension to AFM102, make associated intertie connections, and convey all BHPS flow to WWTP via AFM102. Existing main APS pumps will pump flow to WWTP via AFM101 only. (Limit time to complete this work to one week maximum). After this work, APS will no longer receive BHPS flows.
- Step 2. Remove existing 36-inch gravity sewer from service and plug at ends and fill with CLSM. Allow all flow to pass to APS wetwell via the new grinder structure/diversion pump station. Set-up bypass pumping (APS flows only) from new grinder structure to AFM101 (bypass only to AFM101) using bypass connection in onsite APS AFM101 pig launcher/flowmeter vault. Implement and test bypass pump system.
- Step 3. Confirm bypassed flow into AFM101 can be/is isolated (valve present) from main pump station's piping downstream of flowmeter location in vault (to allow flowmeter and header piping within the main pump station to be removed from service while bypass pumping), if not, conduct short duration shutdown of APS to remove a pipe spool upstream of bypass pumping connection and downstream of existing flowmeter and blind flange piping to separate the piping systems.
- Step 4. Demolish generator, electrical /I&C equipment, and main pumps; install and test new main pumps, diversion pumps (connect to ESB), new flowmeter, electrical/I&C equipment and generator. All facilities shall be operational by Oct 1st. Disconnect bypass pumping. At end of Dry Weather Season 2, APS Diversion PS shall be operational, and APS shall use new pumps to convey flow through only AFM101 to WWTP.

4.4 DESIGN AND CONSTRUCTION SCHEDULE

The design and construction schedule for the project is shown in Table 4.3.

The construction schedule is dry weather season dependent and is based on advertising the project for bid in October 2023 with Contractor's Notice-to-Proceed in January 2024.

Based on the Contractor's Notice-to-Proceed in January 2024, time for submittals, construction of new structures, lead time for long lead time equipment (pumps, electrical/I&C, and generator), and dry weather season work and bypass pumping, the construction is shown to occur over two dry weather seasons with construction completed in December 2025.

Table 4.3 Recommended Project - Design and Construction Schedule		
Milestone	**Duration**	**Date**
Predesign Phase		
Predesign (Includes Surge Analysis, Surcharge/Overflow Analysis, APS Structural Analysis (if needed), 14-inch BH FM condition Assessment (if requested), Survey, Land/Easement Acquisition, Geotechnical, Permitting, and Utility Investigation)	7 months	Jan – July 2022
Design Phase		
Detailed Design	12 months	Aug 2022 – Sept 2023
Design Completion/Bid Documents		Sept 2023
Bid Phase		
Bid Phase	3.5 months	Oct 2023 - Mid-Jan 2024
Bid Period	6 weeks	Oct – Mid-Nov 2023
Bid Advertise		Early Oct 2023
Pre-Bid Meeting		To Be Determined
Bid Opening		Mid-Nov 2023
Contract Award		December 2023
Bond, Insurance, Etc.	3 weeks	Mid-Jan 2024
Notice-to-Proceed		Mid-Jan 2024
Construction Phase		
Construction Phase	24 months	Mid-Jan 2024 – December 2025
Contracts to Subcontractors and Vendors/Mfr	6 weeks	Mid-Jan – Feb 2024
Submittals/Mfr Equipment/Deliver Equipment		April 2024 – April 1, 2025
Dry Weather Season 1 Work 1 - Construct New Gravity Sewers & MHs (Keep 36" GS in service) and Build Diversion Pump Station/Grinder Facility Structure w/ Bypass Pumping 2- Construct AFM102 Repairs/Modifications		May – Oct 2024
Construct BH FM Extension (Do not make connections. BHPS flow to continue to APS. APS continue to use AFM101 and AFM102)		May 2024 – April 2025
Dry Weather Season 2 Equipment Delivery Deadline (Main pumps and associated piping and valves, all electrical/I&C equipment, and generator)		April 1, 2025
Temporary Standby Generator		Feb – April 2025
Dry Weather Season 2 Work 1 – Connect BH FM Extension to AFM102, make associated intertie connections, and convey all BHPS flow to WWTP via AFM102. 2 - Remove 36-inch GS from service; 3 - Implement Bypass Pumping (Use AFM101 only) 4 – Demolish main generator, electrical /I&C equipment and main pumps; install and test new main pumps, electrical/I&C equipment and generator (by Oct 1, 2025); 3 – At end of Dry Weather Season 2, APS Diversion PS shall be operational, and APS shall use new pumps to convey flow through only AFM101 to WWTP.		May – Oct 2025 (All new equipment shall be installed, tested and in-service by October 1, 2025)
Punch List Items		Nov – Dec 2025
Project Completion		Dec 2025

4.5 HYDRAULIC MODEL UPDATE

The District's InfoWorks ICM hydraulic model was constructed under the District's 2010 Conveyance System Master Plan and includes flow projections from the District's 2010 Conveyance System Master Plan rather than the 2014 City of Antioch Collection System Master Plan which was used under this work.

VWHA updated the District's InfoWorks ICM hydraulic model to accurately represent the recommended alternative for the pumps and forcemain configurations under the long term/ buildout conveyance system with the proposed improvements in the Antioch and Bridgehead conveyance system, including new equal sized pumps at APS with the APS using only forcemain AFM101, and BHPS using the existing pumps to pump directly to the WWTP headworks using AFM102 and the new Bridgehead forcemain extension between the end of the existing BHFM and the blind flange location on forcemain AFM102 at the intersection of Fulton Shipyard Road and Wilbur Avenue.

The model includes a representation of bypass flow to equalization storage. A new scenario was included in the hydraulic model parameters to represent the buildout dry weather sewer loads from the 2014 City of Antioch Collection System Master Plan. The District's design storm wet weather factors from the original models were retained. These adjustments use broad assumptions developed by the team, and were included for the purpose of confirming viability of the proposed improvements. The District's model was not recalibrated to new flows, or otherwise adjusted for existing or projected flows for this analysis.

Hydraulic model updates included the following:

- APS with forcemain AFM101 updates, including pump (three equal sized duty pumps on VFDs) and pump suction and discharge piping changes (Per information on Figures 2.8 and 2.11), and changes to wetwell setpoints. Changes match the hydraulic calculations and reflect the proposed configuration.
- BHPS with forcemain AFM102 updates, including new forcemain extension and use of a majority of AFM102 (Per information on Figures 2.6 and 2.7). Changes include all horizontal and vertical alignment and major and minor loss changes and match the hydraulic calculations to reflect the proposed configuration.
- Changes were made to adjust the buildout dry weather flow projections from the 2014 City of Antioch Collection System Master Plan.

Information on groundwater inflows, discharge boundary conditions, wet weather events, and calibration parameters remained unchanged from the original model.

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Figure 2.1. Bridgehead Diversion Pump Station – Pump, System, and Suction & Discharge Loss Curves

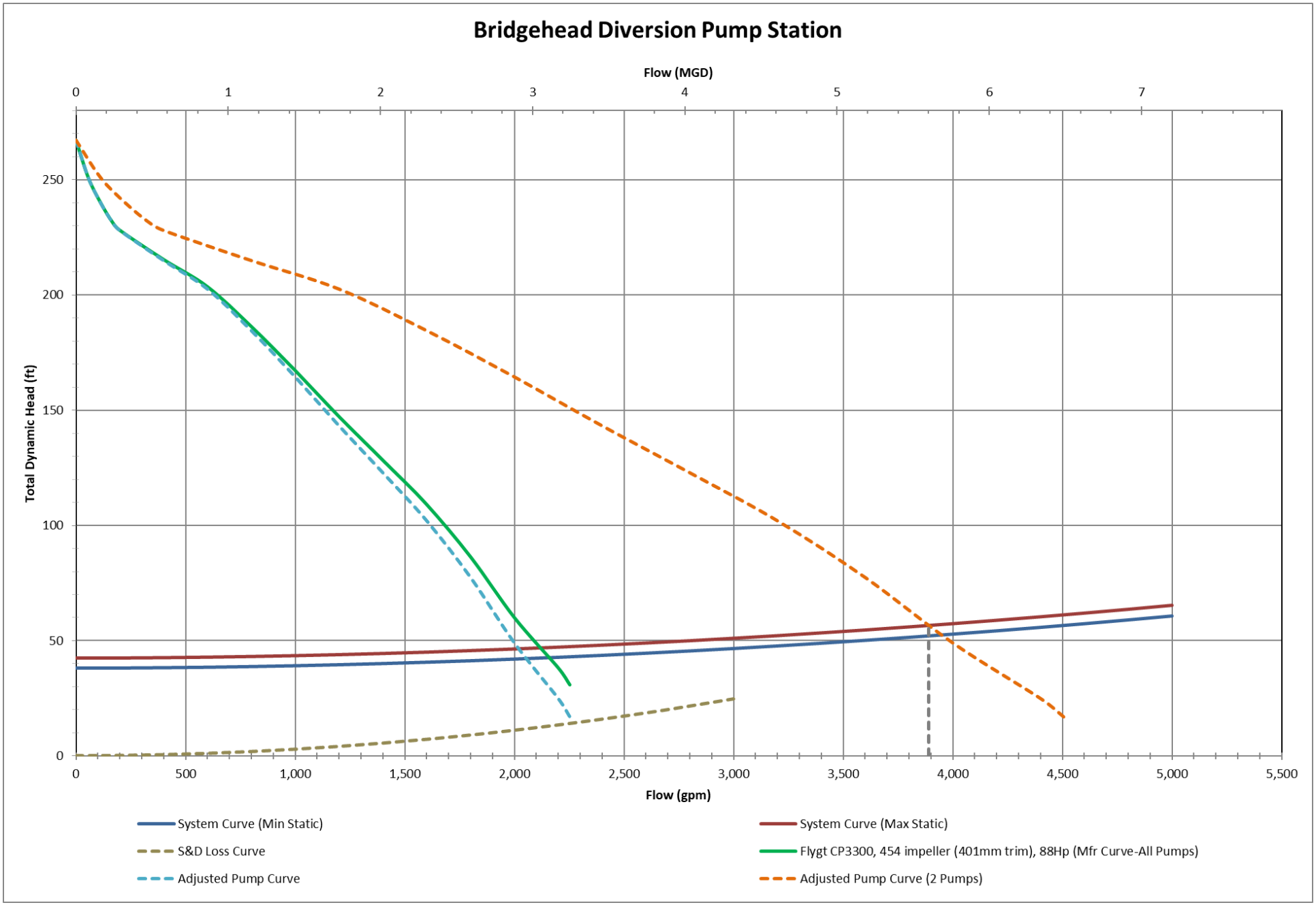


Figure 2.2. BHPS with Forcemain AFM 101 – System Curve Development (Segments BHFM High Point at Wilbur Bridge and B Modified End of FM)

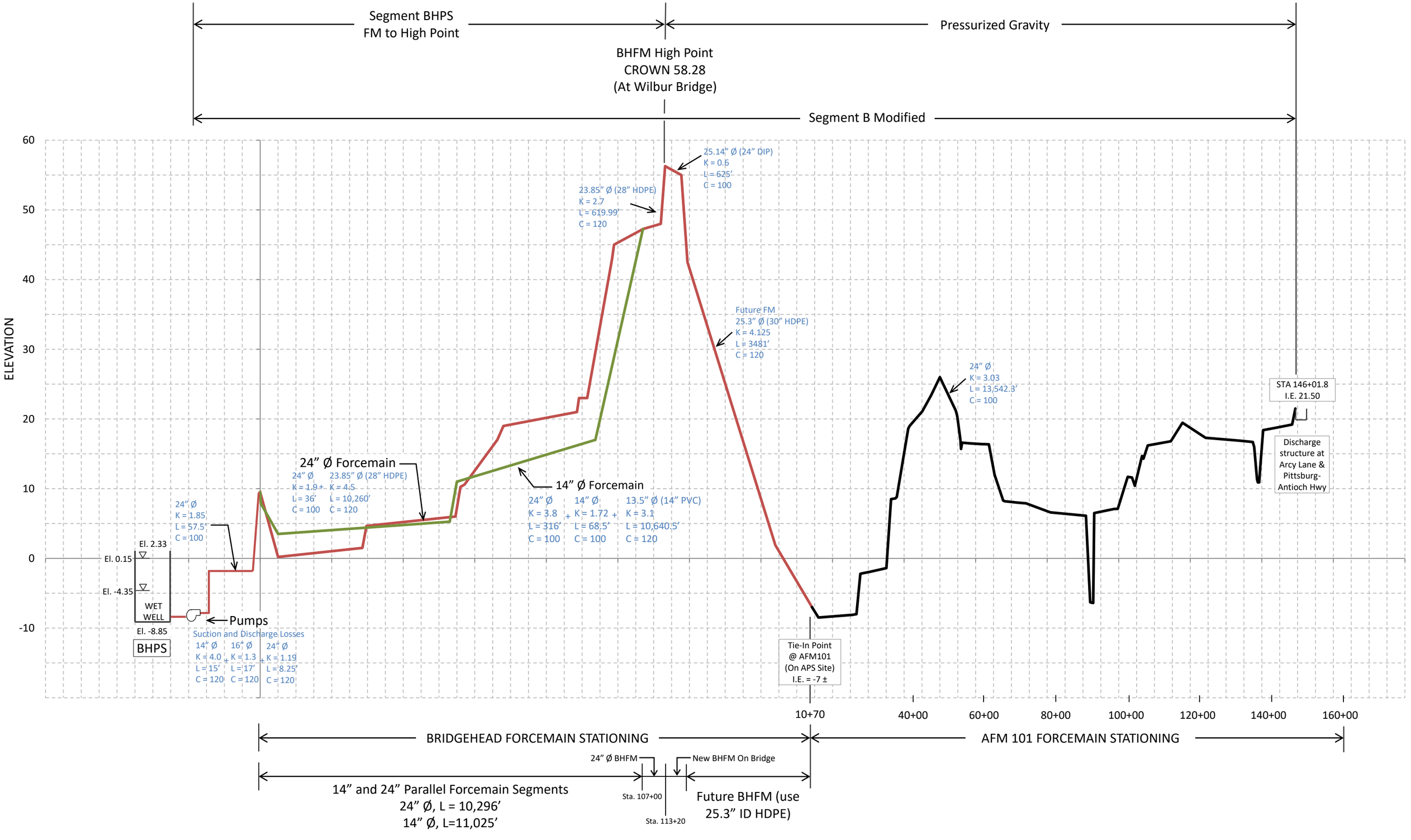


Figure 2.3. Bridgehead Pump Station with AFM101– Pump, System, and Suction & Discharge Loss Curves

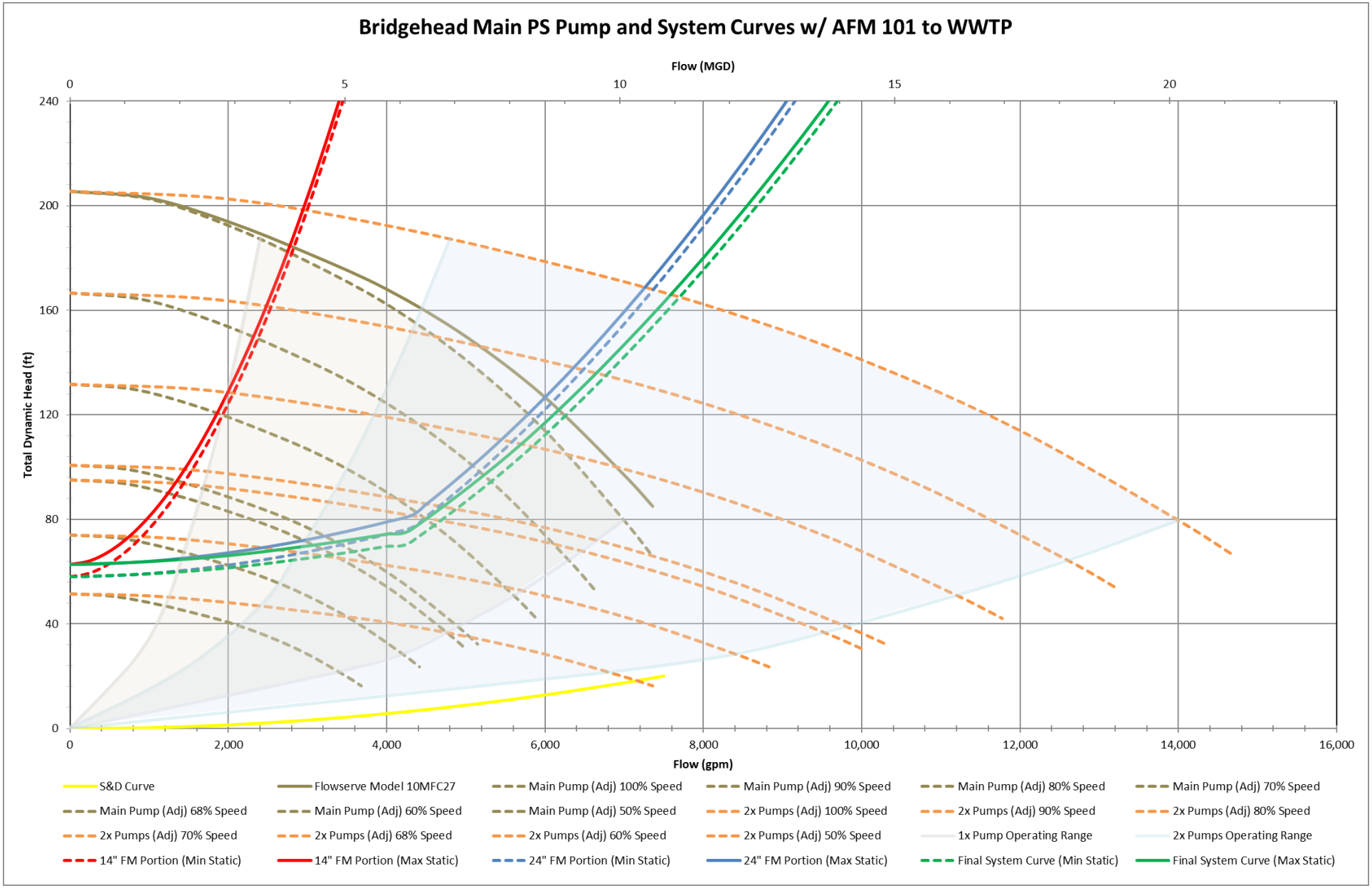


Figure 2.4. APS with Forcemain AFM 102 – System Curve Development (Segments A, B, D and E)

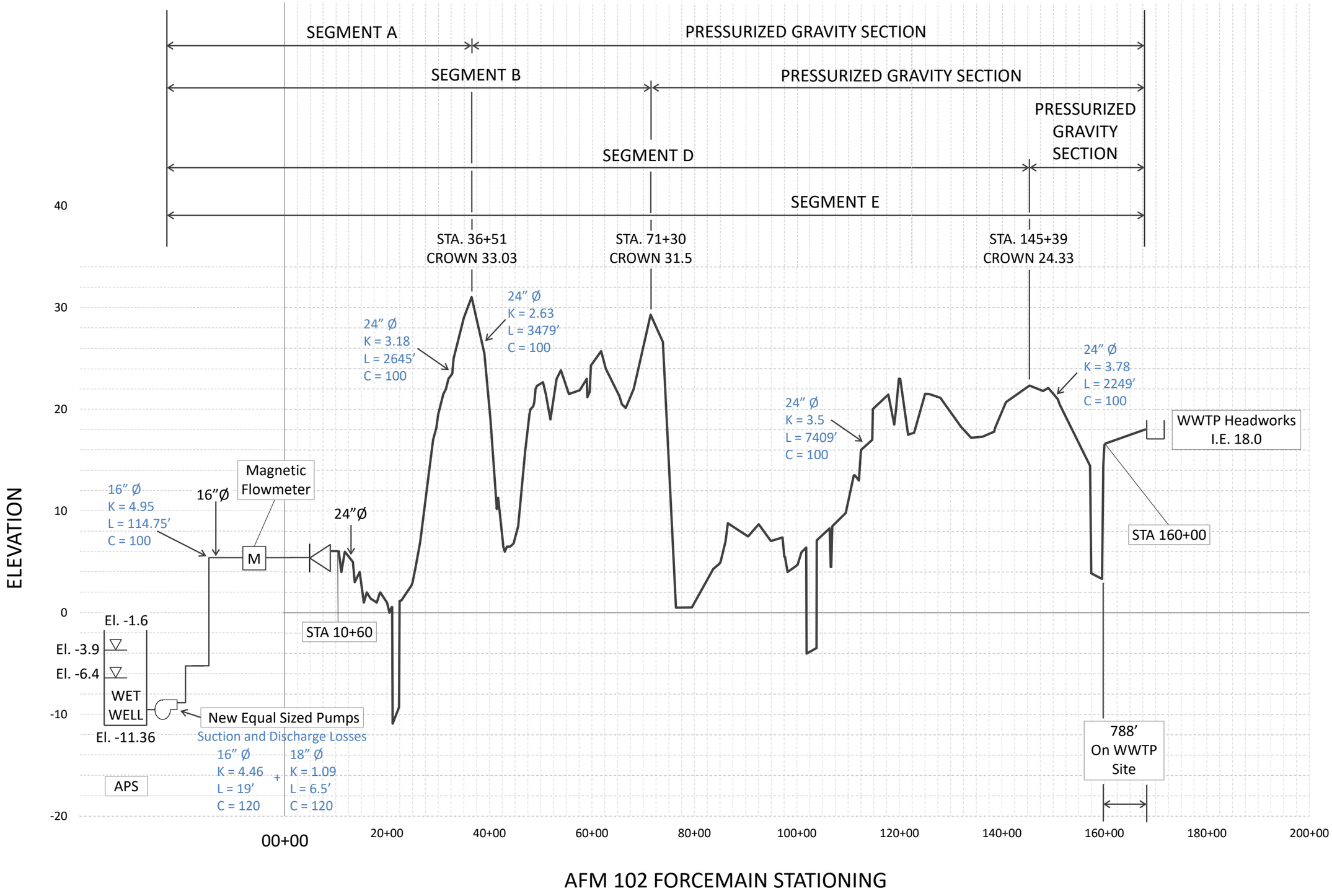


Figure 2.5. Antioch Pump Station with AFM102– Pump, System, and Suction & Discharge Loss Curves for New Equal Sized Pumps

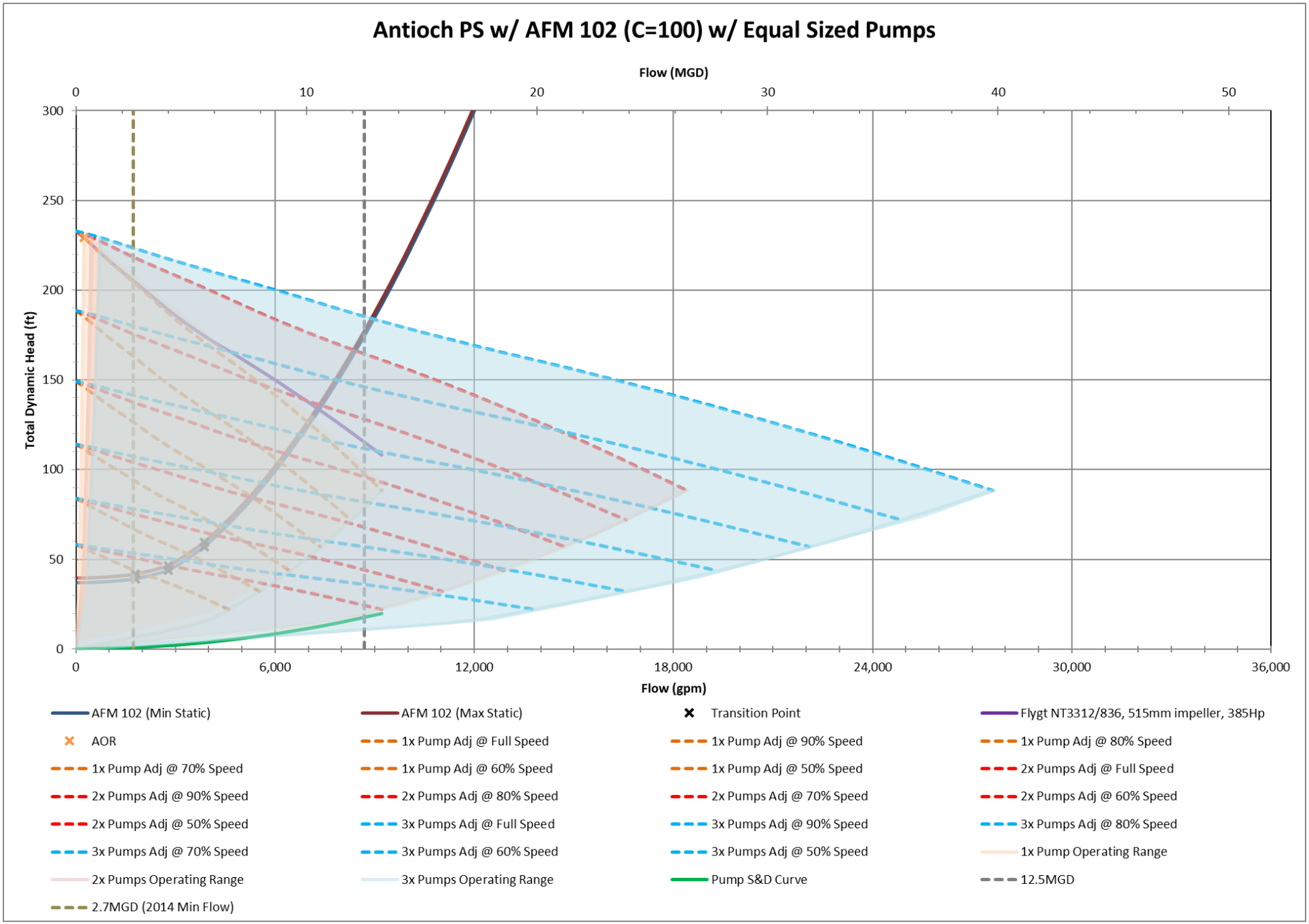


Figure 2.6. BHPS with Forcemain AFM 102 – System Curve Development (Segments BHFM High Point at Wilbur Bridge and E Modified End of FM)

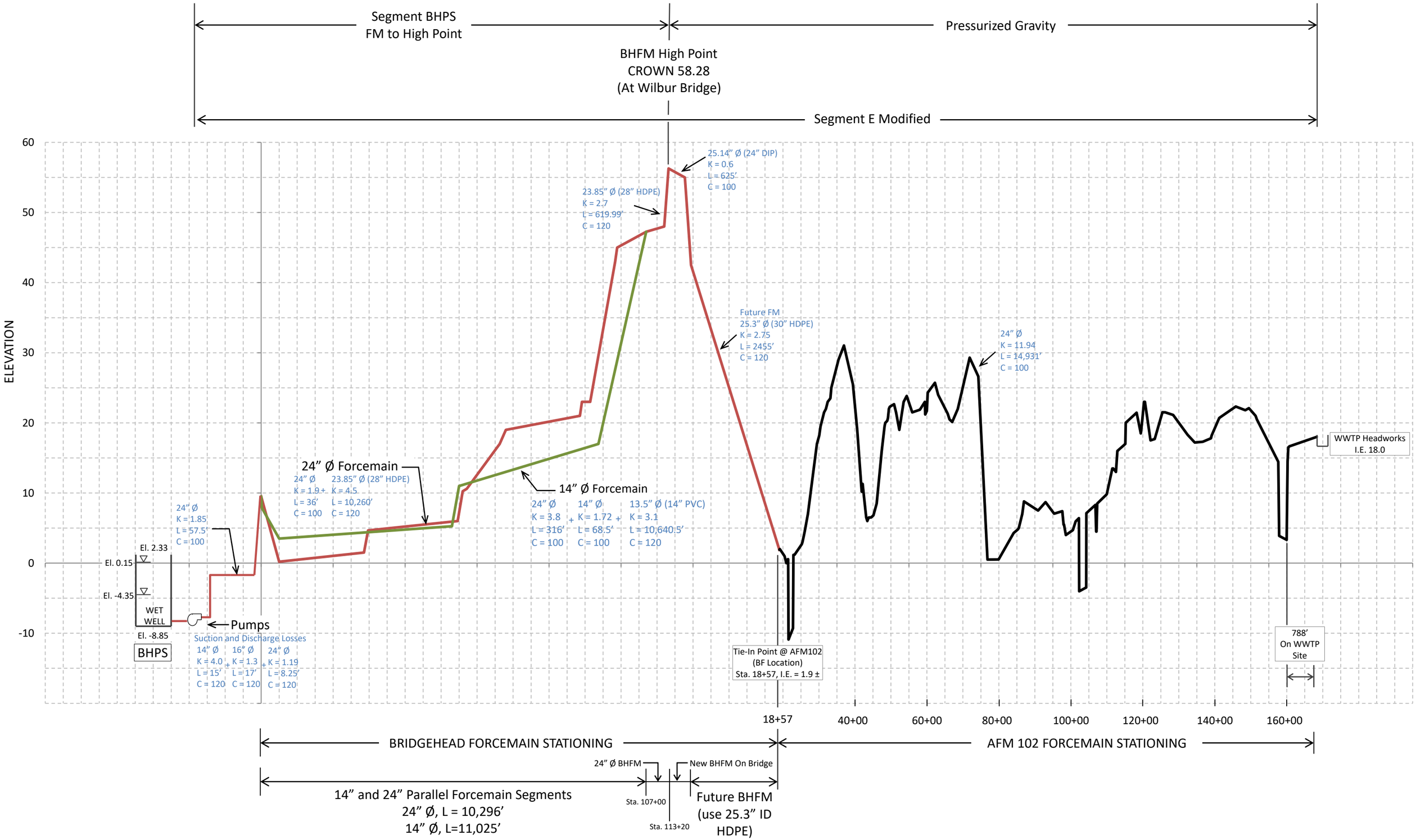


Figure 2.7. Bridgehead Pump Station with AFM102– Pump, System, and Suction & Discharge Loss Curves

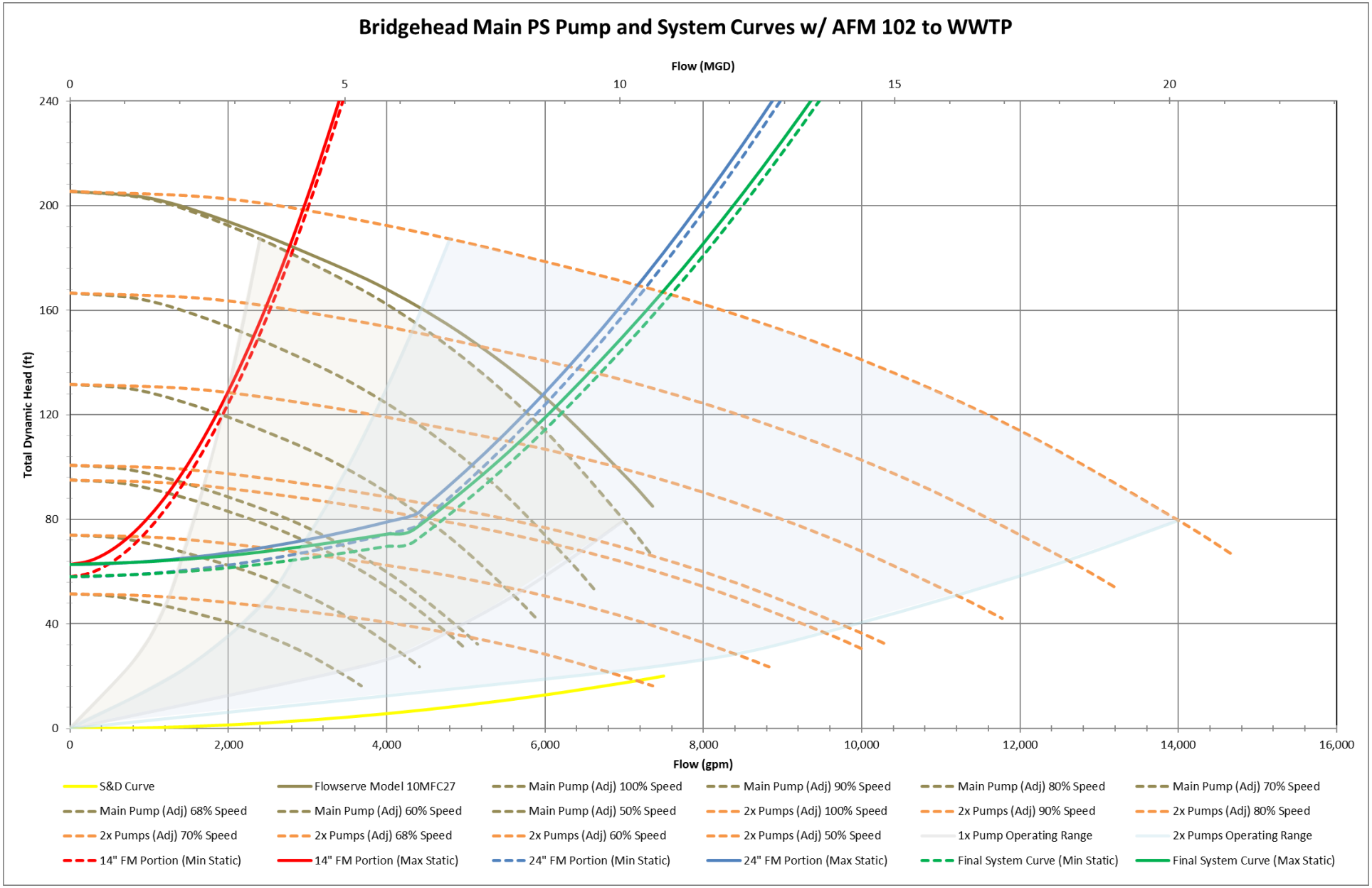


Figure 2.8. APS with Forcemain AFM 101 – System Curve Development (Segments A and B)

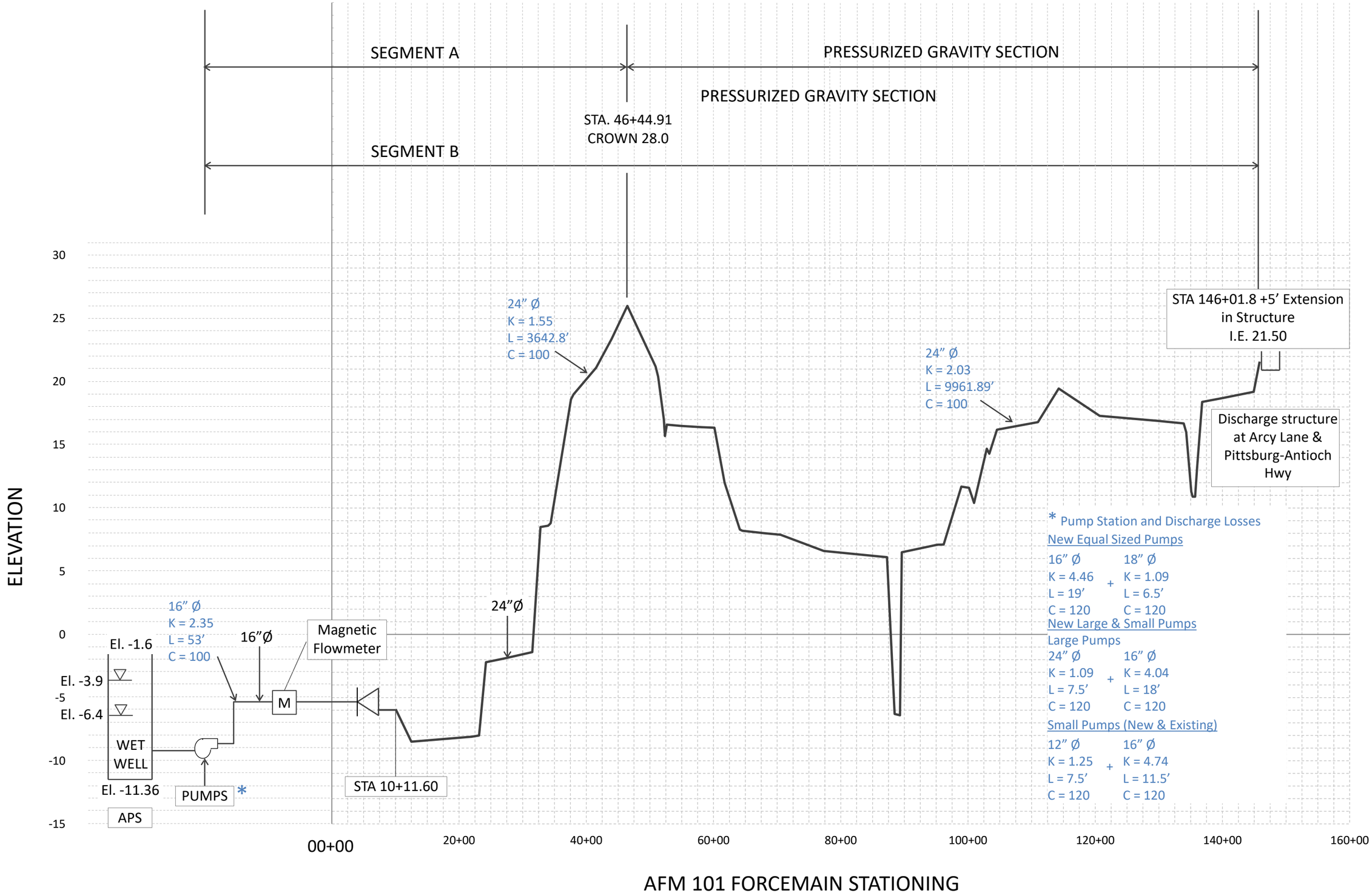


Figure 2.9. Antioch Pump Station with AFM101– Pump, System, and Suction & Discharge Loss Curves for New Large Pumps and Existing Small Pumps

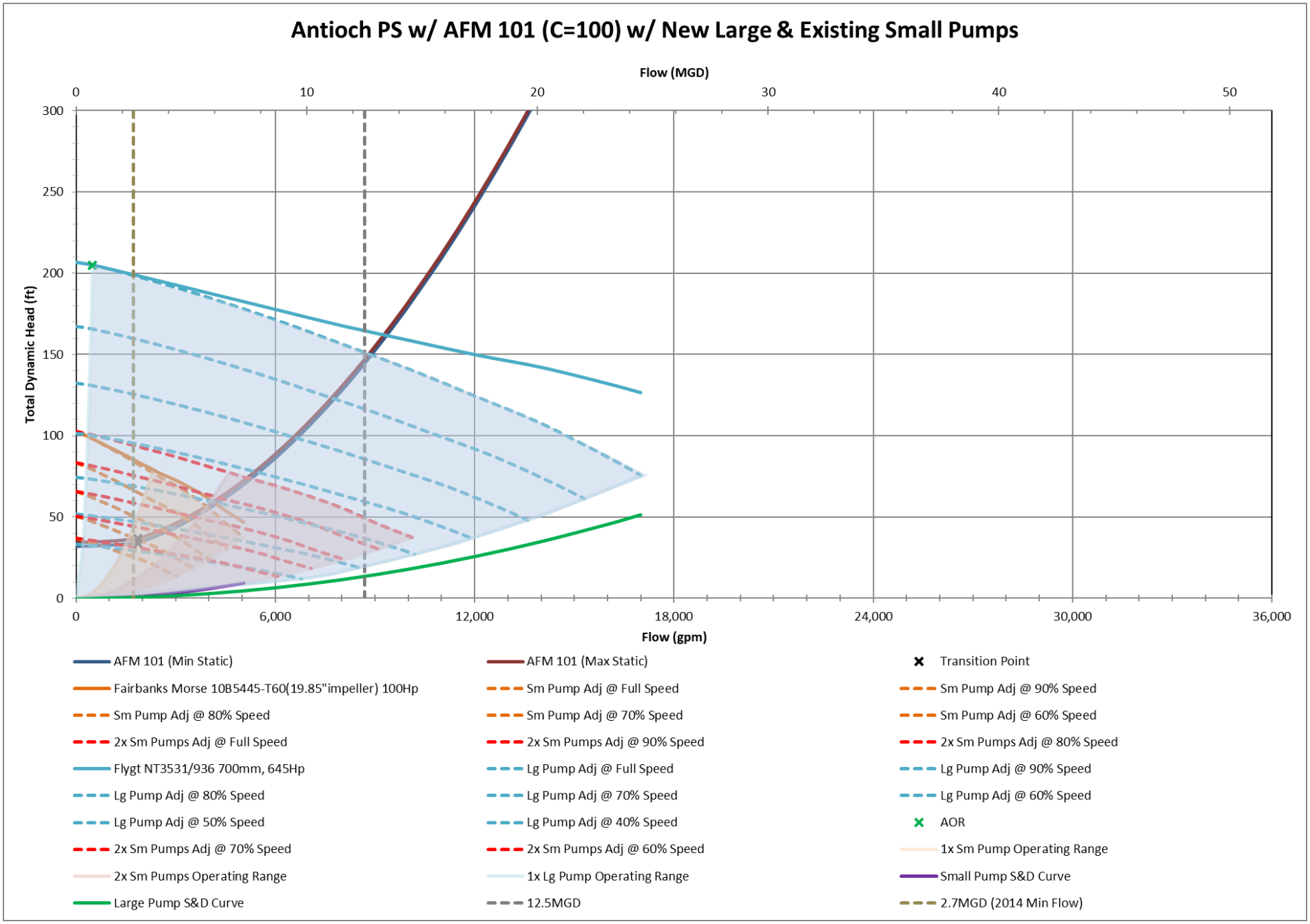


Figure 2.10. Antioch Pump Station with AFM101– Pump, System, and Suction & Discharge Loss Curves for New Large and New Small Pumps

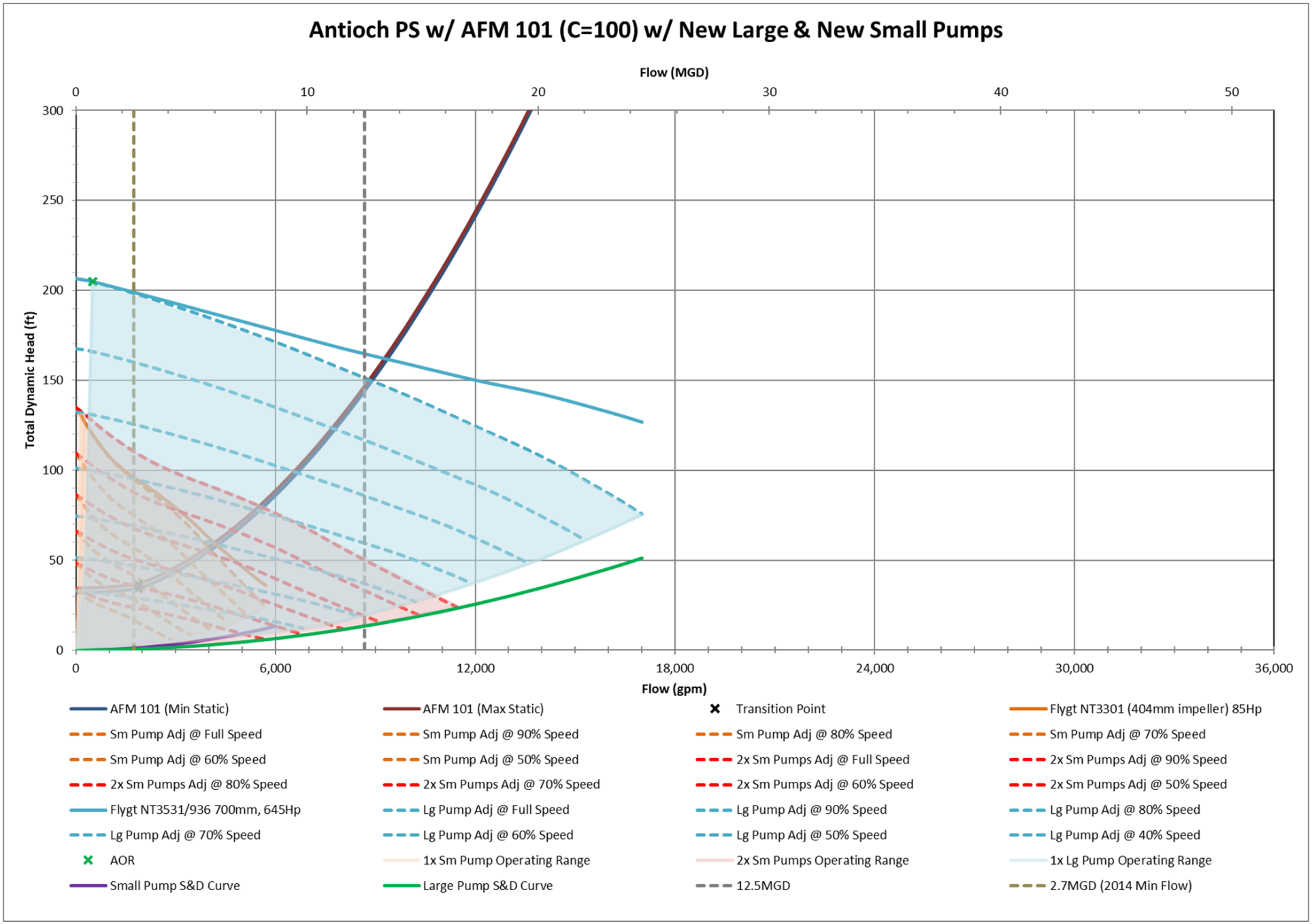
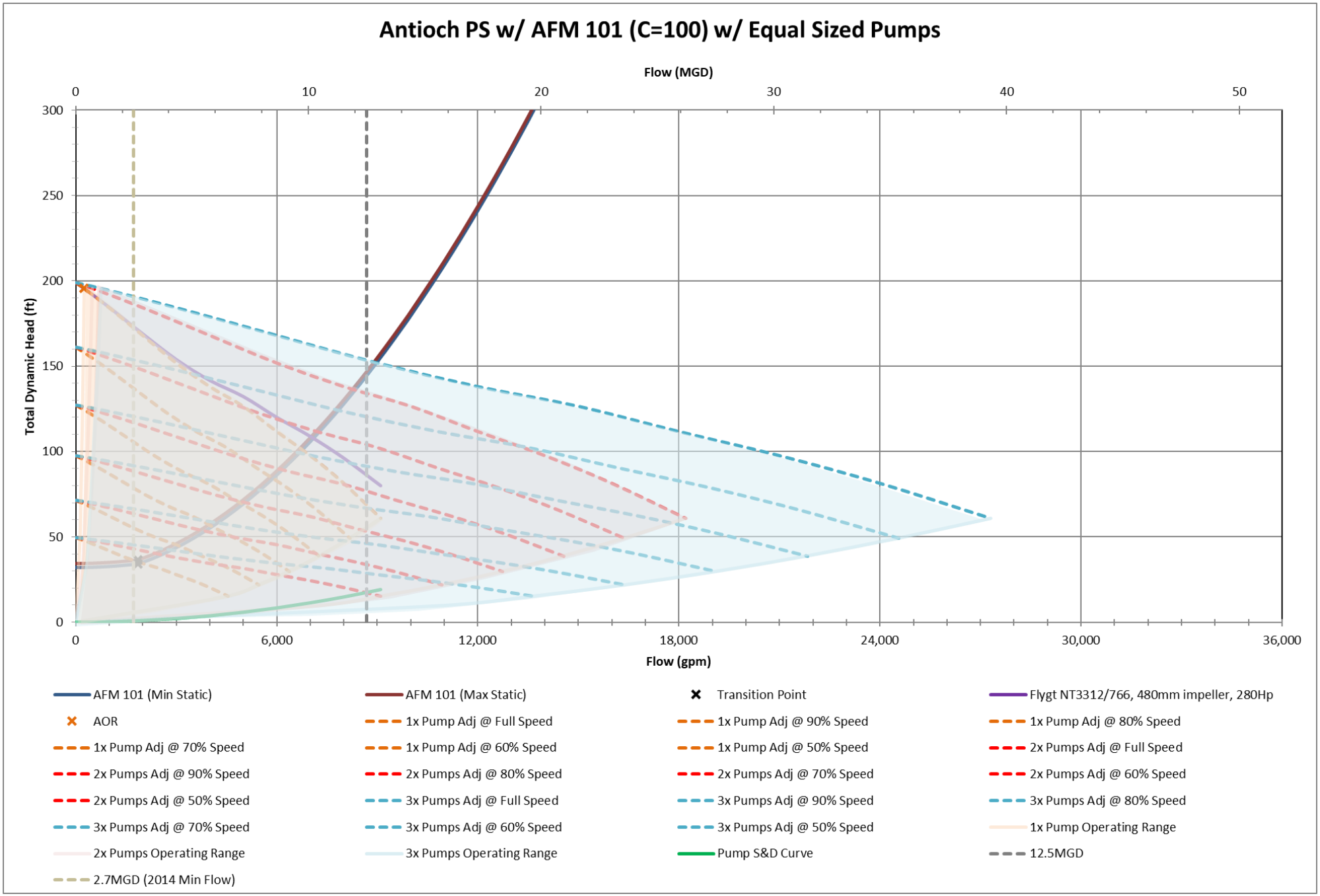
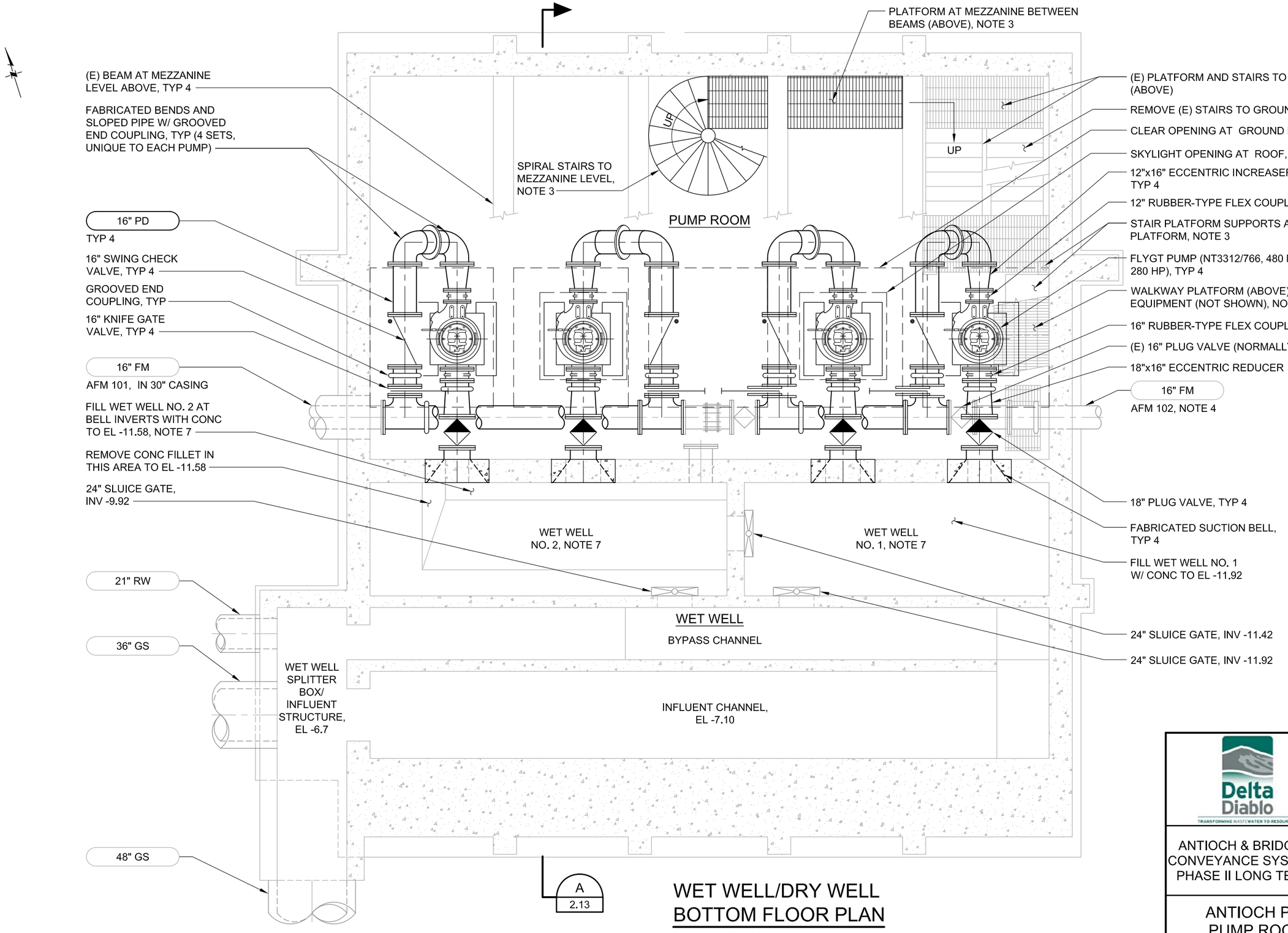


Figure 2.11. Antioch Pump Station with AFM101– Pump, System, and Suction & Discharge Loss Curves for New Equal Sized Pumps



NOTES:

1. FOR NOTES, SEE FIGURE 2.13.



WET WELL/DRY WELL BOTTOM FLOOR PLAN

SCALE: 3/16"=1'-0"

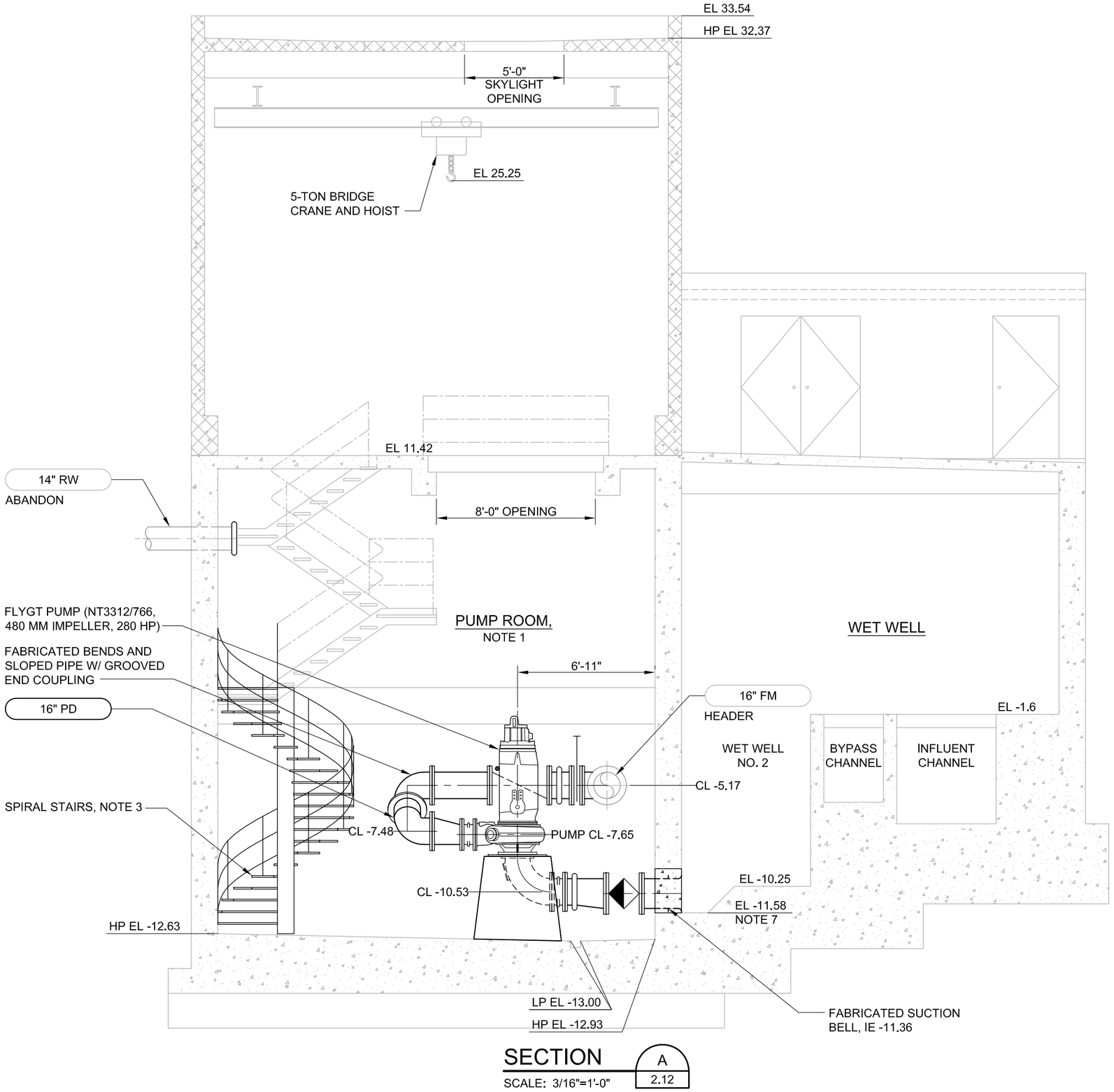
Delta Diablo
TRANSFORMING WASTEWATER TO RESOURCES

V.W. HOUSEN & ASSOCIATES

ANTIOCH & BRIDGEHEAD PUMP STATIONS AND CONVEYANCE SYSTEM IMPROVEMENTS PROJECT
PHASE II LONG TERM ALTERNATIVES ANALYSIS

ANTIOCH PUMP STATION
PUMP ROOM/WET WELL
LOWER LEVEL FLOOR PLAN

FIGURE NO.
2.12



SECTION A 2.12

SCALE: 3/16"=1'-0"

NOTES:

1. EXISTING SEWAGE PUMPS, ASSOCIATED PIPING, AND MOTOR ACCESS PLATFORMS WILL BE REMOVED TO ACCOMMODATE INSTALLATION OF NEW DRYPIT SUBMERSIBLE PUMPS AND PIPING.
2. A WALKWAY PLATFORM AND VENTILATION EQUIPMENT EXIST AT THE GROUND FLOOR LEVEL WITHIN THE APS WHICH PARTIALLY BLOCKS THE AREA OF THE CLEAR OPENING ABOVE THE EASTERN-MOST PUMP. DURING THE DESIGN PROCESS, THE PLATFORM AND VENTILATION EQUIPMENT CAN BE RE-DESIGNED/RE-LOCATED TO ALLOW CLEAR SPACE DIRECTLY ABOVE THE PUMP FOR INSTALLATION/REMOVAL, IF REQUIRED. THE PUMP MAY BE ABLE TO BE REMOVED WITH THE PLATFORM AND VENTILATION IN PLACE, IF THE PUMP IS SHIFTED WITH THE BRIDGE CRANE AS THE PUMP IS LIFTED.
3. THE STAIRS AT THE BOTTOM FLOOR SHALL BE REMOVED AND SUPPORT SYSTEM AND STAIR PLATFORM MODIFIED AS SHOWN TO ALLOW THE EASTERN-MOST PUMP AND ITS ASSOCIATED PIPING TO BE INSTALLED. DEMOLISH ADJACENT UNUSED CONCRETE PLATFORM. SPIRAL STAIRS SHALL BE PROVIDED FOR ACCESS TO LOWER LEVEL.
4. FORCEMAIN AFM 102 WILL NOT BE USED FOR APS AND THE VALVE TO FM 102 SHALL REMAIN CLOSED UNDER NORMAL OPERATION. AFM 102 WILL BE DEDICATED TO BHPS. HOWEVER, AFM 102 ON THE PS SITE WILL REMAIN PER DISTRICT REQUEST FOR ADDITIONAL FLEXIBILITY FOR USE IN AN EMERGENCY SITUATION TO ALLOW FLOW TO BE PUMPED FROM THE APS TO THE WWTP VIA AFM 102. NOTE: SUFFICIENT CAPACITY WILL NOT EXIST IN AFM102 FOR FLOWS FROM BOTH BHPS AND APS TO BE PUMPED TO THE WWTP IN THE FUTURE.
5. PIPE SUPPORTS NOT SHOWN.
6. NOT ALL ITEMS SHOWN FOR CLARITY. SOME ITEMS MAY REQUIRE RELOCATION DURING THE DESIGN PHASE.
7. DURING DESIGN PHASE, SURVEY WET WELLS TO DETERMINE PIPE INVERTS AND FLOOR ELEVATIONS. WET WELL NO. 2 IS LIKELY DEEPER THAN SHOWN.

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TRANSFORMING WASTEWATER TO RESOURCES

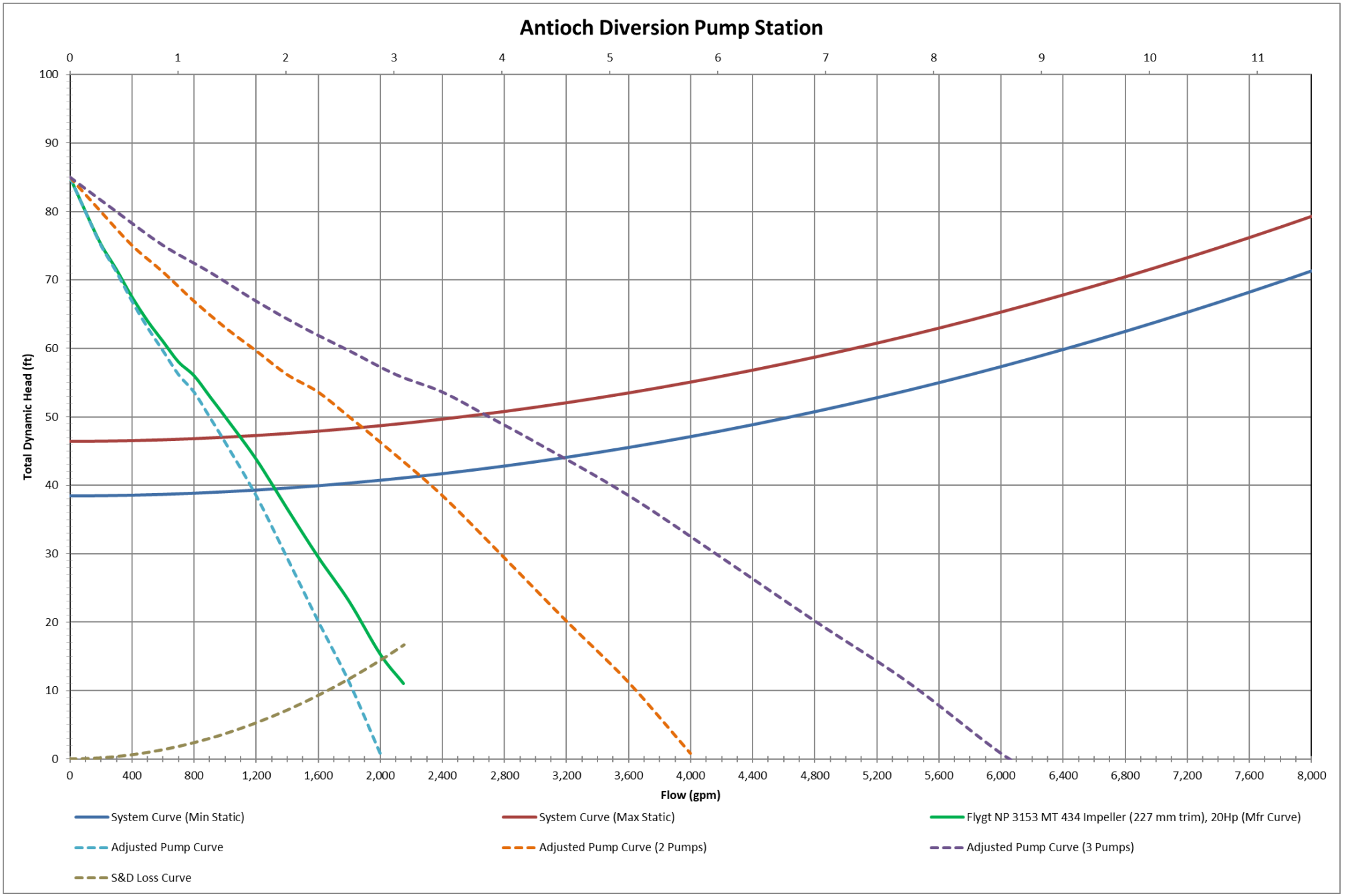
V.W. HOUSEN & ASSOCIATES

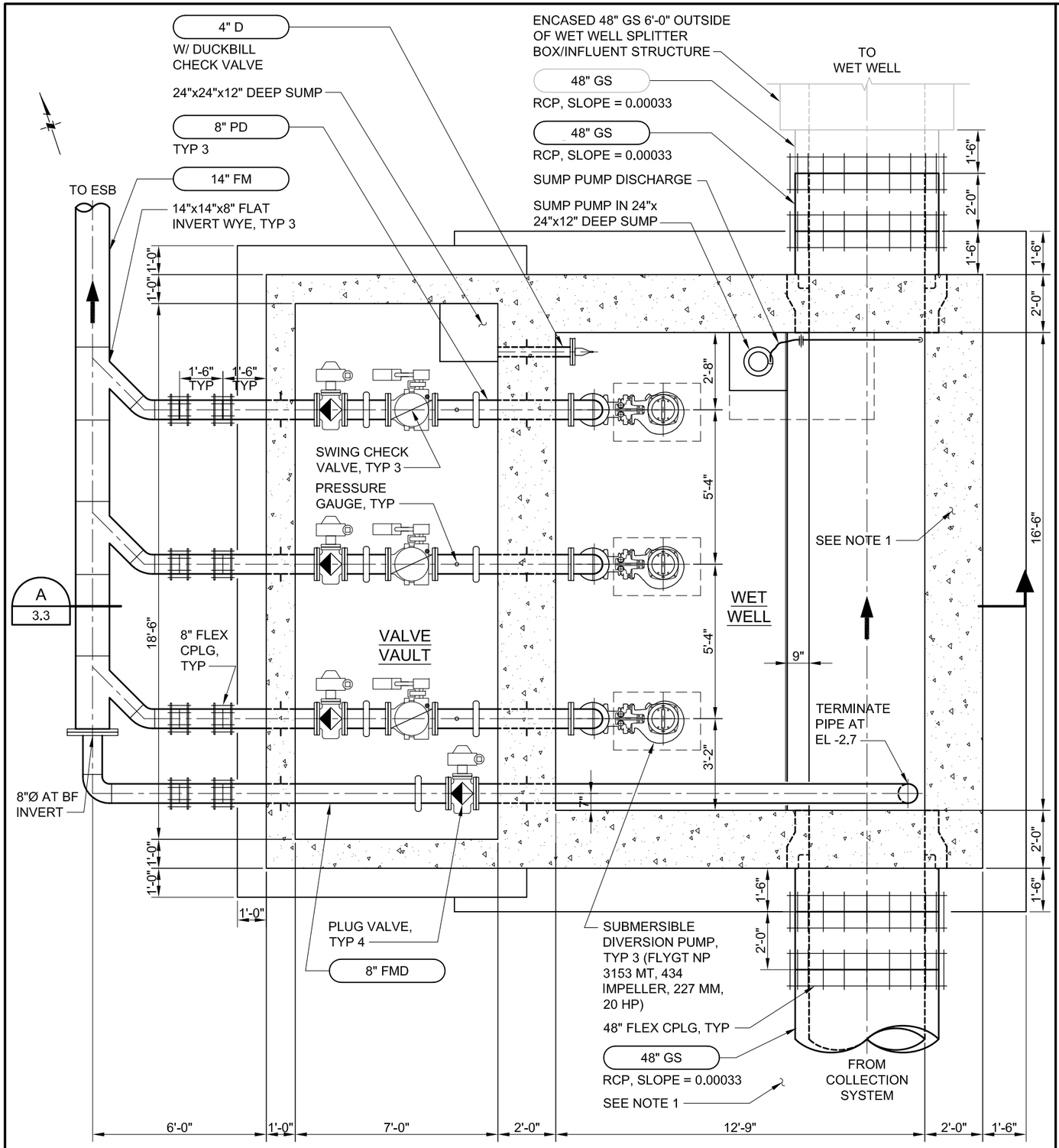
ANTIOCH & BRIDGEHEAD PUMP STATIONS AND CONVEYANCE SYSTEM IMPROVEMENTS PROJECT
PHASE II LONG TERM ALTERNATIVES ANALYSIS

ANTIOCH PUMP STATION
DRY WELL/WET WELL
SECTION

FIGURE NO.
2.13

Figure 3.1. Antioch Diversion Pump Station– Pump, System, and Suction & Discharge Loss Curves



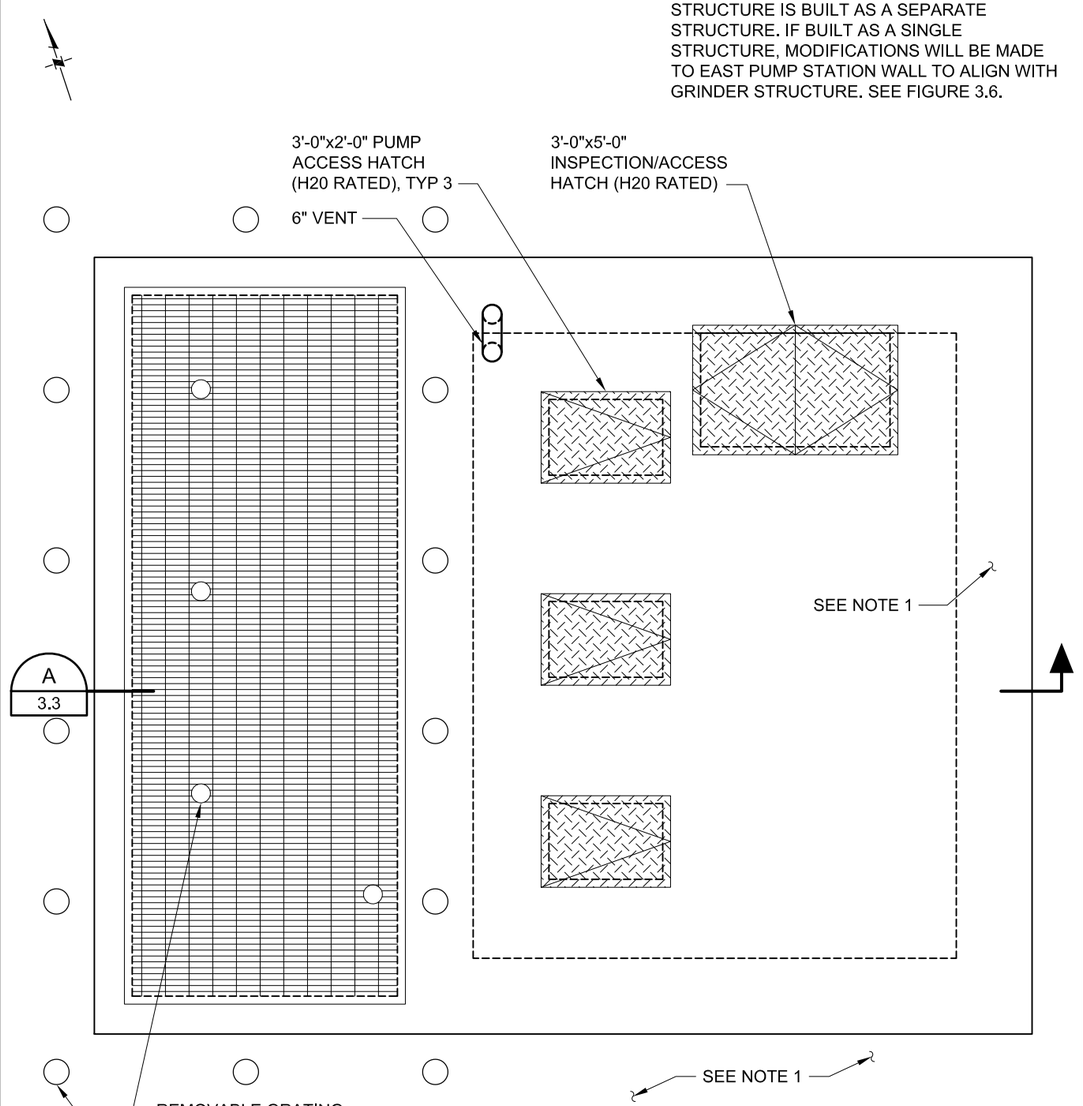


BOTTOM PLAN

SCALE: 1/4"=1'-0"

NOTES:

1. PLANS DEPICT DIVERSION PUMP STATION IN A SITUATION IN WHICH THE GRINDER STRUCTURE IS BUILT AS A SEPARATE STRUCTURE. IF BUILT AS A SINGLE STRUCTURE, MODIFICATIONS WILL BE MADE TO EAST PUMP STATION WALL TO ALIGN WITH GRINDER STRUCTURE. SEE FIGURE 3.6.



TOP PLAN

SCALE: 1/4"=1'-0"

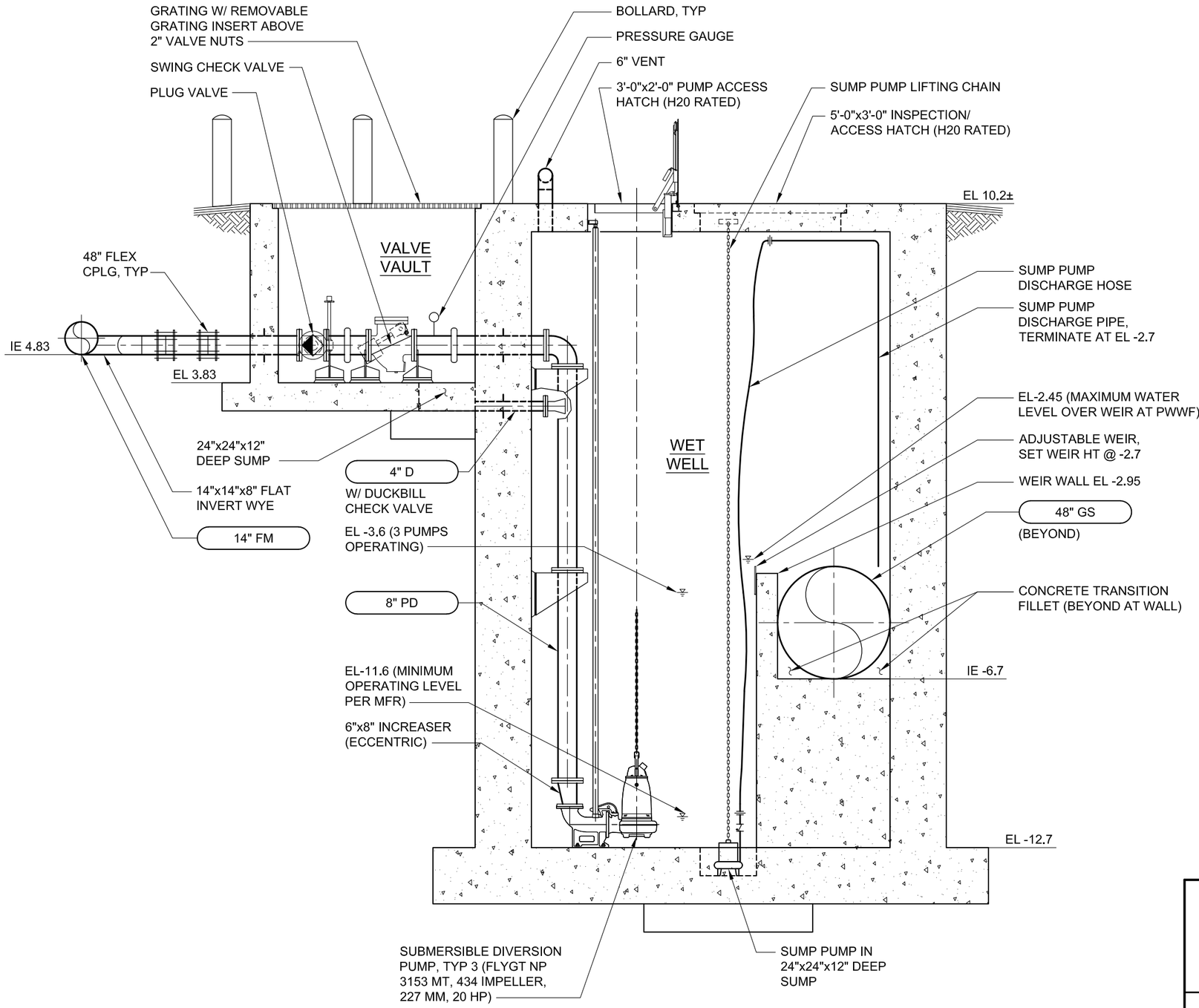
Delta Diablo
TRANSFORMING WASTEWATER TO RESOURCES

V.W. HOUSEN & ASSOCIATES

ANTIOCH & BRIDGEHEAD PUMP STATIONS AND CONVEYANCE SYSTEM IMPROVEMENTS PROJECT
PHASE II LONG TERM ALTERNATIVES ANALYSIS

ANTIOCH PUMP STATION
DIVERSION PUMP STATION
PLANS

FIGURE NO.
3.2



SECTION A 3.2

SCALE: 1/4"=1'-0"

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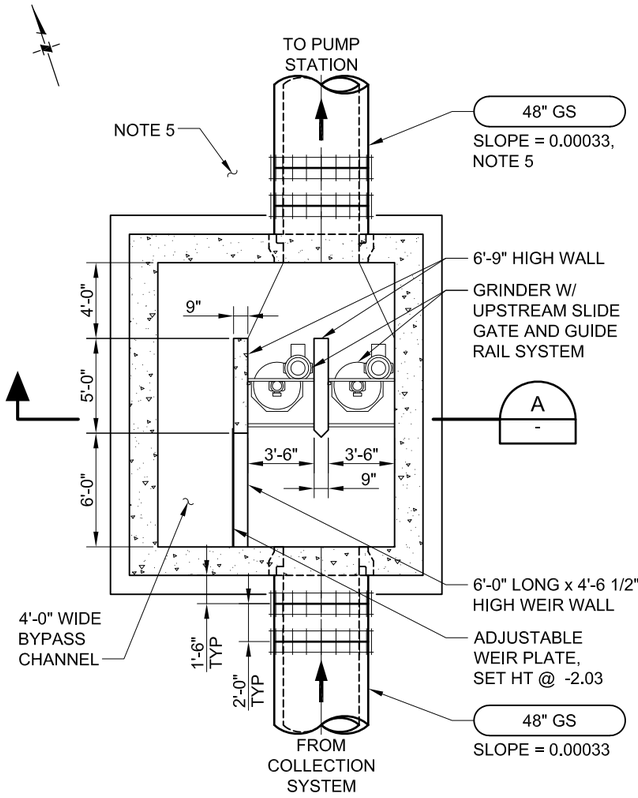
TRANSFORMING WASTEWATER TO RESOURCES

V.W. HOUSEN & ASSOCIATES

ANTIOCH & BRIDGEHEAD PUMP STATIONS AND CONVEYANCE SYSTEM IMPROVEMENTS PROJECT
PHASE II LONG TERM ALTERNATIVES ANALYSIS

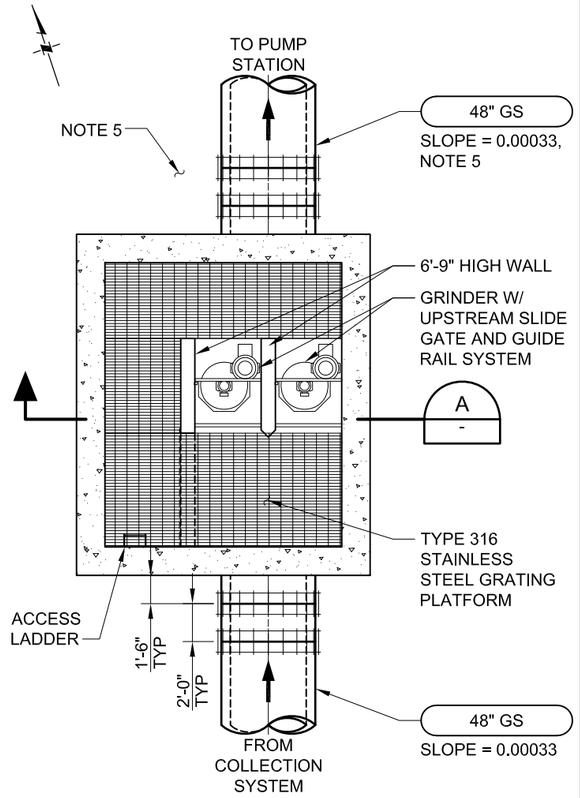
ANTIOCH PUMP STATION
DIVERSION PUMP STATION
SECTION

FIGURE NO.
3.3



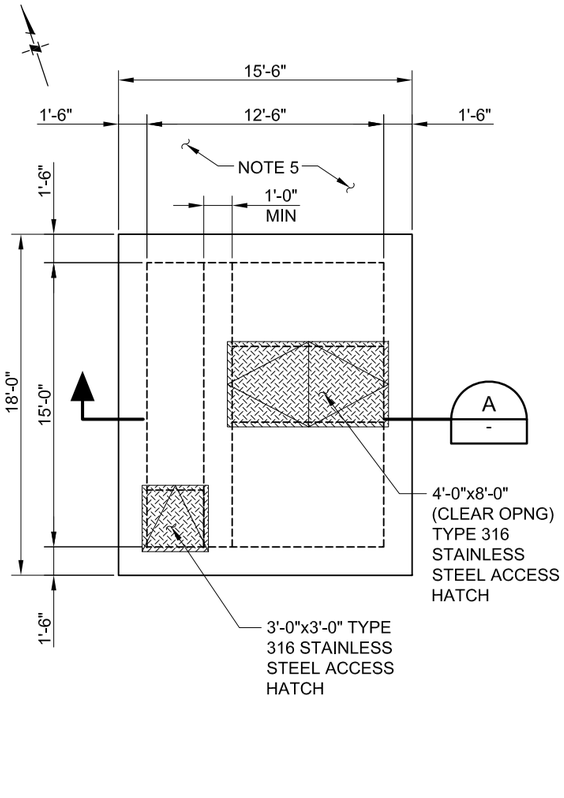
BOTTOM PLAN

SCALE: 1/8"=1'-0"



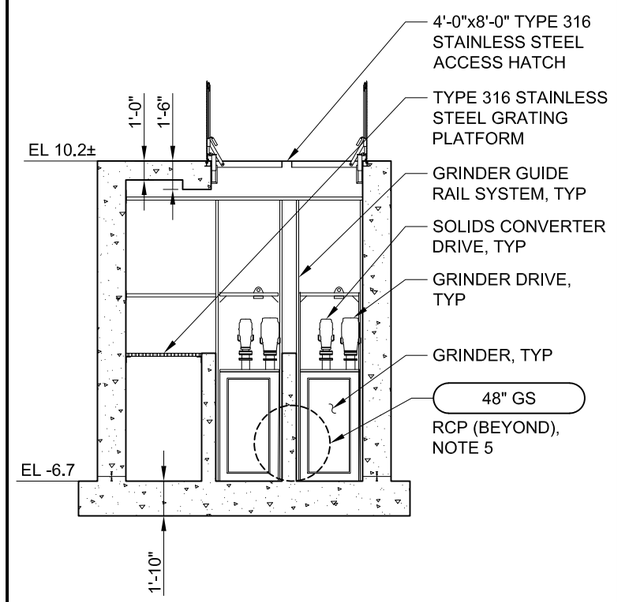
INTERMEDIATE PLAN

SCALE: 1/8"=1'-0"



TOP PLAN

SCALE: 1/8"=1'-0"



SECTION A

SCALE: 1/8"=1'-0"

NOTES:

1. FLOW/CAPACITY
   - A. GRINDER BOX PWWF = 14.3 MGD
   - B. GRINDER BOX PDWF = 10.3 MGD
   - C. EACH GRINDER HAS A CAPACITY OF 10.3 MGD
2. GRINDER INFORMATION
   - A. JWC CHANNEL MONSTER FLEX MODEL CFM6030-M2.0E
   - B. CHANNEL WIDTH (EACH) = 42 INCHES
   - C. WT (EACH) = 4,000 LBS
   - D. HORSEPOWER (EACH) = 5HP (GRINDER) +1HP (SOLIDS DIVERTER) = 6 HP
3. HYDRAULIC INFORMATION AT PDWF WITH 1 GRINDER OUT OF SERVICE
   - A. DOWNSTREAM WATER DEPTH (INCHES) = 31
   - B. GRINDER HEADLOSS (INCHES) = 6
   - C. UPSTREAM WATER DEPTH (INCHES) = 37
     (UPSTREAM SEWER NOT SURCHARGED ABOVE CROWN)
4. HYDRAULIC INFORMATION AT PWWF WHEN DIVERTING DOWNSTREAM (BOTH GRINDERS IN SERVICE)
   - A. DOWNSTREAM WATER DEPTH (INCHES) = 52
   - B. GRINDER HEADLOSS (INCHES) = 2.5
   - C. UPSTREAM WATER DEPTH (INCHES) = 54.5
     (SURCHARGE UPSTREAM SEWER BY 6.5 INCHES)
   - D. WEIR HEIGHT (INCHES) = 56
   - E. WATER ELEVATION OVER WEIR WITH BOTH GRINDERS OUT OF SERVICE (INCHES) = 13.0
     (69 INCHES ABOVE FLOOR)
     (SURCHARGE UPSTREAM SEWER BY 21.0 INCHES)
5. PLANS DEPICT GRINDER STRUCTURE BUILT AS A SEPARATE STRUCTURE FROM THE DIVERSION PUMP STATION. THEY MAY BE BUILT AS A COMBINED STRUCTURE WITH A COMMON WALL. SEE FIGURE 3.6.

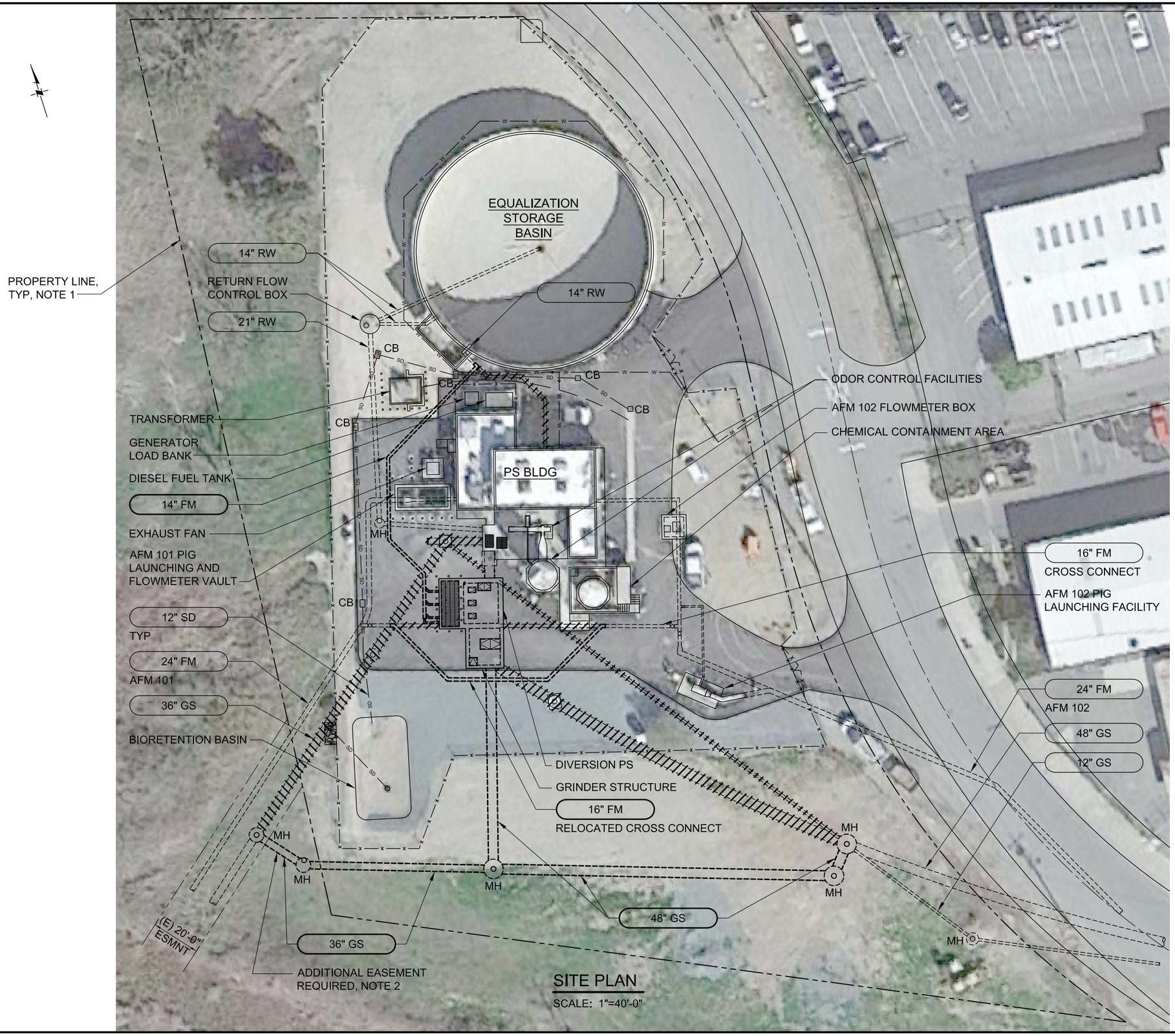
Delta Diablo
TRANSFORMING WASTEWATER TO RESOURCES

V.W. HOUSEN & ASSOCIATES

ANTIOCH & BRIDGEHEAD PUMP STATIONS AND CONVEYANCE SYSTEM IMPROVEMENTS PROJECT
PHASE II LONG TERM ALTERNATIVES ANALYSIS

ANTIOCH PUMP STATION
GRINDER STRUCTURE

FIGURE NO.
3.4



SITE PLAN

SCALE: 1"=40'-0"

NOTES:

1. THE SITE PLAN INFORMATION HEREIN IS DERIVED AS FOLLOWS:
   - 1.A. THE PHOTO BACKGROUND IS AN AERIAL IMAGES OBTAINED FROM GOOGLE MAPS IN JULY 2021. THE SCALE IS ESTIMATED.
   - 1.B. THE PROPERTY LINE IS DRAWN PER PROPERTY DEED INFORMATION . THE LOCATION IS ESTIMATED BASED ON PREVIOUS DRAWINGS AND AERIAL PHOTO INFORMATION.
   - 1.C. STRUCTURE AND PIPELINE SIZES ARE DRAWN PER PREVIOUS DRAWINGS. THE LOCATION AND ORIENTATION OF THESE STRUCTURES AND PIPELINES IS ESTIMATED FROM PREVOUS DRAWINGS AND AERIAL PHOTO INFORMATION.

2. A SURVEY SHALL BE COMPLETED TO DETERMINE PROPERTY LINE AND EASEMENT LOCATIONS, EXISTING STRUCTURE LOCATIONS AND ORIENTATIONS, MANHOLE LOCATIONS AND INVERTS, ABOVE GRADE UTILITIES, SURFACE FEATURES, AND TOPOGRAPHIC INFORMATION IN ORDER TO SUPPORT DESIGN ACTIVITIES.

3. THIS DRAWING RELECTS THE FOLLOWING SITUATIONS:
   A) BOTH THE DIVERSION PUMP STATION AND THE GRINDER STRUCTURE ARE BUILT AT THE SAME TIME UTILIZING A COMMON WALL.
   B) THE DIVERSION PUMP STATION IS BUILT SOON AND THE GRINDER STRUCTURE IS BUILT AT A LATER TIME (IF REQUIRED), BUT BOTH STRUCTURES STILL SHARE A COMMON WALL. IN THIS CASE, THE DIVERSION PUMP STATION WOULD BE BUILT WITH STARTER WALLS AND SLAB FOR FUTURE GRINDER STRUCTURE EXPANSION.

4. **PRIOR TO PROCEEDING WITH DESIGN AND/OR CONSTRUCTION OF THE DIVERSION PUMP STATION OR GRINDER STRUCTURE, DISTRICT SHALL CONFIRM THAT HYDRAULIC IMPACTS OF THESE FACILITIES WILL NOT RESULT IN UPSTREAM COLLECTION SYSTEM OVERFLOWS DURING BUILDOUT PWWF CONDITIONS.**

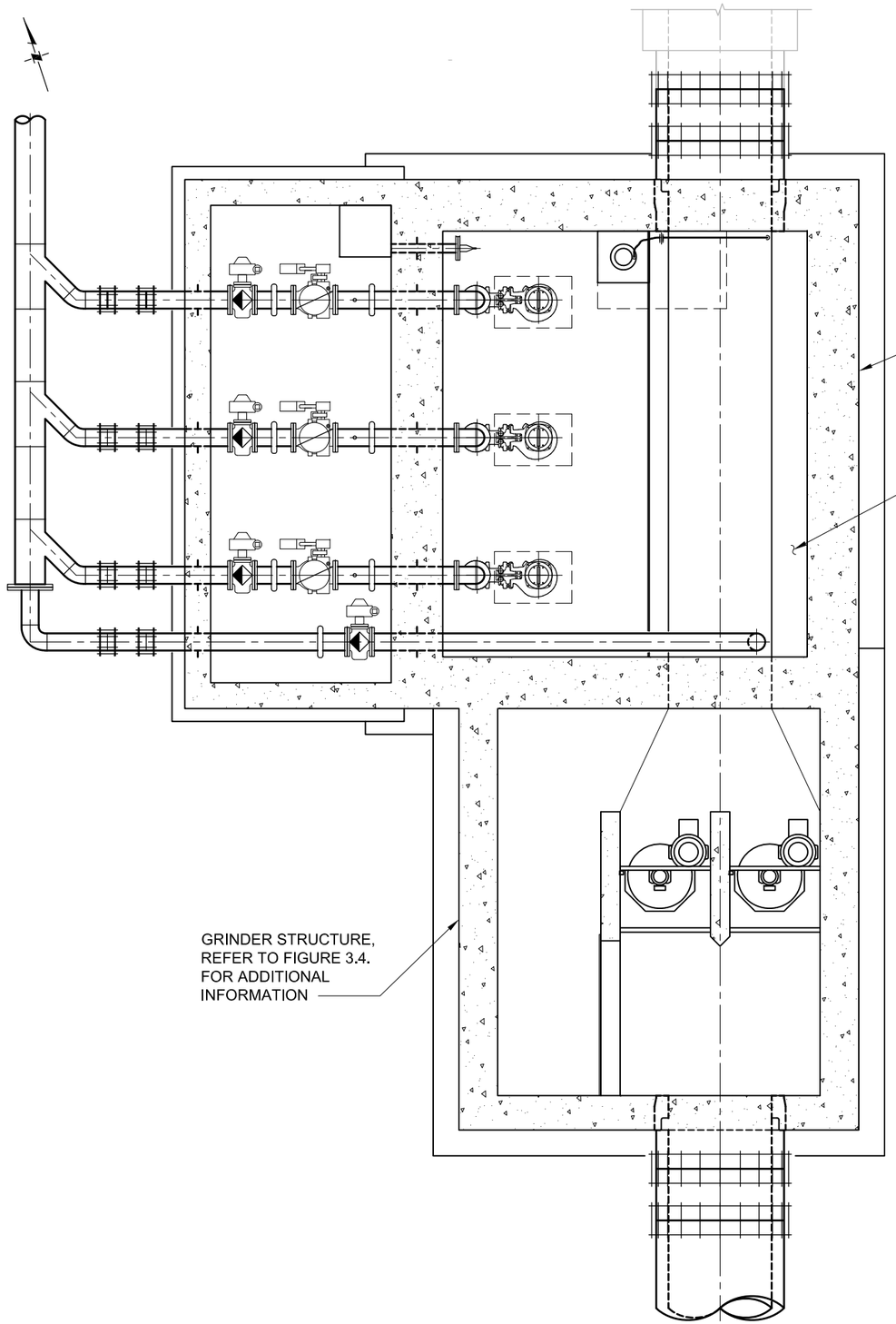
Delta Diablo
TRANSFORMING WASTEWATER TO RESOURCES

V.W. HOUSEN & ASSOCIATES

ANTIOCH & BRIDGEHEAD PUMP STATIONS AND CONVEYANCE SYSTEM IMPROVEMENTS PROJECT
PHASE II LONG TERM ALTERNATIVES ANALYSIS

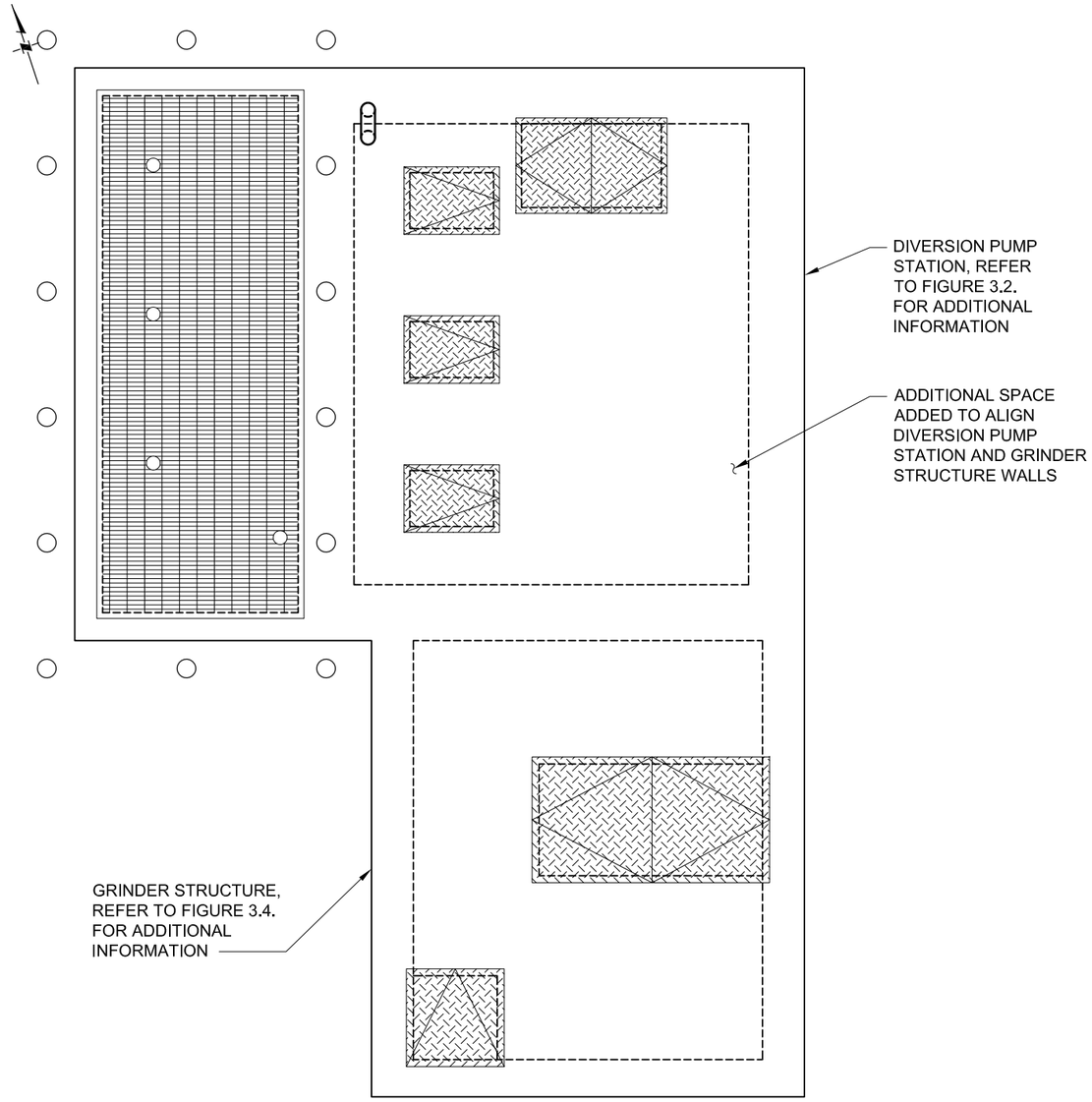
ANTIOCH PUMP STATION
SITE PLAN W/ COMBINED DIVERSION PS AND GRINDER STRUCTURE

FIGURE NO.
3.5



BOTTOM PLAN

SCALE: 3/16"=1'-0"



TOP PLAN

SCALE: 3/16"=1'-0"

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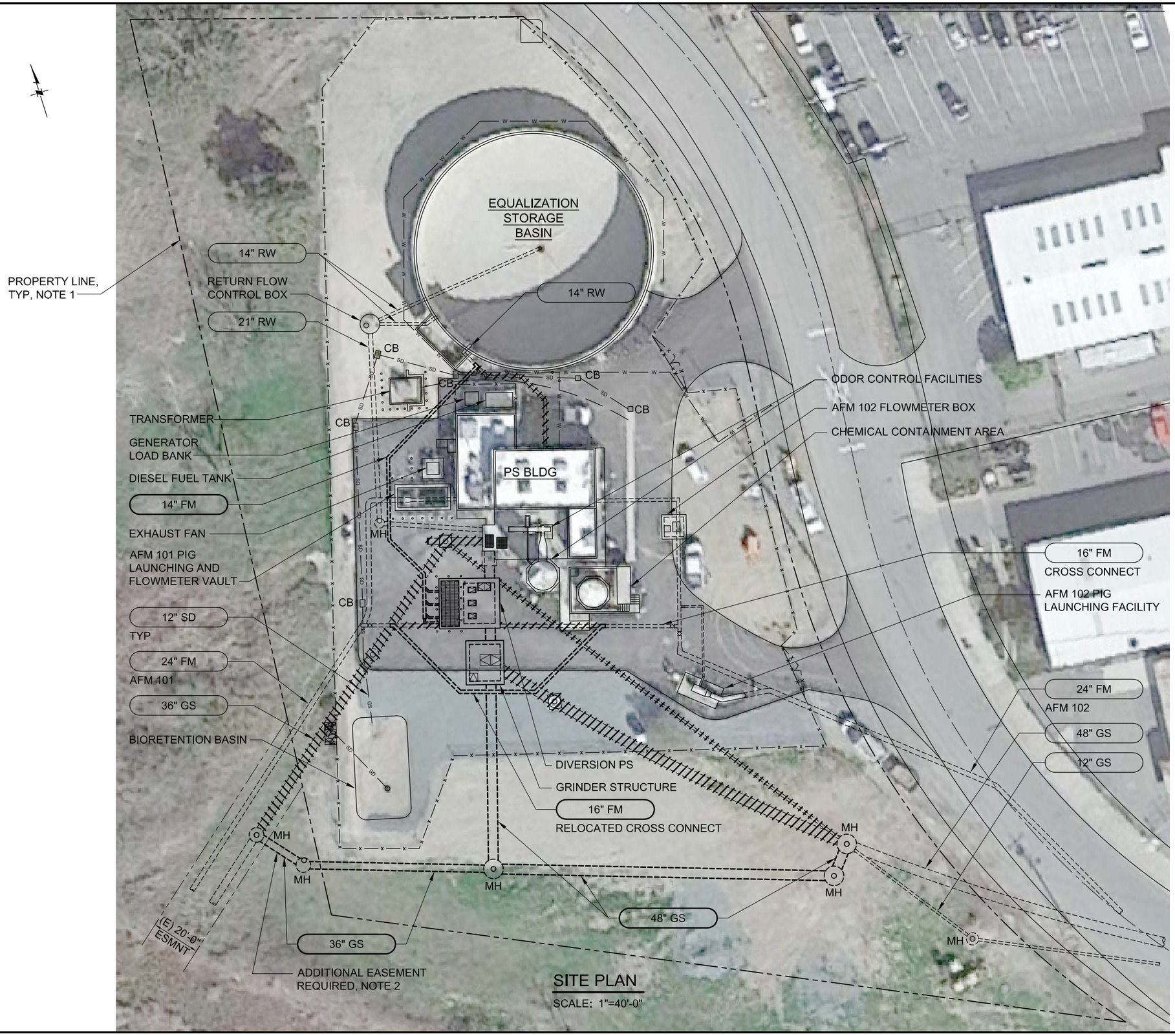
PHASE II LONG TERM ALTERNATIVES ANALYSIS

ANTIOCH PUMP STATION
COMBINED DIVERSION PS AND GRINDER STRUCTURE - PLANS

FIGURE NO.
3.6



SITE PLAN

SCALE: 1"=40'-0"

NOTES:

1. THE SITE PLAN INFORMATION HEREIN IS DERIVED AS FOLLOWS:
   - 1.A. THE PHOTO BACKGROUND IS AN AERIAL IMAGES OBTAINED FROM GOOGLE MAPS IN JULY 2021. THE SCALE IS ESTIMATED.
   - 1.B. THE PROPERTY LINE IS DRAWN PER PROPERTY DEED INFORMATION . THE LOCATION IS ESTIMATED BASED ON PREVIOUS DRAWINGS AND AERIAL PHOTO INFORMATION.
   - 1.C. STRUCTURE AND PIPELINE SIZES ARE DRAWN PER PREVIOUS DRAWINGS. THE LOCATION AND ORIENTATION OF THESE STRUCTURES AND PIPELINES IS ESTIMATED FROM PREVOUS DRAWINGS AND AERIAL PHOTO INFORMATION.
2. A SURVEY SHALL BE COMPLETED TO DETERMINE PROPERTY LINE AND EASEMENT LOCATIONS, EXISTING STRUCTURE LOCATIONS AND ORIENTATIONS, MANHOLE LOCATIONS AND INVERTS, ABOVE GRADE UTILITIES, SURFACE FEATURES, AND TOPOGRAPHIC INFORMATION IN ORDER TO SUPPORT DESIGN ACTIVITIES.
3. THIS DRAWING RELECTS THE SITUATION IN WHICH THE TWO DISTINCT STRUCTURES ARE BUILT SEPARATELY WITH THE DIVERSION PUMP STATION BEING BUILT SOON AND THE GRINDER STRUCTURE BUILT AT A LATER TIME (IF REQUIRED). IN THIS CASE, THE DESIGN MUST ACCOMMODATE DIFFERENTIAL SETTLEMENT OF THE TWO STRUCTURES.
4. **PRIOR TO PROCEEDING WITH DESIGN AND/OR CONSTRUCTION OF THE DIVERSION PUMP STATION OR GRINDER STRUCTURE, DISTRICT SHALL CONFIRM THAT HYDRAULIC IMPACTS OF THESE FACILITIES WILL NOT RESULT IN UPSTREAM COLLECTION SYSTEM OVERFLOWS DURING BUILDOUT PWWF CONDITIONS.**

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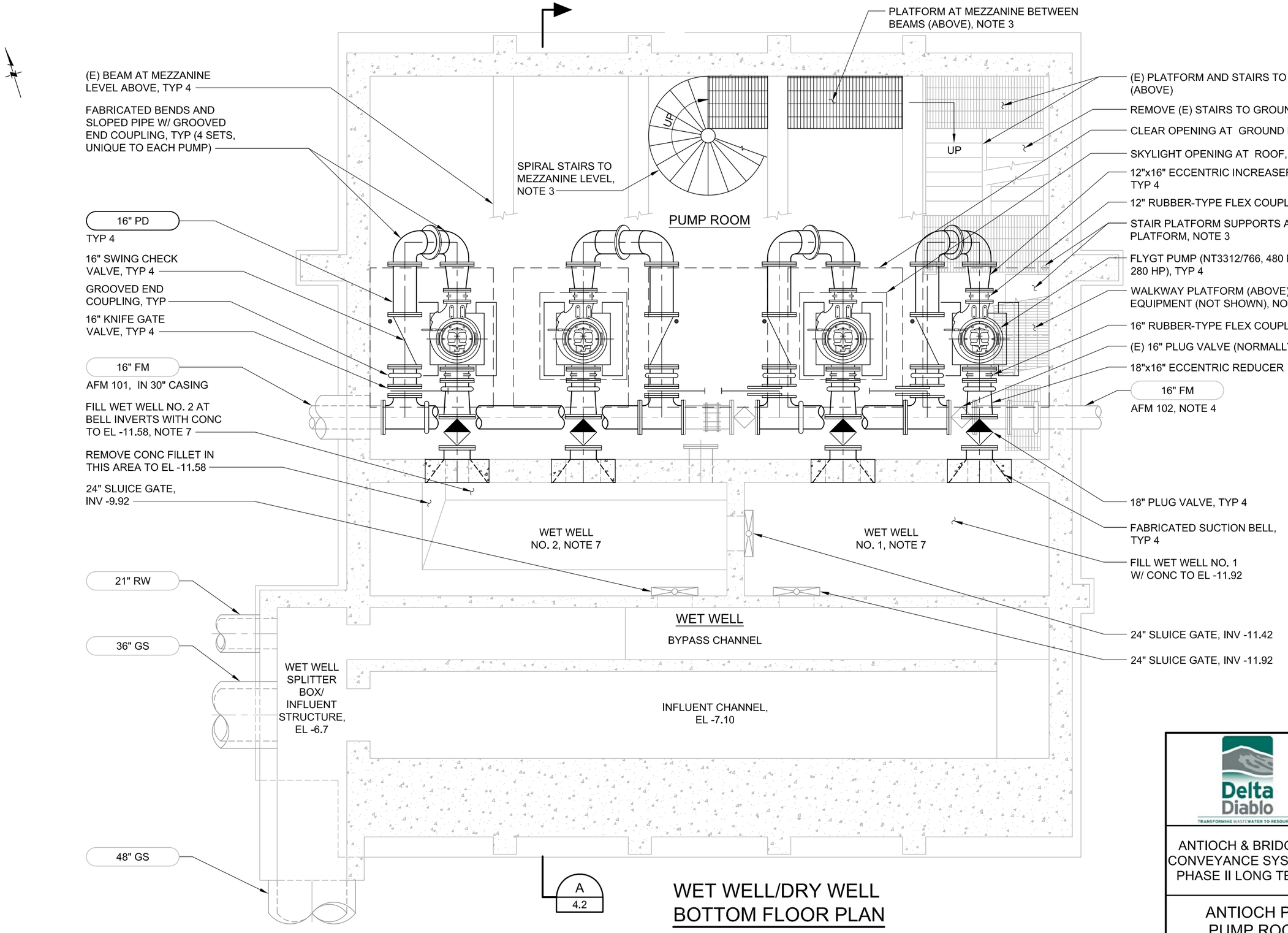
ANTIOCH & BRIDGEHEAD PUMP STATIONS AND CONVEYANCE SYSTEM IMPROVEMENTS PROJECT
PHASE II LONG TERM ALTERNATIVES ANALYSIS

ANTIOCH PUMP STATION
SITE PLAN W/ SEPARATE DIVERSION PS AND GRINDER STRUCTURE

FIGURE NO.
3.7

NOTES:

1. FOR NOTES, SEE FIGURE 4.2.



WET WELL/DRY WELL BOTTOM FLOOR PLAN

SCALE: 3/16"=1'-0"

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TRANSFORMING WASTEWATER TO RESOURCES

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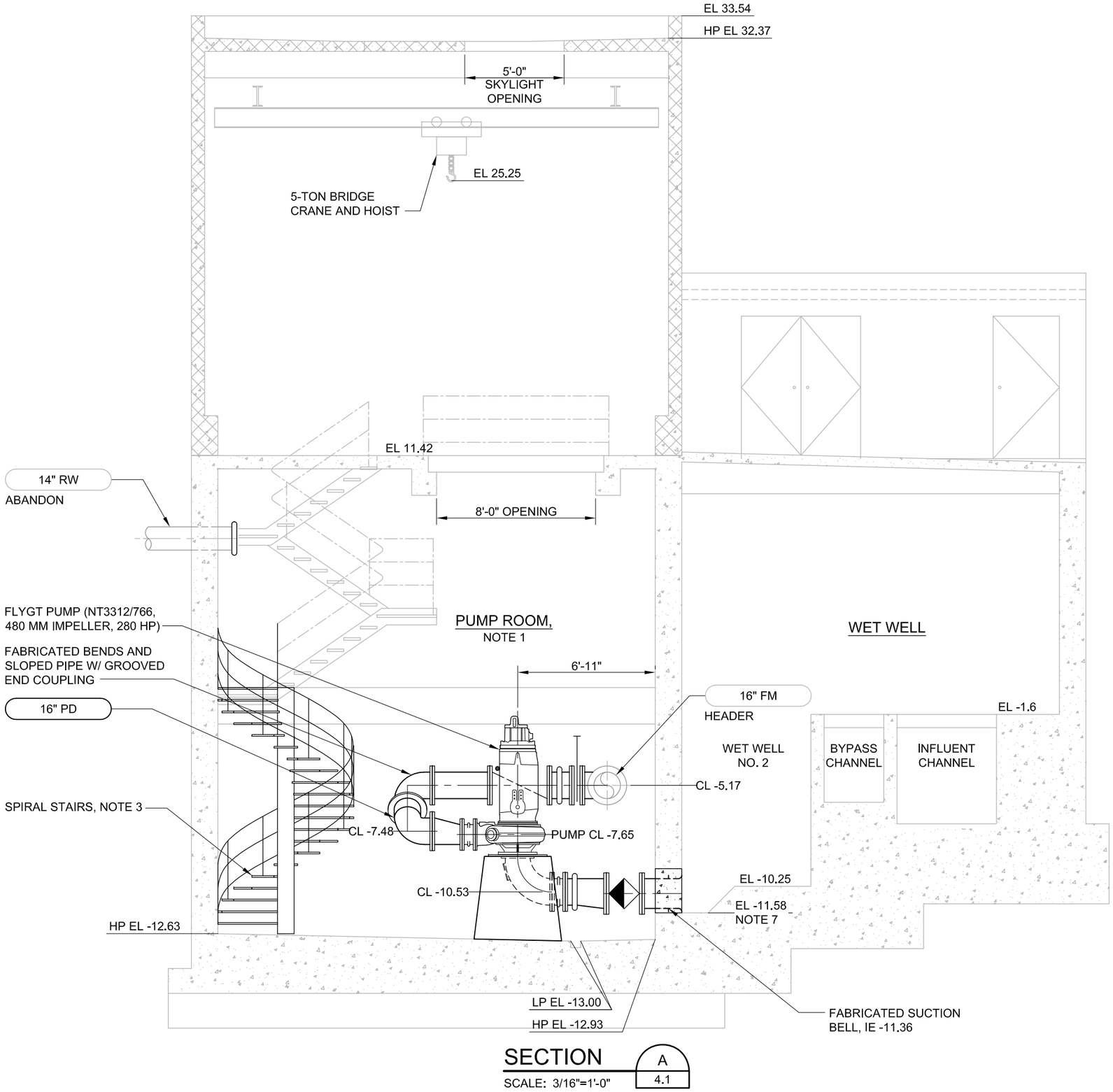
ANTIOCH & BRIDGEHEAD PUMP STATIONS AND CONVEYANCE SYSTEM IMPROVEMENTS PROJECT
PHASE II LONG TERM ALTERNATIVES ANALYSIS

ANTIOCH PUMP STATION
PUMP ROOM/WET WELL
LOWER LEVEL FLOOR PLAN

FIGURE NO.
4.1



SECTION A 4.1

SCALE: 3/16"=1'-0"

NOTES:

1. EXISTING SEWAGE PUMPS, ASSOCIATED PIPING, AND MOTOR ACCESS PLATFORMS WILL BE REMOVED TO ACCOMMODATE INSTALLATION OF NEW DRYPIT SUBMERSIBLE PUMPS AND PIPING.
2. A WALKWAY PLATFORM AND VENTILATION EQUIPMENT EXIST AT THE GROUND FLOOR LEVEL WITHIN THE APS WHICH PARTIALLY BLOCKS THE AREA OF THE CLEAR OPENING ABOVE THE EASTERN-MOST PUMP. DURING THE DESIGN PROCESS, THE PLATFORM AND VENTILATION EQUIPMENT CAN BE RE-DESIGNED/RE-LOCATED TO ALLOW CLEAR SPACE DIRECTLY ABOVE THE PUMP FOR INSTALLATION/REMOVAL, IF REQUIRED. THE PUMP MAY BE ABLE TO BE REMOVED WITH THE PLATFORM AND VENTILATION IN PLACE, IF THE PUMP IS SHIFTED WITH THE BRIDGE CRANE AS THE PUMP IS LIFTED.
3. THE STAIRS AT THE BOTTOM FLOOR SHALL BE REMOVED AND SUPPORT SYSTEM AND STAIR PLATFORM MODIFIED AS SHOWN TO ALLOW THE EASTERN-MOST PUMP AND ITS ASSOCIATED PIPING TO BE INSTALLED. DEMOLISH ADJACENT UNUSED CONCRETE PLATFORM. SPIRAL STAIRS SHALL BE PROVIDED FOR ACCESS TO LOWER LEVEL.
4. FORCEMAIN AFM 102 WILL NOT BE USED FOR APS AND THE VALVE TO FM 102 SHALL REMAIN CLOSED UNDER NORMAL OPERATION. AFM 102 WILL BE DEDICATED TO BHPS. HOWEVER, AFM 102 ON THE PS SITE WILL REMAIN PER DISTRICT REQUEST FOR ADDITIONAL FLEXIBILITY FOR USE IN AN EMERGENCY SITUATION TO ALLOW FLOW TO BE PUMPED FROM THE APS TO THE WWTP VIA AFM 102. NOTE: SUFFICIENT CAPACITY WILL NOT EXIST IN AFM102 FOR FLOWS FROM BOTH BHPS AND APS TO BE PUMPED TO THE WWTP IN THE FUTURE.
5. PIPE SUPPORTS NOT SHOWN.
6. NOT ALL ITEMS SHOWN FOR CLARITY. SOME ITEMS MAY REQUIRE RELOCATION DURING THE DESIGN PHASE.
7. DURING DESIGN PHASE, SURVEY WET WELLS TO DETERMINE PIPE INVERTS AND FLOOR ELEVATIONS. WET WELL NO. 2 IS LIKELY DEEPER THAN SHOWN.

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TRANSFORMING WASTEWATER TO RESOURCES

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ANTIOCH & BRIDGEHEAD PUMP STATIONS AND CONVEYANCE SYSTEM IMPROVEMENTS PROJECT
PHASE II LONG TERM ALTERNATIVES ANALYSIS

ANTIOCH PUMP STATION
DRY WELL/WET WELL
SECTION

FIGURE NO.
4.2

SITE PLAN

SCALE: 1"=40'-0"

NOTES:

1. THE SITE PLAN INFORMATION HEREIN IS DERIVED AS FOLLOWS:
   - 1.A. THE PHOTO BACKGROUND IS AN AERIAL IMAGES OBTAINED FROM GOOGLE MAPS IN JULY 2021. THE SCALE IS ESTIMATED.
   - 1.B. THE PROPERTY LINE IS DRAWN PER PROPERTY DEED INFORMATION . THE LOCATION IS ESTIMATED BASED ON PREVIOUS DRAWINGS AND AERIAL PHOTO INFORMATION.
   - 1.C. STRUCTURE AND PIPELINE SIZES ARE DRAWN PER PREVIOUS DRAWINGS. THE LOCATION AND ORIENTATION OF THESE STRUCTURES AND PIPELINES IS ESTIMATED FROM PREVOUS DRAWINGS AND AERIAL PHOTO INFORMATION.
2. A SURVEY SHALL BE COMPLETED TO DETERMINE PROPERTY LINE AND EASEMENT LOCATIONS, EXISTING STRUCTURE LOCATIONS AND ORIENTATIONS, MANHOLE LOCATIONS AND INVERTS, ABOVE GRADE UTILITIES, SURFACE FEATURES, AND TOPOGRAPHIC INFORMATION IN ORDER TO SUPPORT DESIGN ACTIVITIES.

Delta Diablo
TRANSFORMING WASTEWATER TO RESOURCES

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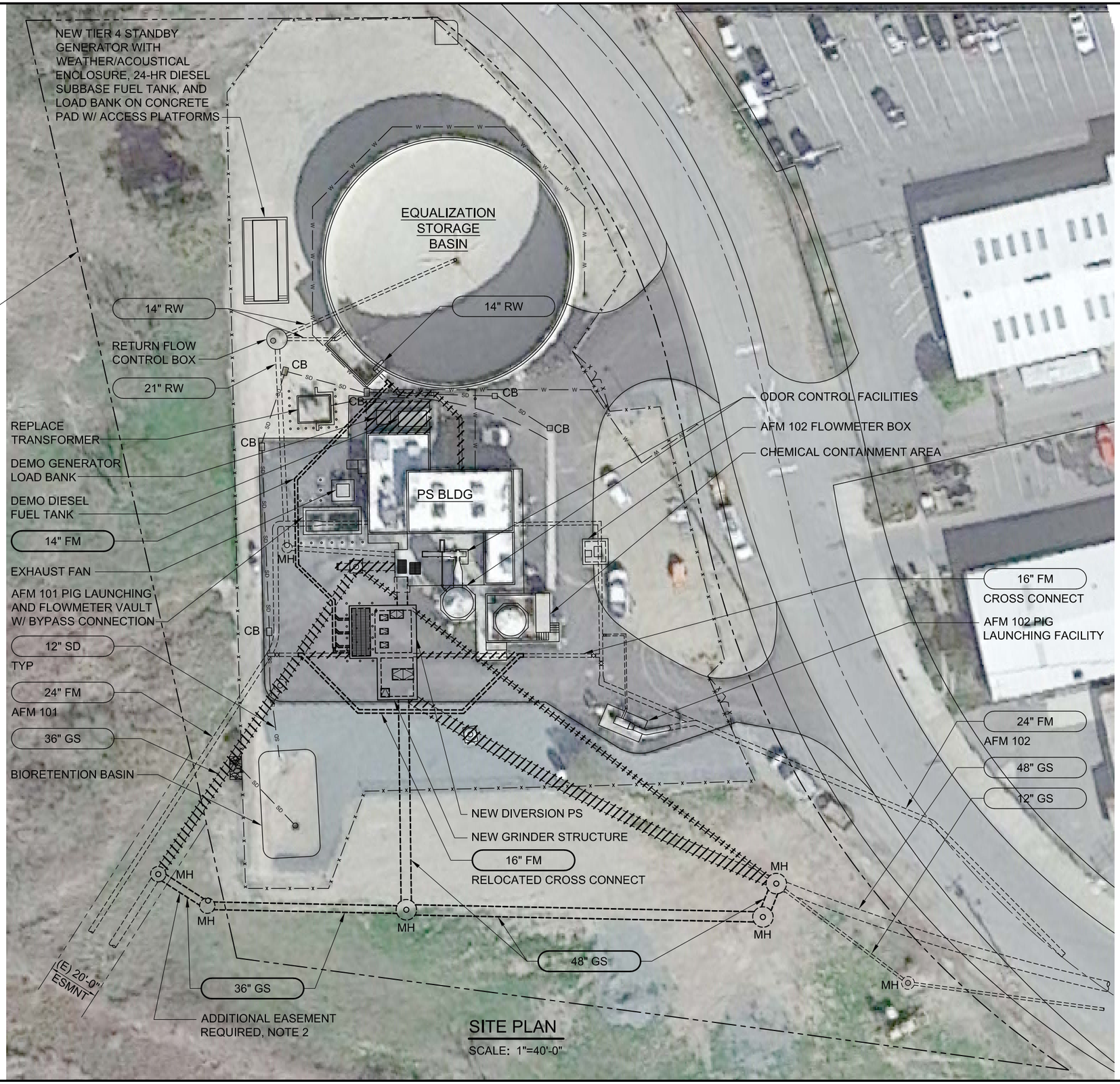
ANTIOCH & BRIDGEHEAD PUMP STATIONS AND CONVEYANCE SYSTEM IMPROVEMENTS PROJECT
PHASE II LONG TERM ALTERNATIVES ANALYSIS

ANTIOCH PUMP STATION
EXISTING SITE PLAN

FIGURE NO.
4.3



SITE PLAN

SCALE: 1"=40'-0"

NOTES:

1. THE SITE PLAN INFORMATION HEREIN IS DERIVED AS FOLLOWS:
   - 1.A. THE PHOTO BACKGROUND IS AN AERIAL IMAGES OBTAINED FROM GOOGLE MAPS IN JULY 2021. THE SCALE IS ESTIMATED.
   - 1.B. THE PROPERTY LINE IS DRAWN PER PROPERTY DEED INFORMATION . THE LOCATION IS ESTIMATED BASED ON PREVIOUS DRAWINGS AND AERIAL PHOTO INFORMATION.
   - 1.C. STRUCTURE AND PIPELINE SIZES ARE DRAWN PER PREVIOUS DRAWINGS. THE LOCATION AND ORIENTATION OF THESE STRUCTURES AND PIPELINES IS ESTIMATED FROM PREVOUS DRAWINGS AND AERIAL PHOTO INFORMATION.
2. A SURVEY SHALL BE COMPLETED TO DETERMINE PROPERTY LINE AND EASEMENT LOCATIONS, EXISTING STRUCTURE LOCATIONS AND ORIENTATIONS, MANHOLE LOCATIONS AND INVERTS, ABOVE GRADE UTILITIES, SURFACE FEATURES, AND TOPOGRAPHIC INFORMATION IN ORDER TO SUPPORT DESIGN ACTIVITIES.
3. THIS DRAWING RELECTS THE FOLLOWING SITUATIONS:
   A) BOTH THE DIVERSION PUMP STATION AND THE GRINDER STRUCTURE ARE BUILT AT THE SAME TIME UTILIZING A COMMON WALL.
   B) THE DIVERSION PUMP STATION IS BUILT SOON AND THE GRINDER STRUCTURE IS BUILT AT A LATER TIME (IF REQUIRED), BUT BOTH STRUCTURES STILL SHARE A COMMON WALL. IN THIS CASE, THE DIVERSION PUMP STATION WOULD BE BUILT WITH STARTER WALLS AND SLAB FOR FUTURE GRINDER STRUCTURE EXPANSION.
4. **PRIOR TO PROCEEDING WITH DESIGN AND/OR CONSTRUCTION OF THE DIVERSION PUMP STATION OR GRINDER STRUCTURE, DISTRICT SHALL CONFIRM THAT HYDRAULIC IMPACTS OF THESE FACILITIES WILL NOT RESULT IN UPSTREAM COLLECTION SYSTEM OVERFLOWS DURING BUILDOUT PWWF CONDITIONS.**
5. SURGE PROTECTION FACILITIES NOT SHOWN. SURGE ANALYSIS SHALL BE PERFORMED AND SURGE PROTECTION FACILITIES DESIGNED AND INSTALLED.

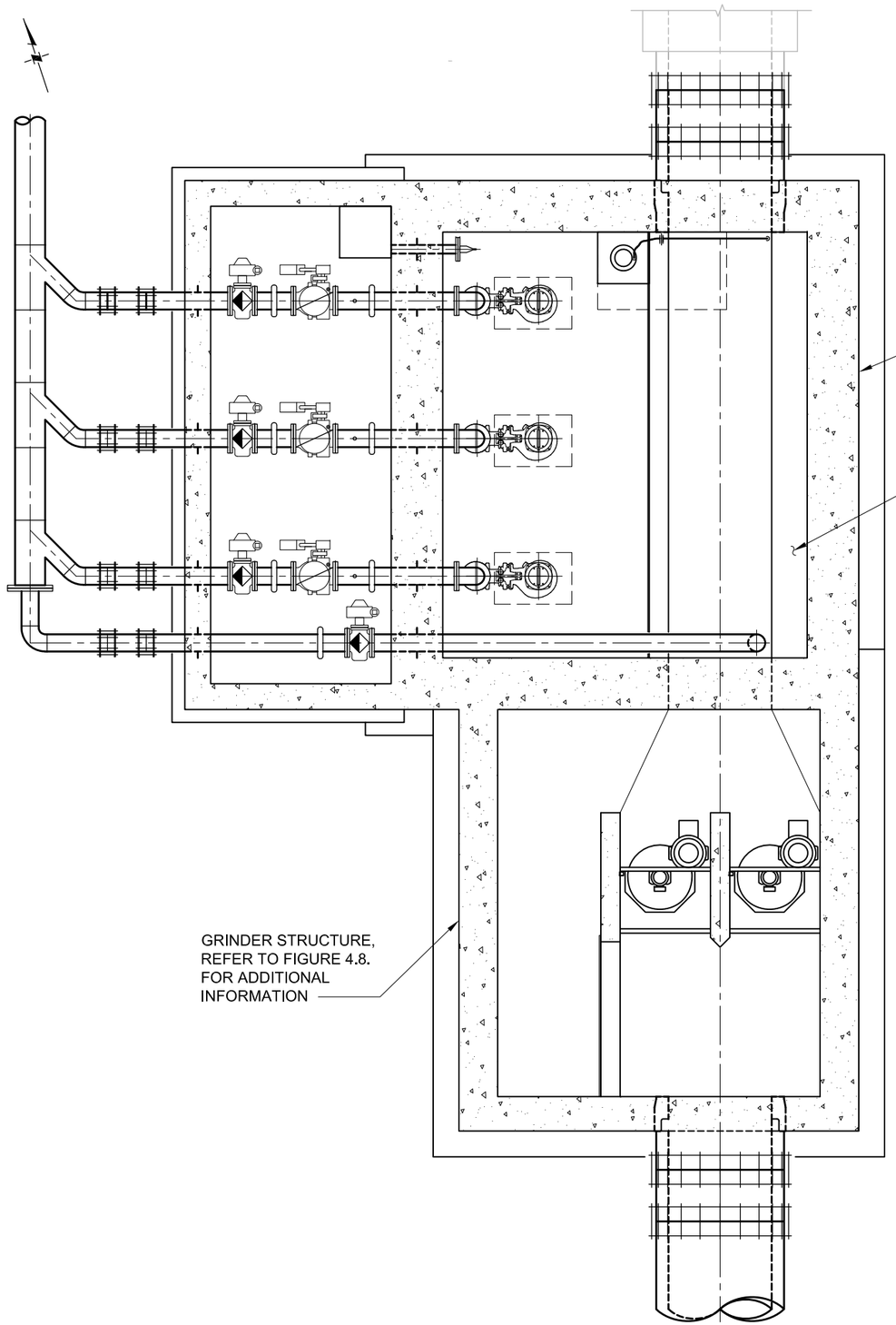
Delta Diablo
TRANSFORMING WASTEWATER TO RESOURCES

V.W. HOUSEN & ASSOCIATES

ANTIOCH & BRIDGEHEAD PUMP STATIONS AND CONVEYANCE SYSTEM IMPROVEMENTS PROJECT
PHASE II LONG TERM ALTERNATIVES ANALYSIS

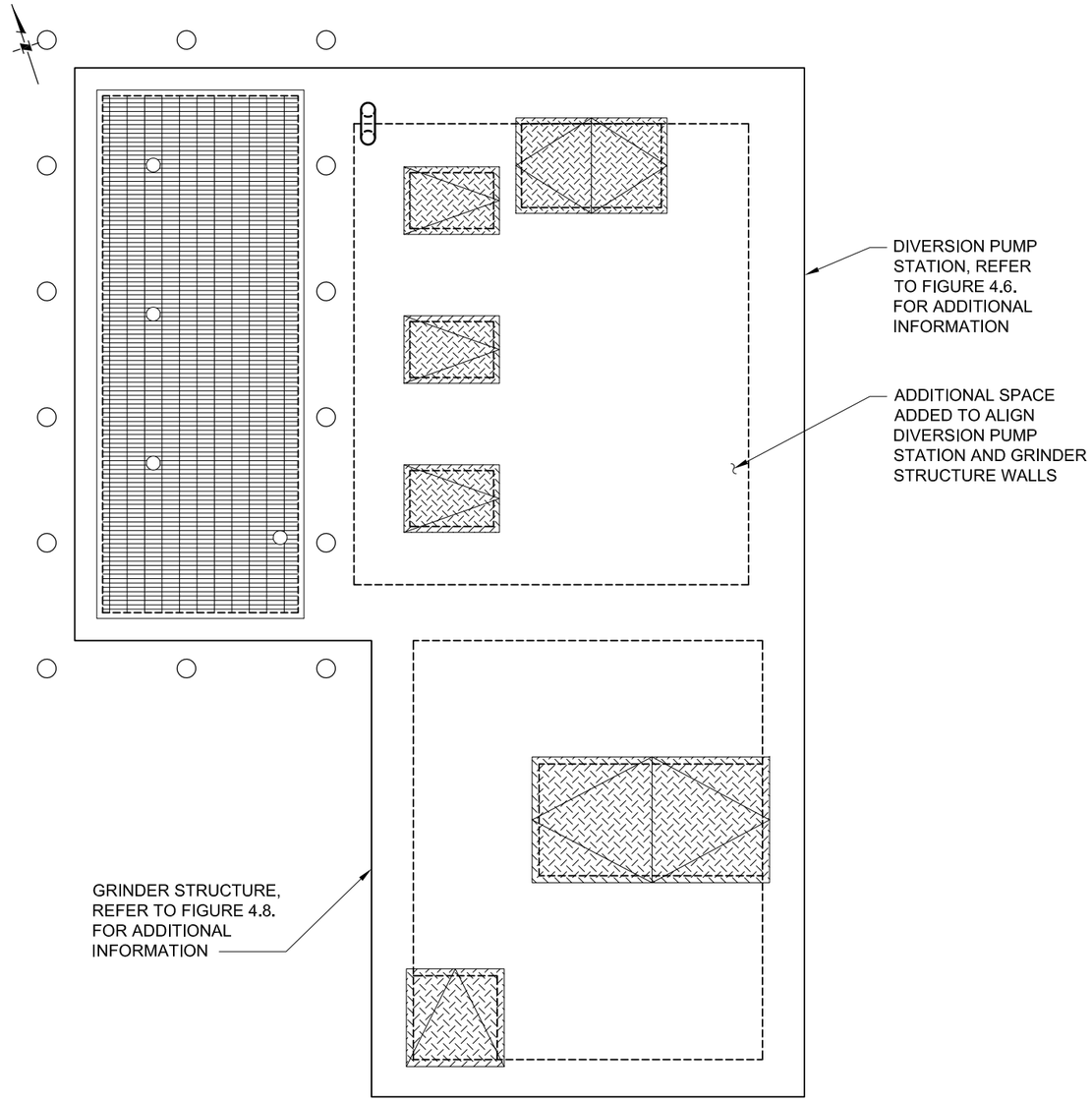
ANTIOCH PUMP STATION
SITE PLAN W/ PROPOSED IMPROVEMENTS

FIGURE NO.
4.4



BOTTOM PLAN

SCALE: 3/16"=1'-0"



TOP PLAN

SCALE: 3/16"=1'-0"

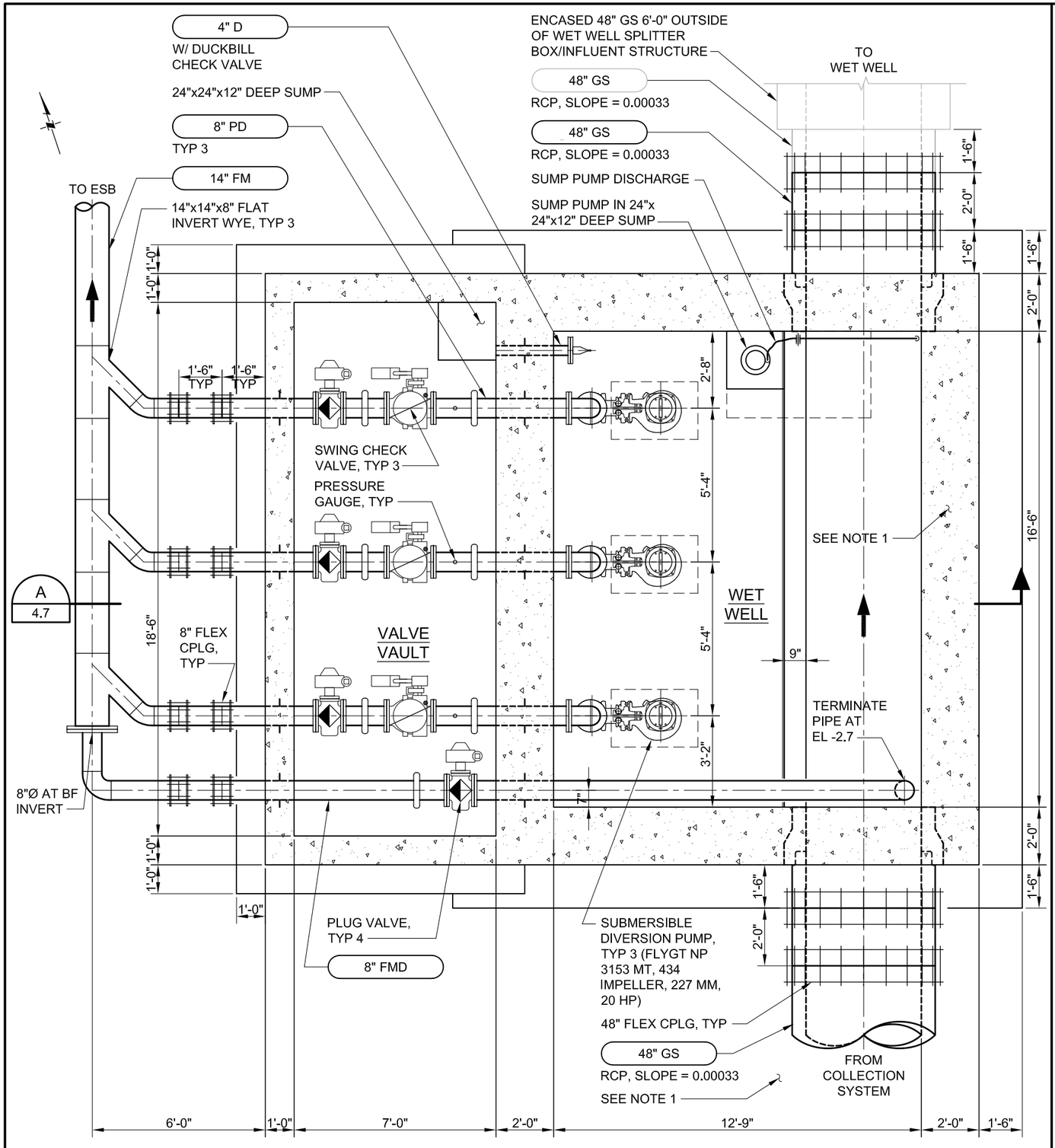
Delta Diablo
TRANSFORMING WASTEWATER TO RESOURCES

V.W. HOUSEN & ASSOCIATES

ANTIOCH & BRIDGEHEAD PUMP STATIONS AND CONVEYANCE SYSTEM IMPROVEMENTS PROJECT
PHASE II LONG TERM ALTERNATIVES ANALYSIS

ANTIOCH PUMP STATION
COMBINED DIVERSION PS AND GRINDER STRUCTURE - PLANS

FIGURE NO.
4.5

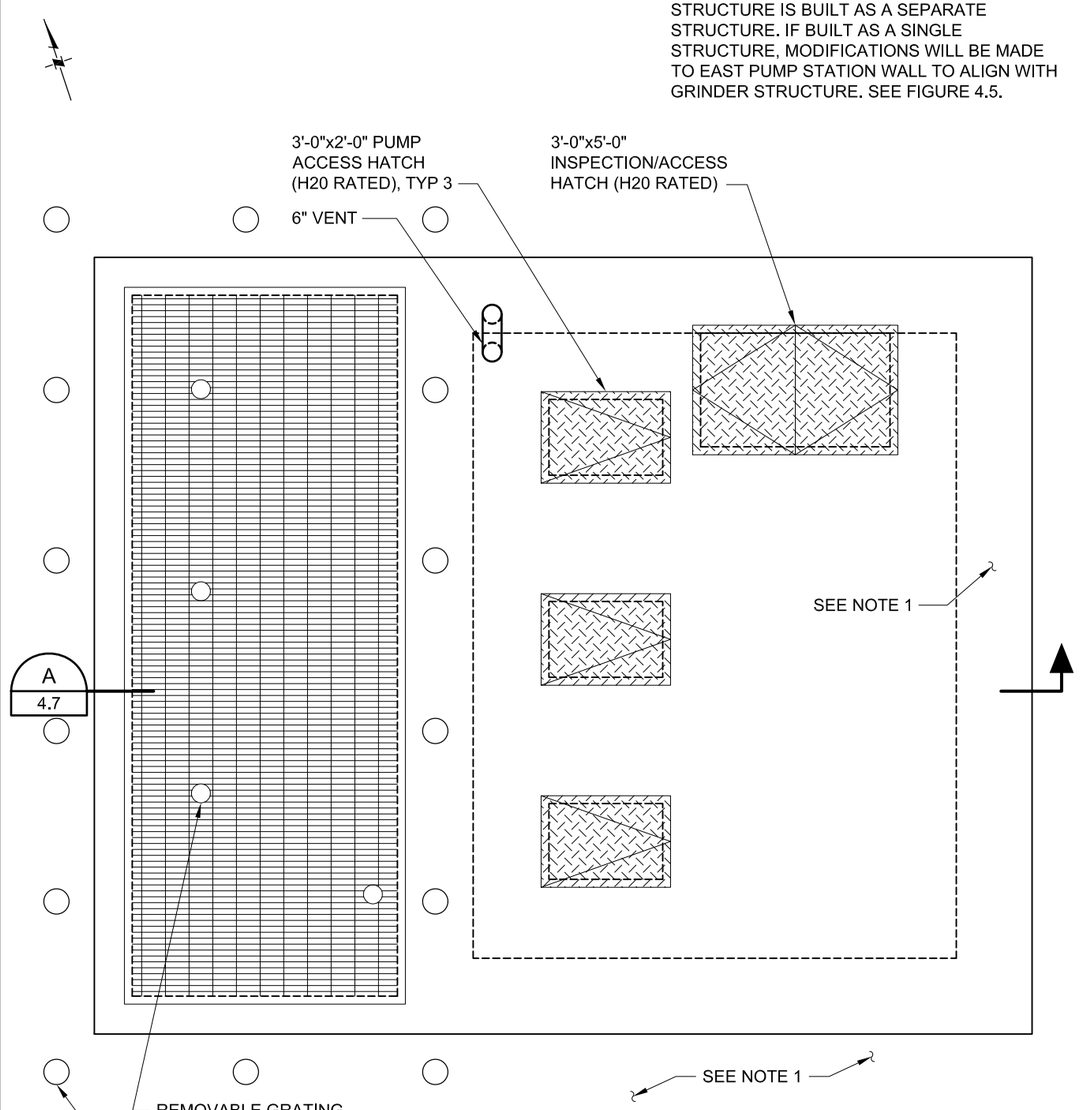


BOTTOM PLAN

SCALE: 1/4"=1'-0"

NOTES:

1. PLANS DEPICT DIVERSION PUMP STATION IN A SITUATION IN WHICH THE GRINDER STRUCTURE IS BUILT AS A SEPARATE STRUCTURE. IF BUILT AS A SINGLE STRUCTURE, MODIFICATIONS WILL BE MADE TO EAST PUMP STATION WALL TO ALIGN WITH GRINDER STRUCTURE. SEE FIGURE 4.5.



TOP PLAN

SCALE: 1/4"=1'-0"

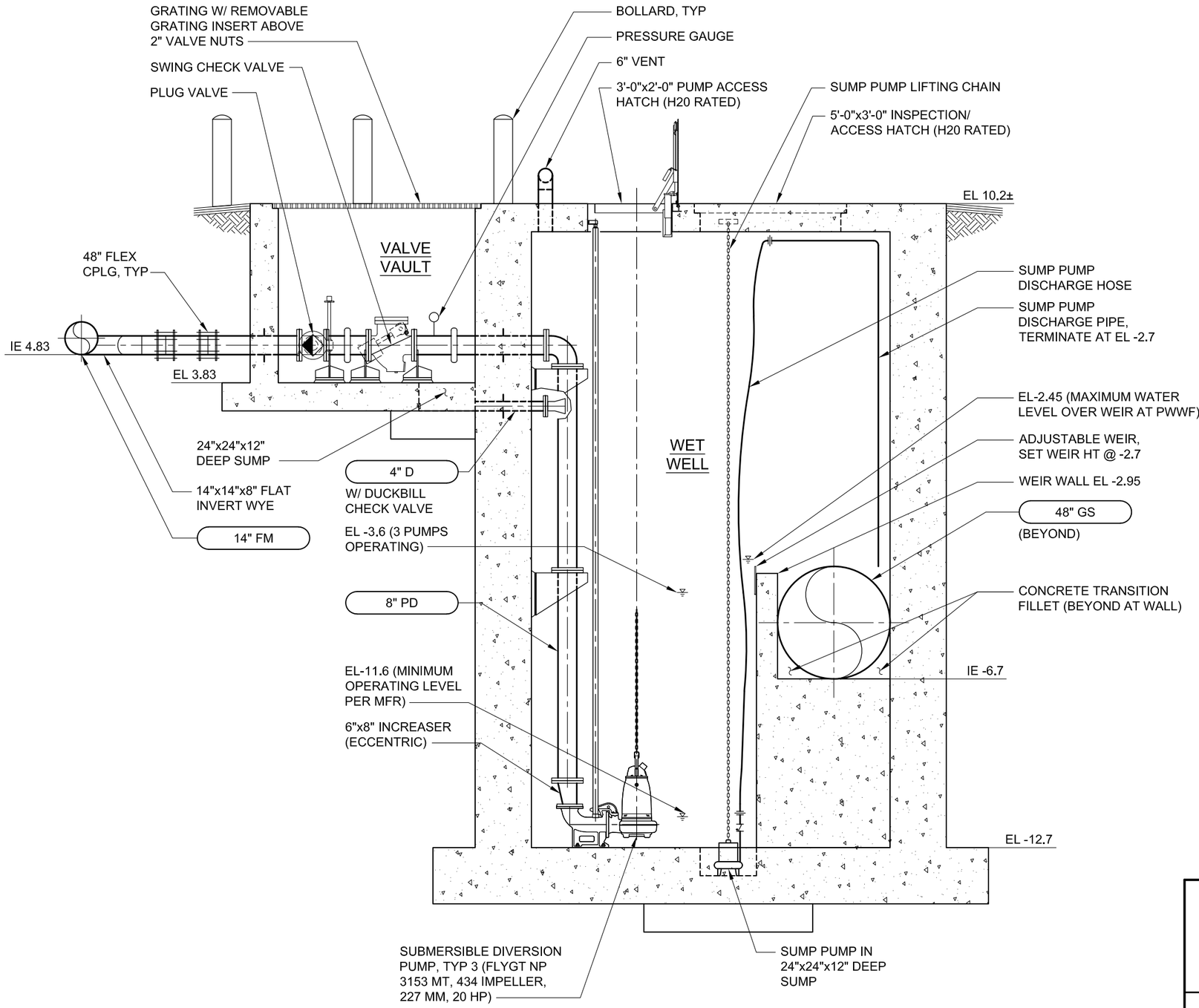
Delta Diablo
TRANSFORMING WASTEWATER TO RESOURCES

V.W. HOUSEN & ASSOCIATES

ANTIOCH & BRIDGEHEAD PUMP STATIONS AND CONVEYANCE SYSTEM IMPROVEMENTS PROJECT
PHASE II LONG TERM ALTERNATIVES ANALYSIS

ANTIOCH PUMP STATION
DIVERSION PUMP STATION
PLANS

FIGURE NO.
4.6



SECTION A 4.6

SCALE: 1/4"=1'-0"

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TRANSFORMING WASTEWATER TO RESOURCES

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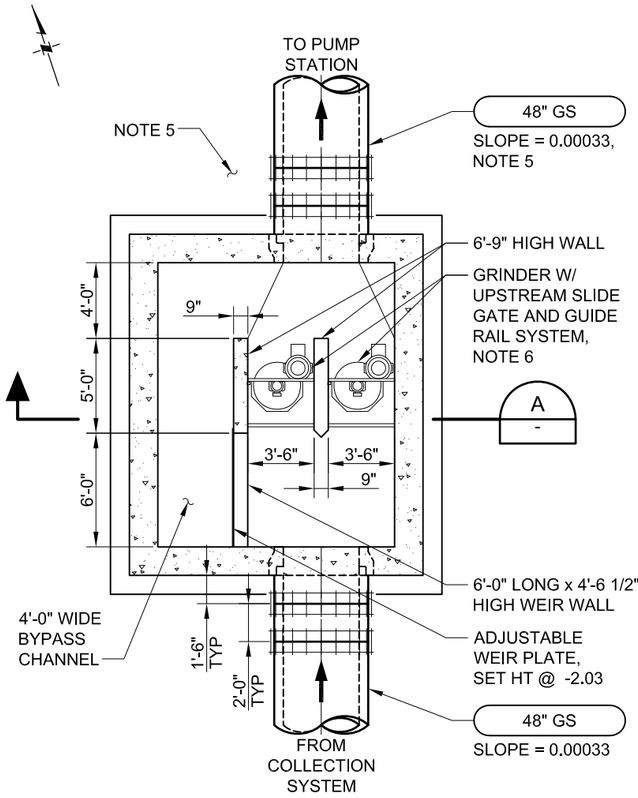
ANTIOCH & BRIDGEHEAD PUMP STATIONS AND CONVEYANCE SYSTEM IMPROVEMENTS PROJECT
PHASE II LONG TERM ALTERNATIVES ANALYSIS

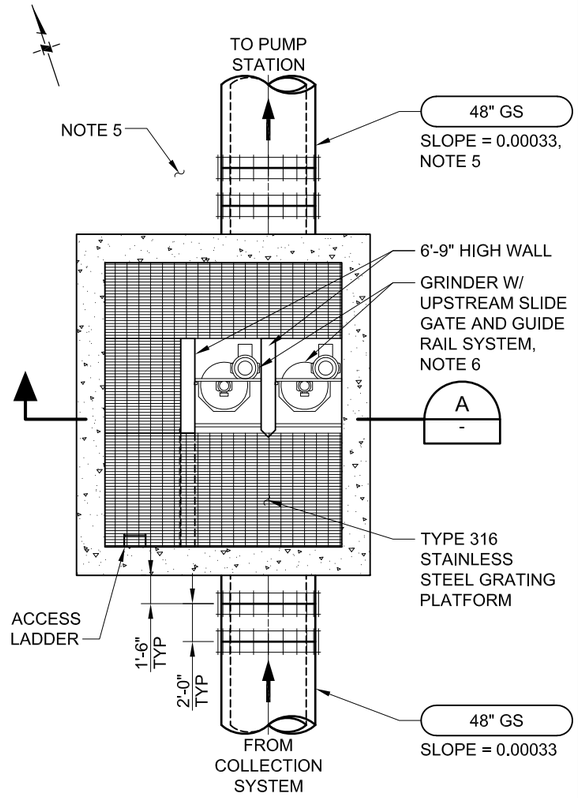
ANTIOCH PUMP STATION
DIVERSION PUMP STATION
SECTION

FIGURE NO.
4.7



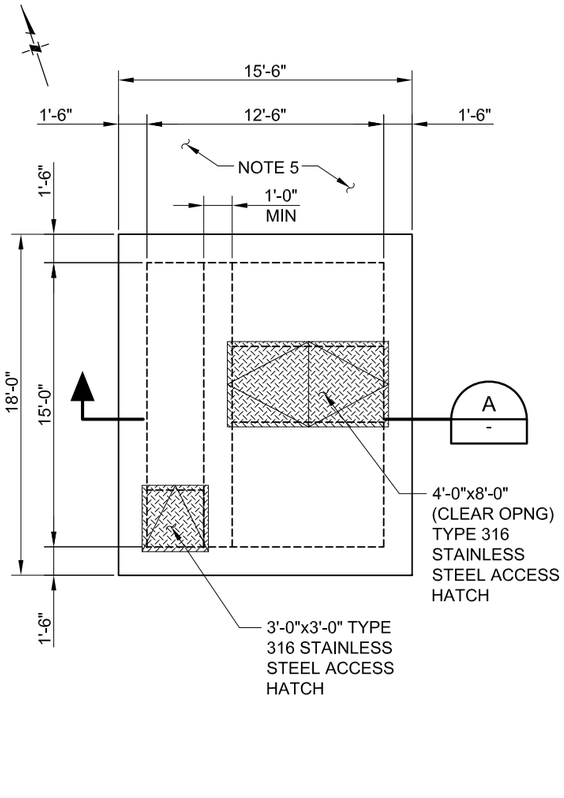
BOTTOM PLAN

SCALE: 1/8"=1'-0"



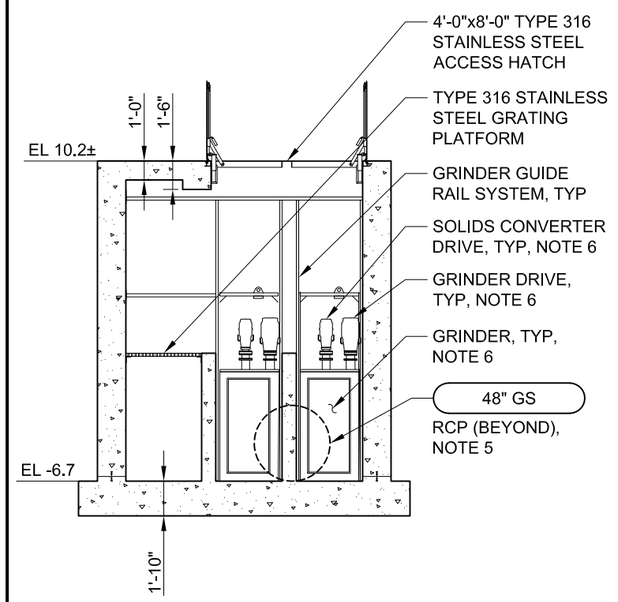
INTERMEDIATE PLAN

SCALE: 1/8"=1'-0"



TOP PLAN

SCALE: 1/8"=1'-0"



SECTION A - SCALE: 1/8"=1'-0"

NOTES:

1. FLOW/CAPACITY
   - A. GRINDER BOX PWWF = 14.3 MGD
   - B. GRINDER BOX PDWF = 10.3 MGD
   - C. EACH GRINDER HAS A CAPACITY OF 10.3 MGD
2. GRINDER INFORMATION
   - A. JWC CHANNEL MONSTER FLEX MODEL CFM6030-M2.0E
   - B. CHANNEL WIDTH (EACH) = 42 INCHES
   - C. WT (EACH) = 4,000 LBS
   - D. HORSEPOWER (EACH) = 5HP (GRINDER) +1HP (SOLIDS DIVERTER) = 6 HP
3. HYDRAULIC INFORMATION AT PDWF WITH 1 GRINDER OUT OF SERVICE
   - A. DOWNSTREAM WATER DEPTH (INCHES) = 31
   - B. GRINDER HEADLOSS (INCHES) = 6
   - C. UPSTREAM WATER DEPTH (INCHES) = 37 (UPSTREAM SEWER NOT SURCHARGED ABOVE CROWN)
4. HYDRAULIC INFORMATION AT PWWF WHEN DIVERTING DOWNSTREAM (BOTH GRINDERS IN SERVICE)
   - A. DOWNSTREAM WATER DEPTH (INCHES) = 52
   - B. GRINDER HEADLOSS (INCHES) = 2.5
   - C. UPSTREAM WATER DEPTH (INCHES) = 54.5 (SURCHARGE UPSTREAM SEWER BY 6.5 INCHES)
   - D. WEIR HEIGHT (INCHES) = 56
   - E. WATER ELEVATION OVER WEIR WITH BOTH GRINDERS OUT OF SERVICE (INCHES) = 13.0 (69 INCHES ABOVE FLOOR) (SURCHARGE UPSTREAM SEWER BY 21.0 INCHES)
5. PLANS DEPICT GRINDER STRUCTURE BUILT AS A SEPARATE STRUCTURE FROM THE DIVERSION PUMP STATION. THEY WILL BE BUILT AS A COMBINED STRUCTURE WITH A COMMON WALL. SEE FIGURE 4.5.
6. PER DISTRICT REQUEST, PURCHASE AND INSTALLATION OF GRINDERS SHALL BE DEFERRED UNTIL IT IS CONFIRMED THAT GRINDERS ARE NEEDED TO HANDLE INCOMING SCREENINGS AND RAGS.

Delta Diablo — TRANSFORMING WASTEWATER TO RESOURCES

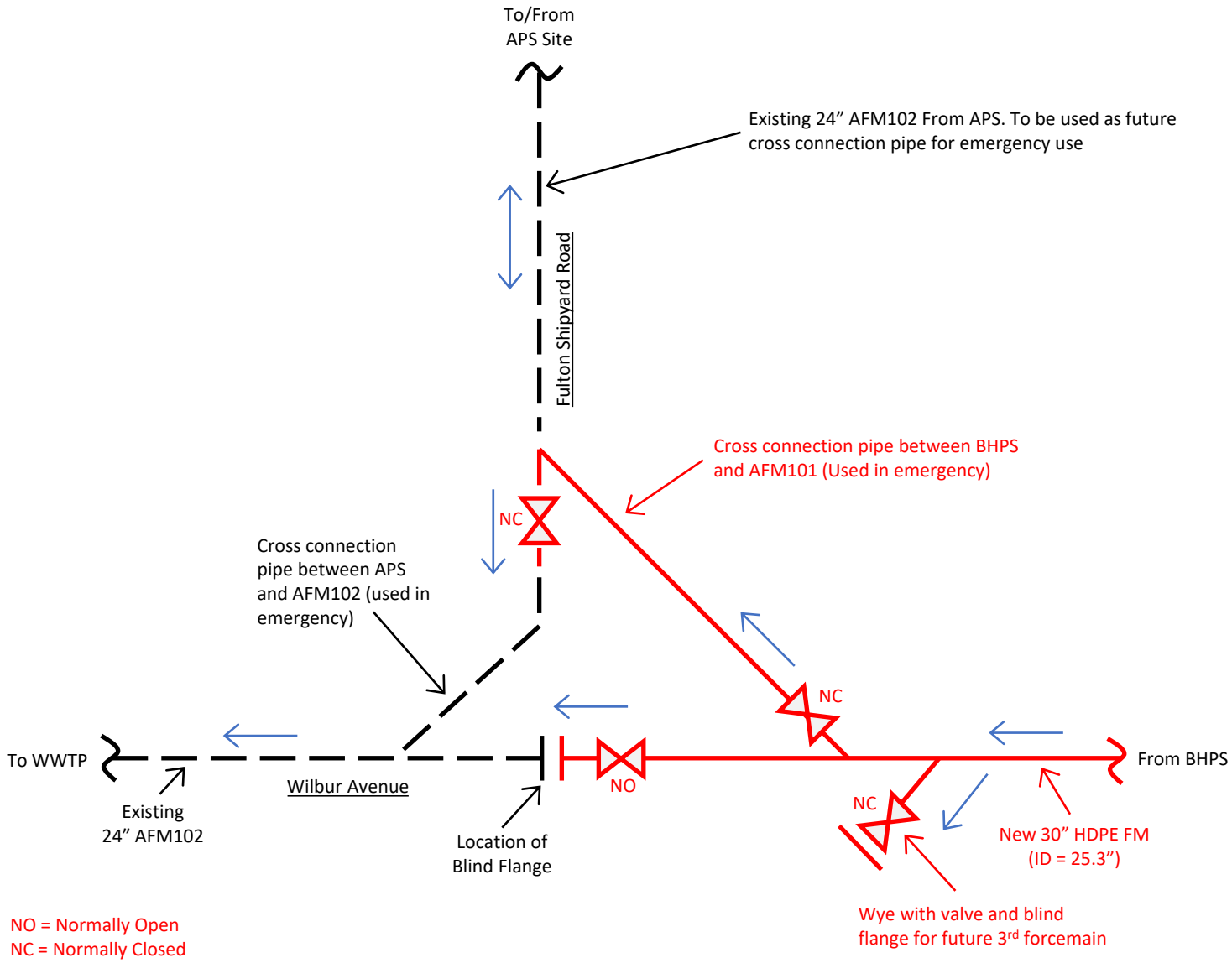
V.W. HOUSEN & ASSOCIATES

ANTIOCH & BRIDGEHEAD PUMP STATIONS AND CONVEYANCE SYSTEM IMPROVEMENTS PROJECT
PHASE II LONG TERM ALTERNATIVES ANALYSIS

ANTIOCH PUMP STATION
GRINDER STRUCTURE

FIGURE NO. 4.8

Figure 4.9. Forcemain/Valving Schematic at Intersection of Fulton Shipyard Road and Wilbur Avenue



V.W. HOUSEN
& ASSOCIATES

Appendix A. Bridgehead Diversion Pump Station – Pump and Hydraulic Information

V.W. HOUSEN & ASSOCIATES

Bridgehead Diversion Pump Station – Existing Flygt Pump Information

Performance Curve

Product	Type
CP3300.091	HT

Date	Project	Curve No	Issue
2021-05-11		63-454-00-2050	9

	1/1-Load	3/4-Load	1/2-Load
Power Factor	0.85	0.82	0.74
Efficiency	92.0 %	92.5 %	92.0 %
Motor Data	---	---	---

Rated Power ...	88	hp
Starting Current ...	545	A
Rated Current ...	105	A
Rated Speed ...	1775	rpm
Tot. Mom. of Inertia ...	1.4	kgm2
No. of Blades	1	

Impeller Diameter: 401 mm

Motor #	Stator	Rev
35-28-4AA	38D	12

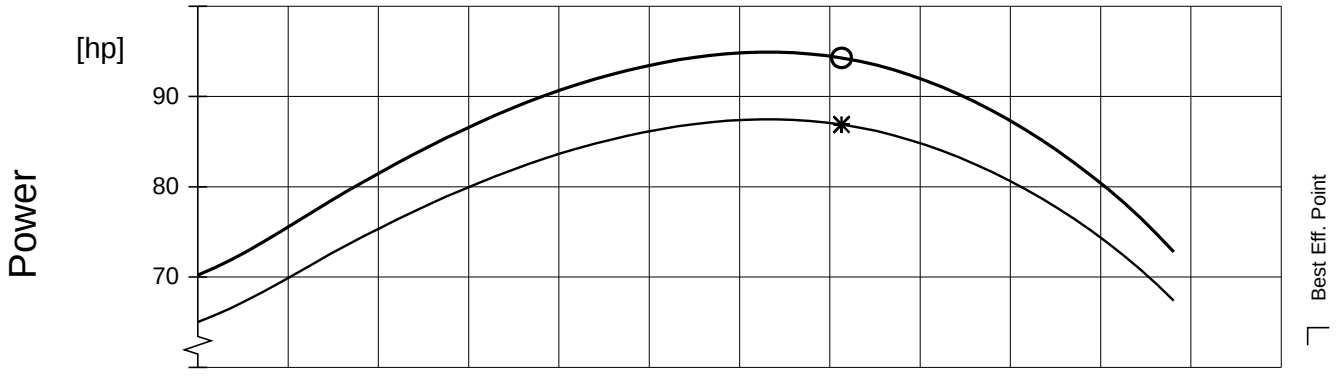
Freq.	Phases	Voltage	Poles
60 Hz	3	460 V	4

Geartype	Ratio
---	---

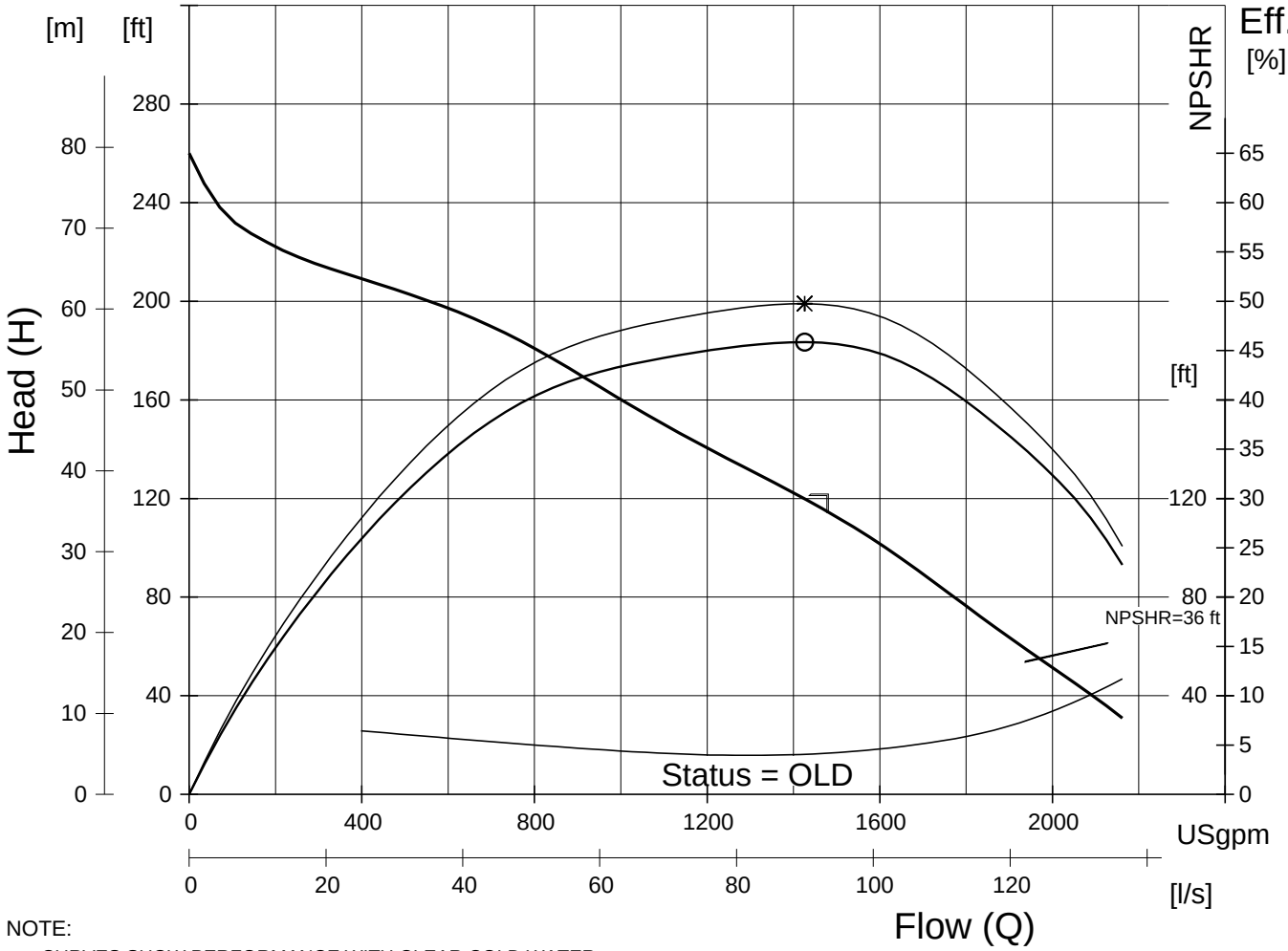
Comments

Inlet/Outlet: -/ 6 inch

Imp. Throughlet: 2.9 inch



Duty-Point	Flow[USgpm]	Head[ft]	Power [hp]	Eff. [%]	NPSHR[ft]
B.E.P.	1426	119.9	94.3 (86.9) *	45.9 (49.8) *	16.3



NOTE:

CURVES SHOW PERFORMANCE WITH CLEAR COLD WATER

* : Pump EFFICIENCY/Shaft POWER

O : Overall EFFICIENCY/Input POWER

NPSHR = NPSH3 + min. operational margin

HI Curve

unix AUTHOR: DTROYER SACU (rev:8.1)

V.W. HOUSEN
& ASSOCIATES

Bridgehead Diversion Pump Station – Hydraulic Calculations

Bridgehead Diversion Pump Station

Pump and Suction and Discharge Loss Curves – Diversion Pumps

Suction & Discharge - 8"

Diameter = 8 in
Area = 0.349066 ft^2
RH=D/4= 0.166667
C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x $(v^2/2g)$	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.00	0.00	0.00	8.00	0.00	0.00	22.00	120	0.0000	0.0000	3.7	0.000	0.0000
56.52	0.08	0.13	8.00	0.36	0.00	22.00	120	0.0001	0.0023	3.7	0.007	0.0098
113.04	0.16	0.25	8.00	0.72	0.01	22.00	120	0.0004	0.0082	3.7	0.030	0.0381
165.22	0.24	0.37	8.00	1.05	0.02	22.00	120	0.0008	0.0166	3.7	0.064	0.0805
200.00	0.29	0.45	8.00	1.28	0.03	22.00	120	0.0011	0.0237	3.7	0.094	0.1173
400.00	0.58	0.89	8.00	2.55	0.10	22.00	120	0.0039	0.0854	3.7	0.375	0.4600
600.00	0.86	1.34	8.00	3.83	0.23	22.00	120	0.0082	0.1810	3.7	0.843	1.0237
800.00	1.15	1.78	8.00	5.11	0.40	22.00	120	0.0140	0.3084	3.7	1.498	1.8066
1000.00	1.44	2.23	8.00	6.38	0.63	22.00	120	0.0212	0.4662	3.7	2.341	2.8071
1200.00	1.73	2.67	8.00	7.66	0.91	22.00	120	0.0297	0.6534	3.7	3.371	4.0244
1414.00	2.04	3.15	8.00	9.03	1.27	22.00	120	0.0402	0.8855	3.7	4.681	5.5660
1600.00	2.30	3.57	8.00	10.21	1.62	22.00	120	0.0506	1.1132	3.7	5.993	7.1061
1800.00	2.59	4.01	8.00	11.49	2.05	22.00	120	0.0629	1.3846	3.7	7.585	8.9693
2000.00	2.88	4.46	8.00	12.77	2.53	22.00	120	0.0765	1.6829	3.7	9.364	11.0467
2200.00	3.17	4.90	8.00	14.04	3.06	22.00	120	0.0913	2.0078	3.7	11.330	13.3380
2252.17	3.24	5.02	8.00	14.38	3.21	22.00	120	0.0953	2.0968	3.7	11.874	13.9708

Pump Suction and Discharge Losses

Q (gpm)	Q (mgd)	Total Losses S&D (ft)
0.00	0.00	0.0000
56.52	0.08	0.0098
113.04	0.16	0.0381
165.22	0.24	0.0805
200.00	0.29	0.1173
400.00	0.58	0.4600
600.00	0.86	1.0237
800.00	1.15	1.8066
1000.00	1.44	2.8071
1200.00	1.73	4.0244
1414.00	2.04	5.5660
1600.00	2.30	7.1061
1800.00	2.59	8.9693
2000.00	2.88	11.0467
2200.00	3.17	13.3380
2252.17	3.24	13.9708

Bridgehead Diversion Pump Station

Pump and Suction and Discharge Loss Curves – Diversion Pumps

Pumps – Flygt CP3300, 454 (401mm)

Mfr Pump Curve

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
0	0.00	267.27
57	0.08	250.91
113	0.16	240.00
165	0.24	231.82
200	0.29	228.18
400	0.58	215.45
600	0.86	203.64
800	1.15	186.36
1000	1.44	167.27
1200	1.73	147.27
1414	2.04	127.00
1600	2.30	109.10
1800	2.59	86.36
2000	2.88	60.00
2200	3.17	38.18
2252	3.24	30.91

S&D Losses S&D
(ft)
0.0000
0.0098
0.0381
0.0805
0.1173
0.4600
1.0237
1.8066
2.8071
4.0244
5.5660
7.1061
8.9693
11.0467
13.3380
13.9708

Adjusted Pump Curves

1 PUMP

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	267.27
57	0.08	250.90
113	0.16	239.96
165	0.24	231.74
200	0.29	228.06
400	0.58	214.99
600	0.86	202.62
800	1.15	184.55
1000	1.44	164.46
1200	1.73	143.25
1414	2.04	121.43
1600	2.30	101.99
1800	2.59	77.39
2000	2.88	48.95
2200	3.17	24.84
2252	3.24	16.94

2 PUMPS

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	267.27
113	0.16	250.90
226	0.33	239.96
330	0.48	231.74
400	0.58	228.06
800	1.15	214.99
1200	1.73	202.62
1600	2.30	184.55
2000	2.88	164.46
2400	3.46	143.25
2828	4.07	121.43
3200	4.61	101.99
3600	5.18	77.39
4000	5.76	48.95
4400	6.34	24.84
4504	6.49	16.94

Bridgehead Diversion Pump Station

System Curve – 14" Forcemain to ESB

FM System Curve - 14"

Diameter = 14 in
Area = 1.069014 ft^2
RH= 0.291667
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x $(v^2/2g)$	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	14.00	0.00	0.00	338.50	100	0.0000	0.0000	5.82	0.000	0.0000
200.0	0.29	0.45	14.00	0.42	0.00	338.50	100	0.0001	0.0334	5.82	0.016	0.0491
400.0	0.58	0.89	14.00	0.83	0.01	338.50	100	0.0004	0.1207	5.82	0.063	0.1835
600.0	0.86	1.34	14.00	1.25	0.02	338.50	100	0.0008	0.2557	5.82	0.141	0.3970
800.0	1.15	1.78	14.00	1.67	0.04	338.50	100	0.0013	0.4356	5.82	0.251	0.6869
1000.0	1.44	2.23	14.00	2.08	0.07	338.50	100	0.0019	0.6585	5.82	0.393	1.0511
1200.0	1.73	2.67	14.00	2.50	0.10	338.50	100	0.0027	0.9230	5.82	0.565	1.4883
1400.0	2.02	3.12	14.00	2.92	0.13	338.50	100	0.0036	1.2279	5.82	0.770	1.9975
1600.0	2.30	3.57	14.00	3.33	0.17	338.50	100	0.0046	1.5724	5.82	1.005	2.5775
1800.0	2.59	4.01	14.00	3.75	0.22	338.50	100	0.0058	1.9557	5.82	1.272	3.2278
2000.0	2.88	4.46	14.00	4.17	0.27	338.50	100	0.0070	2.3771	5.82	1.570	3.9476
2200.0	3.17	4.90	14.00	4.59	0.33	338.50	100	0.0084	2.8360	5.82	1.900	4.7363
2400.0	3.46	5.35	14.00	5.00	0.39	338.50	100	0.0098	3.3319	5.82	2.261	5.5934
2600.0	3.74	5.79	14.00	5.42	0.46	338.50	100	0.0114	3.8643	5.82	2.654	6.5184
2800.0	4.03	6.24	14.00	5.84	0.53	338.50	100	0.0131	4.4328	5.82	3.078	7.5109
3000.0	4.32	6.68	14.00	6.25	0.61	338.50	100	0.0149	5.0370	5.82	3.534	8.5705
3200.0	4.61	7.13	14.00	6.67	0.69	338.50	100	0.0168	5.6765	5.82	4.020	9.6969
3400.0	4.90	7.58	14.00	7.09	0.78	338.50	100	0.0188	6.3510	5.82	4.539	10.8896
3600.0	5.18	8.02	14.00	7.50	0.87	338.50	100	0.0209	7.0602	5.82	5.088	12.1485
3800.0	5.47	8.47	14.00	7.92	0.97	338.50	100	0.0231	7.8038	5.82	5.669	13.4731
4000.0	5.76	8.91	14.00	8.34	1.08	338.50	100	0.0254	8.5814	5.82	6.282	14.8632
4200.0	6.05	9.36	14.00	8.75	1.19	338.50	100	0.0277	9.3930	5.82	6.926	16.3187
4400.0	6.34	9.80	14.00	9.17	1.31	338.50	100	0.0302	10.2381	5.82	7.601	17.8391
4600.0	6.62	10.25	14.00	9.59	1.43	338.50	100	0.0328	11.1166	5.82	8.308	19.4243
4800.0	6.91	10.70	14.00	10.00	1.55	338.50	100	0.0355	12.0283	5.82	9.046	21.0741
5000.0	7.20	11.14	14.00	10.42	1.69	338.50	100	0.0383	12.9729	5.82	9.815	22.7882

Bridgehead Diversion Pump Station

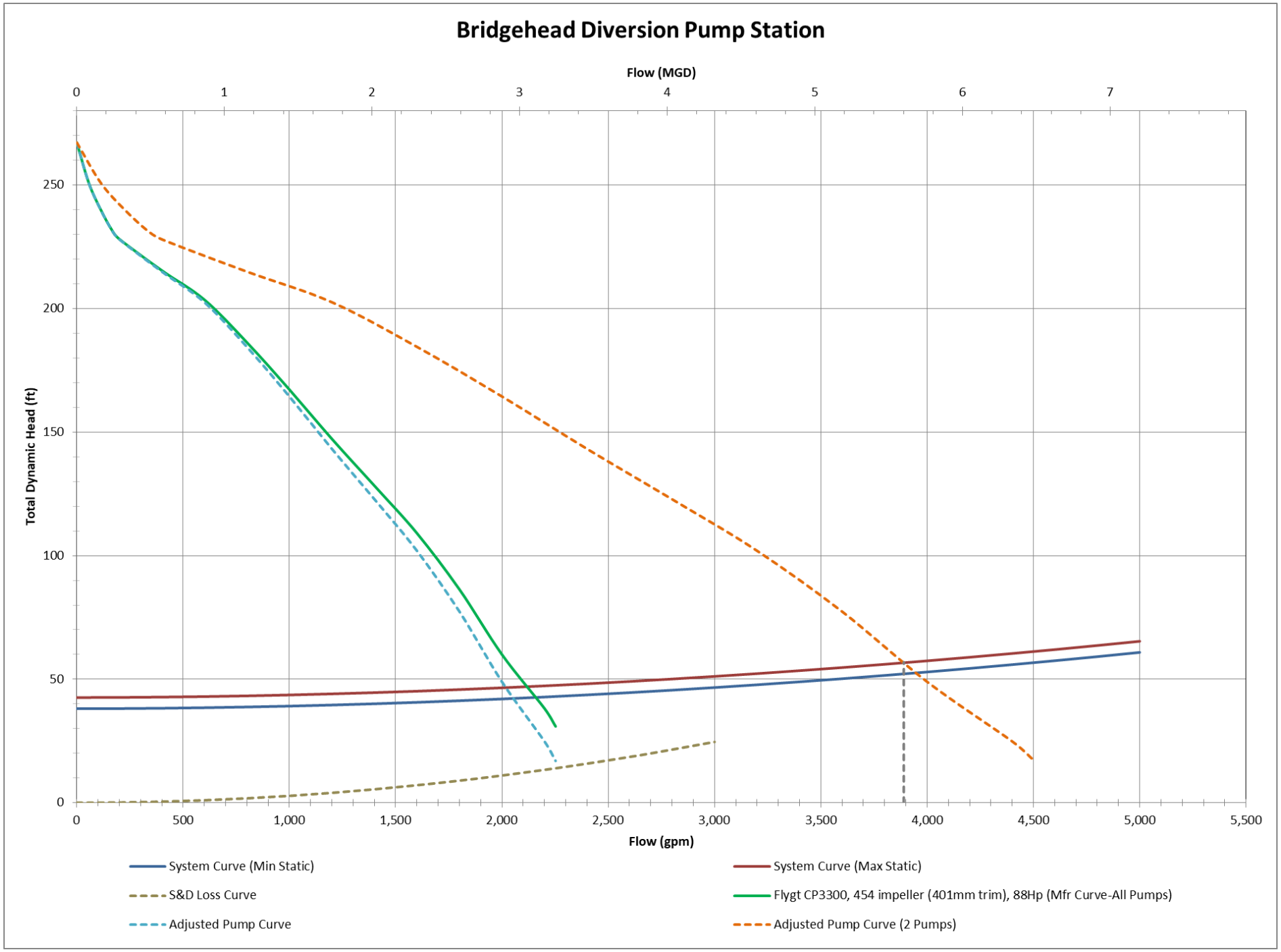
System Curve – 14” Forcemain to ESB

FM System Curve

Q (gpm)	Q (mgd)	Total Losses For Pump No Static (ft)
0	0.00	0.00
200	0.29	0.05
400	0.58	0.18
600	0.86	0.40
800	1.15	0.69
1000	1.44	1.05
1200	1.73	1.49
1400	2.02	2.00
1600	2.30	2.58
1800	2.59	3.23
2000	2.88	3.95
2200	3.17	4.74
2400	3.46	5.59
2600	3.74	6.52
2800	4.03	7.51
3000	4.32	8.57
3200	4.61	9.70
3400	4.90	10.89
3600	5.18	12.15
3800	5.47	13.47
4000	5.76	14.86
4200	6.05	16.32
4400	6.34	17.84
4600	6.62	19.42
4800	6.91	21.07
5000	7.20	22.79

Q (gpm)	Q (mgd)	Total Losses For Pump MIN Static (ft)	Total Losses For Pump MAX Static (ft)
0	0.00	38.08	42.59
200	0.29	38.13	42.64
400	0.58	38.26	42.77
600	0.86	38.48	42.99
800	1.15	38.77	43.28
1000	1.44	39.13	43.64
1200	1.73	39.57	44.08
1400	2.02	40.08	44.59
1600	2.30	40.66	45.17
1800	2.59	41.31	45.82
2000	2.88	42.03	46.54
2200	3.17	42.82	47.33
2400	3.46	43.67	48.18
2600	3.74	44.60	49.11
2800	4.03	45.59	50.10
3000	4.32	46.65	51.16
3200	4.61	47.78	52.29
3400	4.90	48.97	53.48
3600	5.18	50.23	54.74
3800	5.47	51.55	56.06
4000	5.76	52.94	57.45
4200	6.05	54.40	58.91
4400	6.34	55.92	60.43
4600	6.62	57.50	62.01
4800	6.91	59.15	63.66
5000	7.20	60.87	65.38

MIN Static Head = 38.08
MAX Static Head = 42.59

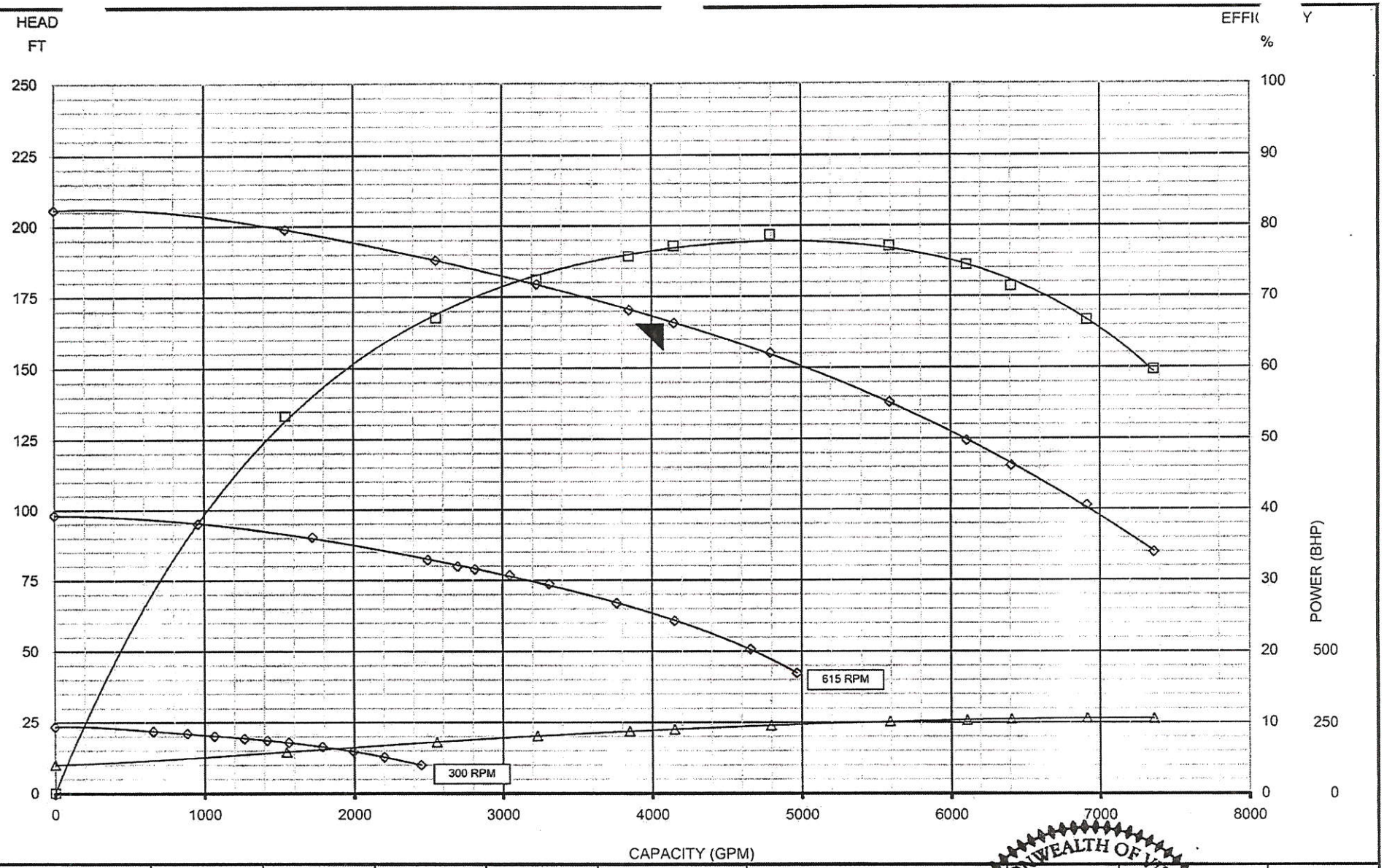

Bridgehead Diversion Pump Station
Flow (MGD)
0
1
2
3
4
5
6
7
Total Dynamic Head (ft)
250
200
150
100
50
0
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
Flow (gpm)
System Curve (Min Static)
System Curve (Max Static)
S&D Loss Curve
Flygt CP3300, 454 impeller (401mm trim), 88Hp (Mfr Curve-All Pumps)
Adjusted Pump Curve
Adjusted Pump Curve (2 Pumps)

V.W. HOUSEN & ASSOCIATES

Appendix B. BHPS w/ AFM101: Main Pump Station – Pump and Hydraulic Information

V.W. HOUSEN & ASSOCIATES

BHPS w/ AFM101: Main Pump Station – Existing Fairbanks Morse Pump Information



0802MS004468-1	S4468	10MFC27	1	MAIN WELL	PUMP	JOB	12x9	03/12/08	1WB
SERIAL NO.	ORDER NO.	MODEL	STAGES	TEST LOOP	TYPE OF TEST	TEST MOTOR	VENTURI	DATE TESTED	CURVE NO

CASING DATA		IMPELLER DATA		CONDITIONS OF SERVICE	
2.5-3% NI CI	MATERIAL	2.5-3% NI CI	#2 FINISH	4084 GPM	166 FT
		MATERIAL		FLOW	HEAD
1A	FINISH	26.61	DIAMETER	1	895 RPM
				SG	SPEED
N/A	TONGUE	DEBURR	TIP		93
					TEMP. (F)

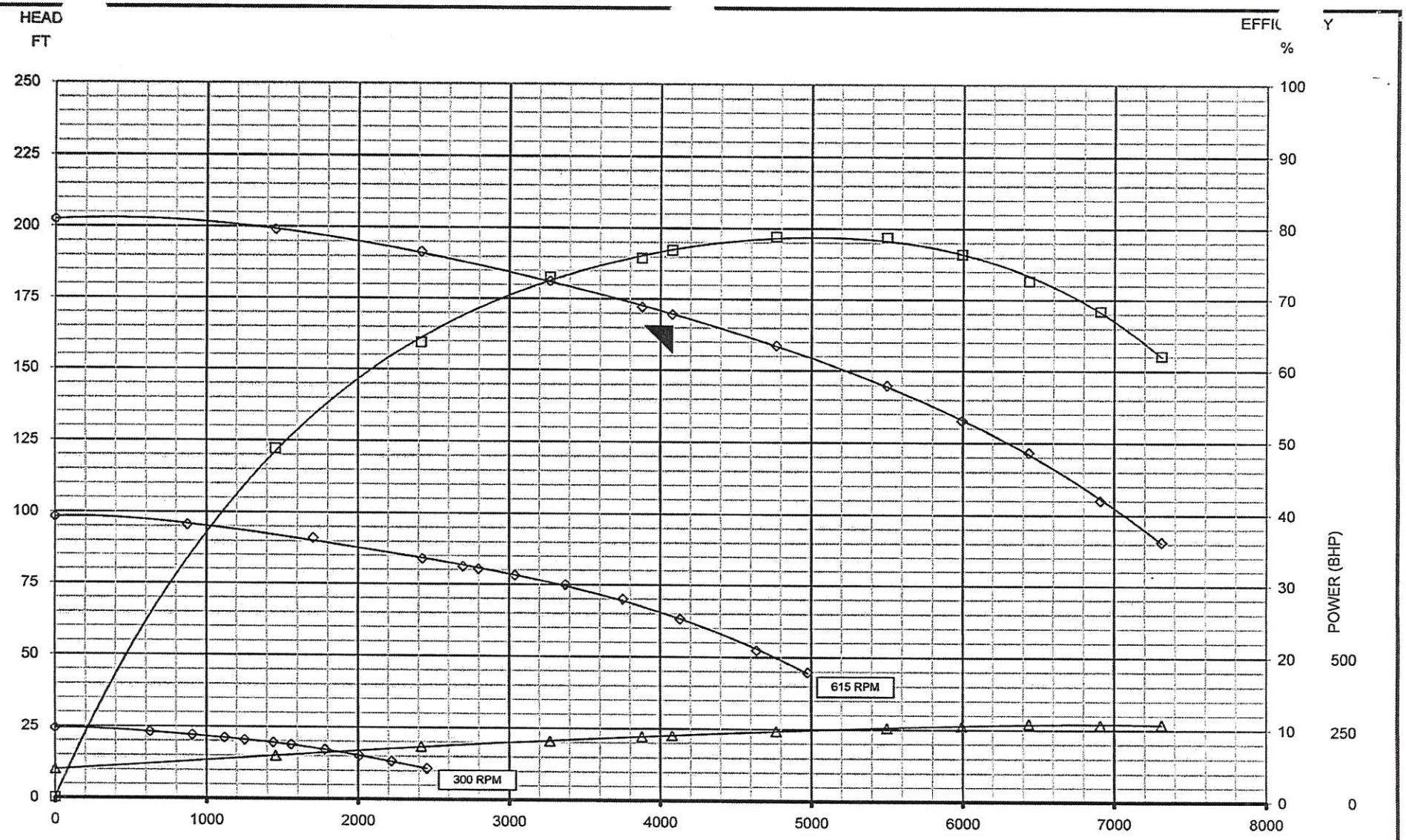
I CERTIFY THAT WITHIN THE ACCURACY OF THE TEST INSTRUMENTATION, THIS TEST REPRESENTS THE PERFORMANCE OF 0802MS004468-1

TEST WITNESSED BY: Lance Anderson 3/12/2008

LANCE ANDERSON REGISTERED PE, STATE OFVIRGINIA 037070

COMMONWEALTH OF VIRGINIA
LANCE D. ANDERSON
No. 37070
PROFESSIONAL ENGINEER

FLOWSERVE



0802MS004468-2 SERIAL NO.	S4468 ORDER NO.	10MFC27 MODEL	1 STAGES	MAIN WELL TEST LOOP	PUMP TYPE OF TEST	JOB TEST MOTOR	VENTURI	02/21/08 DATE TESTED	2WA CURVE NO

CASING DATA	IMPELLER DATA		CONDITIONS OF SERVICE	
2.5-3% NI CI MATERIAL	2.5-3% NI CI MATERIAL	#2 FINISH	4084 GPM FLOW	166 FT HEAD
1A FINISH	26.61 DIAMETER		1 SG	895 RPM SPEED
N/A TONGUE	DEBURR TIP			91 TEMP. (F)

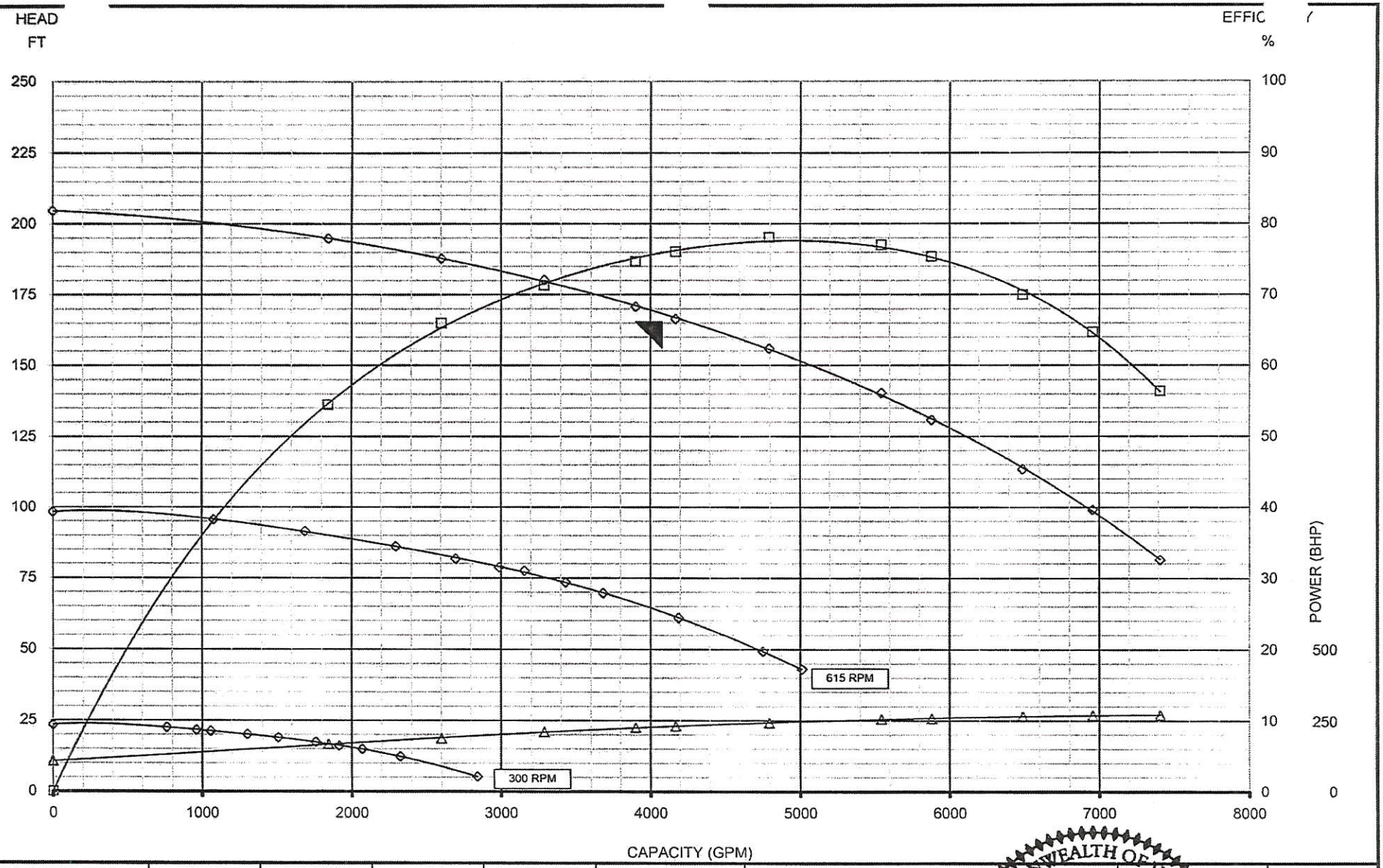
I CERTIFY THAT WITHIN THE ACCURACY OF THE TEST INSTRUMENTATION, THIS TEST REPRESENTS THE PERFORMANCE OF 0802MS004468-2

TEST WITNESSED BY: Lance Anderson 2/21/2008

LANCE ANDERSON REGISTERED PE, STATE OFVIRGINIA 37070

COMMONWEALTH OF VIRGINIA
LANCE D. ANDERSON
No. 37070
PROFESSIONAL ENGINEER

FLOWSERVE



0802MS004468-3 SERIAL NO.	S4468 ORDER NO.	10MFC27 MODEL	1 STAGES	MAIN WELL TEST LOOP	PUMP TYPE OF TEST	JOB TEST MOTOR	12x9 VENTURI	02/22/08 DATE TESTED	3WA CURVE NO

CASING DATA		IMPELLER DATA		CONDITIONS OF SERVICE	
2.5-3% NI CI	MATERIAL	2.5-3% NI CI	#2 FINISH	4084 GPM	166 FT
		MATERIAL		FLOW	HEAD
1A	FINISH	26.61	DIAMETER	1	895 RPM
				SG	SPEED
N/A	TONGUE	DEBURR	TIP		93 TEMP. (F)

I CERTIFY THAT WITHIN THE ACCURACY OF THE TEST INSTRUMENTATION, THIS TEST REPRESENTS THE PERFORMANCE OF 0802MS004468-3

TEST WITNESSED BY: Lance Anderson 2/22/2008

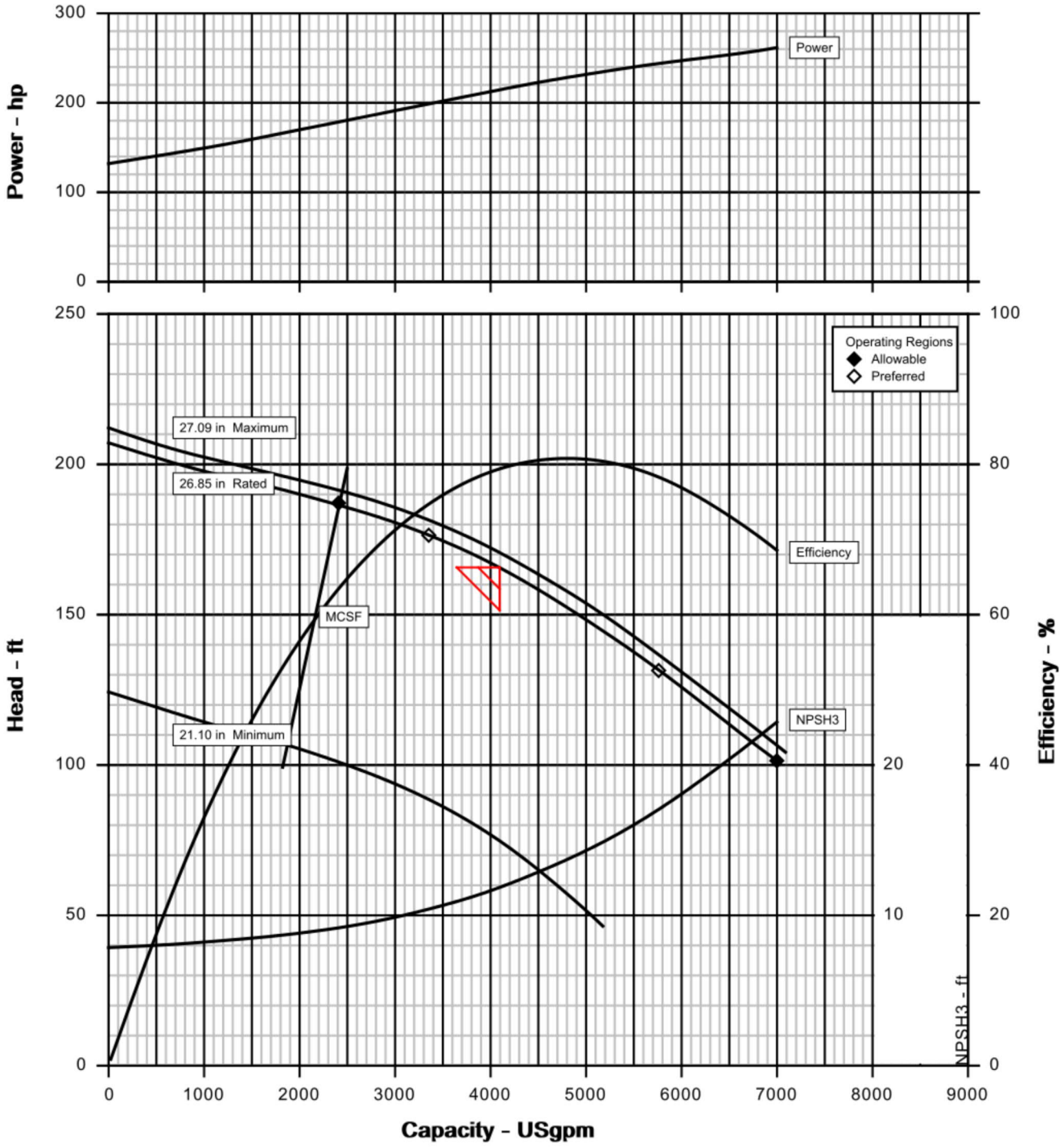
LANCE ANDERSON REGISTERED PE, STATE OFVIRGINIA 037070

COMMONWEALTH OF VIRGINIA
LANCE D. ANDERSON
No. 37070
PROFESSIONAL ENGINEER

FLOWSERVE

		Pump size & type / Stages	: 10MF27A FR7A / 1
		Based on curve no.	: 89116867
		Impeller diameter	: 26.85 in
Customer	: PACIFIC WATER RESOURCES	Capacity	: 4084.0 USgpm
Item number	: Sewage Pumps	Head	: 166.00 ft
Service	: -	Density / Specific gravity	: - / 1.000
Flowserve reference	: 2662524417	Pump speed	: 895 rpm
Date	: July 24, 2020	Ns / Nss	: 1408 / 8780 (US units)
		Test tolerance	: ANSI/HI 14.6 Grade 1U

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.



FLOWSERVE

Hydraulic Datasheet

Customer	: PACIFIC WATER RESOURCES	Pump / Stages	: 10MF27A FR7A	/ 1
Customer reference	: -	Based on curve no.	: 89116867	
Item number	: Sewage Pumps	Flowserve reference	: 2662524417	
Service	: -	Date	: July 24, 2020	

Operating Conditions

Capacity (rated/normal)	: 4084.0 USgpm / -
Water capacity (CQ=1.00)	: -
Total developed head	: 166.00 ft
Water head (CH=1.00)	: -
NPSHa/NPSHa less margin	: 34.0 ft / -
Maximum suction pressure	: 0.0 psig

Liquid

Liquid type	: Other
Liquid description	: -
Temperature	: 60 °F
Density / Specific gravity	: - / 1.000
Solid Size - Actual / Limit	: - / 4.00 in
Viscosity / Vapor pressure	: 1.00 cP / -

Materials / Specification

Material column code	: CI
Pump specification	: -

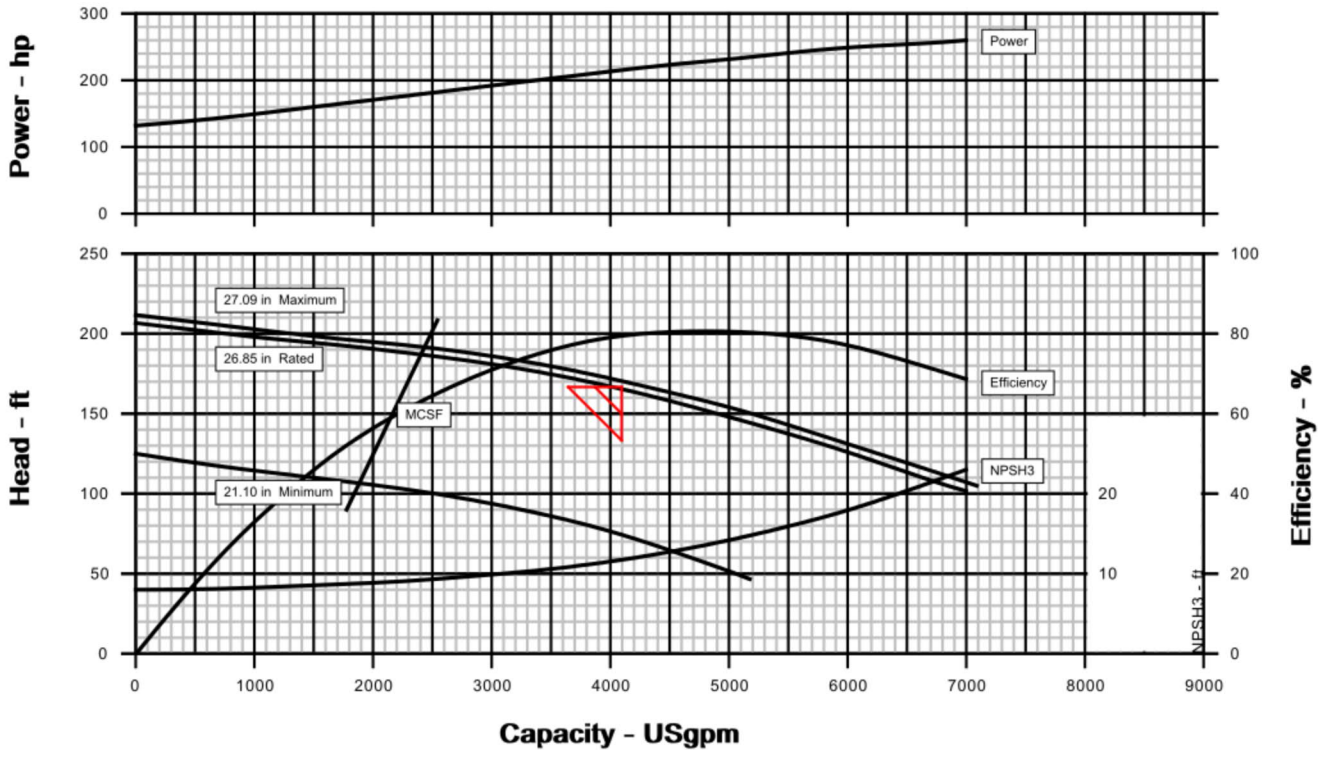
Other Requirements

Hydraulic selection : No specification
Construction : No specification
Test tolerance : ANSI/HI 14.6 Grade 1U
Speed Set : 895 rpm
Driver Sizing : Max Power (SO to EOC) not using SF

Performance

Hydraulic power	: 171 hp	Impeller diameter	
Pump speed	: 895 rpm	Rated	: 26.85 in
Pump overall efficiency (CE=1.00)	: 79.5 %	Maximum	: 27.09 in
NPSH required (NPSH3)	: 11.8 ft	Minimum	: 21.10 in
Rated brake power	: 215 hp	Ns / Nss	: 1408 / 8780 (US units)
		Minimum continuous flow	: 2411.7 USgpm
Maximum brake power	: 261 hp	Maximum head at rated diameter	: 207.44 ft
Driver power rating	: 300 hp / 224 kW	Flow at BEP	: 4799.4 USgpm
Casing working pressure	: 89.8 psig	Flow as % of BEP	: 85.1 %
(based on shut off @ cut dia/rated SG)		Efficiency at normal flow	: -
Maximum allowable	: 115.0 psig	Impeller diameter ratio (rated/max)	: 99.1 %
Hydrostatic test pressure	: 150.0 psig	Head rise to shut off	: 25.0 %
Estimated rated seal chamber pressure	: -	Total head ratio (rated / max) / (max / rated)	: 97.1 % / 103.0 %

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.



V.W. HOUSEN & ASSOCIATES

BHPS w/ AFM101: Main Pump Station – Hydraulic Calculations

Bridgehead Pump Station with AFM101

Pump and Suction and Discharge Loss Curves – Main Pumps

Suction & Discharge - 14"

Diameter = 14 in
Area for = 1.069014 ft^2
RH= 0.29167
C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x $(v^2/2g)$	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	14.00	0.00	0.00	15.00	120	0.0000	0.0000	4	0.000	0.0000
1000.0	1.44	2.23	14.00	2.08	0.07	15.00	120	0.0014	0.0208	4	0.270	0.2907
2000.0	2.88	4.46	14.00	4.17	0.27	15.00	120	0.0050	0.0752	4	1.079	1.1545
3000.0	4.32	6.68	14.00	6.25	0.61	15.00	120	0.0106	0.1592	4	2.429	2.5878
4000.0	5.76	8.91	14.00	8.34	1.08	15.00	120	0.0181	0.2713	4	4.317	4.5887
5000.0	7.20	11.14	14.00	10.42	1.69	15.00	120	0.0273	0.4101	4	6.746	7.1561
6000.0	8.64	13.37	14.00	12.51	2.43	15.00	120	0.0383	0.5749	4	9.714	10.2890
7000.0	10.08	15.60	14.00	14.59	3.31	15.00	120	0.0510	0.7648	4	13.222	13.9868
7360.0	10.60	16.40	14.00	15.34	3.65	15.00	120	0.0560	0.8393	4	14.617	15.4562
7500.0	10.80	16.71	14.00	15.63	3.79	15.00	120	0.0579	0.8691	4	15.178	16.0474

Suction & Discharge - 16"

Diameter = 16 in
Area = 1.396263 ft^2
RH= 0.333333
C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x $(v^2/2g)$	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	16.00	0.00	0.00	17.00	120	0.0000	0.0000	1.3	0.000	0.0000
1000.0	1.44	2.23	16.00	1.60	0.04	17.00	120	0.0007	0.0123	1.3	0.051	0.0637
2000.0	2.88	4.46	16.00	3.19	0.16	17.00	120	0.0026	0.0444	1.3	0.206	0.2501
3000.0	4.32	6.68	16.00	4.79	0.36	17.00	120	0.0055	0.0942	1.3	0.463	0.5568
4000.0	5.76	8.91	16.00	6.38	0.63	17.00	120	0.0094	0.1605	1.3	0.823	0.9830
5000.0	7.20	11.14	16.00	7.98	0.99	17.00	120	0.0143	0.2426	1.3	1.285	1.5277
6000.0	8.64	13.37	16.00	9.57	1.42	17.00	120	0.0200	0.3400	1.3	1.851	2.1906
7000.0	10.08	15.60	16.00	11.17	1.94	17.00	120	0.0266	0.4523	1.3	2.519	2.9712
7360.0	10.60	16.40	16.00	11.75	2.14	17.00	120	0.0292	0.4963	1.3	2.785	3.2810
7500.0	10.80	16.71	16.00	11.97	2.22	17.00	120	0.0302	0.5140	1.3	2.892	3.4056

Suction & Discharge - 24"

Diameter = 24 in
Area = 3.141592 ft^2
RH= 0.5
C= 120

Bridgehead Pump Station with AFM101

Pump and Suction and Discharge Loss Curves – Main Pumps

Q (gpm)	Q (mgd)	Q (cfs)	Pipe Dia. (in)	V (fps)	$V^2/2g$ (ft)	L (ft)	C	S	Friction Losses S x L (ft)	K	Minor Losses K x ($v^2/2g$) (ft)	Total Losses (ft)
0.0	0.00	0.00	24.00	0.00	0.00	8.25	120	0.0000	0.0000	1.19	0.000	0.0000
1000.00	1.44	2.23	24.00	0.71	0.01	8.25	120	0.0001	0.0008	1.19	0.009	0.0101
2000.0	2.88	4.46	24.00	1.42	0.03	8.25	120	0.0004	0.0030	1.19	0.037	0.0402
3000.00	4.32	6.68	24.00	2.13	0.07	8.25	120	0.0008	0.0063	1.19	0.084	0.0900
4000.0	5.76	8.91	24.00	2.84	0.12	8.25	120	0.0013	0.0108	1.19	0.149	0.1595
5000.00	7.20	11.14	24.00	3.55	0.20	8.25	120	0.0020	0.0163	1.19	0.232	0.2487
6000.0	8.64	13.37	24.00	4.26	0.28	8.25	120	0.0028	0.0229	1.19	0.335	0.3575
7000.0	10.08	15.60	24.00	4.96	0.38	8.25	120	0.0037	0.0305	1.19	0.455	0.4859
7360.0	10.60	16.40	24.00	5.22	0.42	8.25	120	0.0041	0.0334	1.19	0.504	0.5369
7500.0	10.80	16.71	24.00	5.32	0.44	8.25	120	0.0042	0.0346	1.19	0.523	0.5575

Pump Suction and Discharge Losses

Q (gpm)	Q (mgd)	Total Losses S&D (ft)
0.0	0.00	0.0000
1000.0	1.44	0.3645
2000.0	2.88	1.4447
3000.0	4.32	3.2346
4000.0	5.76	5.7312
5000.0	7.20	8.9325
6000.0	8.64	12.8371
7000.0	10.08	17.4440
7360.0	10.60	19.2742
7500.0	10.80	20.0104

Pumps

Mfr Pump Curve

Q (gpm)	Q (mgd)	Mfr Curve Head (ft)
0	0.00	205.60
1000	1.44	203.02
2000	2.88	193.96
3000	4.32	181.90
4000	5.76	168.10
5000	7.20	150.00
6000	8.64	126.72
7000	10.08	96.98
7360	10.60	85.00

S&D Losses S&D (ft)
0.0000
0.3645
1.4447
3.2346
5.7312
8.9325
12.8371
17.4440
19.2742

Adjusted Pump Curves

1 PUMP

Q (gpm)	Q (mgd)	ADJ Curve Head (ft)
0	0.00	205.60
1000	1.44	202.66
2000	2.88	192.52
3000	4.32	178.67
4000	5.76	162.37
5000	7.20	141.07
6000	8.64	113.88
7000	10.08	79.54
7360	10.60	65.73

2 PUMPS

Q (gpm)	Q (mgd)	ADJ Curve Head (ft)
0	0.00	205.6
2000	2.88	202.7
4000	5.76	192.5
6000	8.64	178.7
8000	11.52	162.4
10000	14.40	141.1
12000	17.28	113.9
14000	20.16	79.5
14720	21.20	65.7

Reduced Speed Curves @ 80% Speed

Q (gpm)	Q (mgd)	Mfr Curve Head (ft)
0	0.00	131.584
800	1.15	129.9328
1600	2.30	124.1344
2400	3.46	116.416
3200	4.61	107.584
4000	5.76	96
4800	6.91	81.1008
5600	8.06	62.0672
5888	8.48	54.4

S&D Losses S&D (ft)
0.0000
0.2340
0.9273
2.0757
3.6775
5.7312
8.2359
11.1910
12.3649

Adjusted Pump Curves

1 PUMP

Q (gpm)	Q (mgd)	ADJ Curve Head (ft)
0	0.00	131.6
800	1.15	129.7
1600	2.30	123.2
2400	3.46	114.3
3200	4.61	103.9
4000	5.76	90.3
4800	6.91	72.9
5600	8.06	50.9
5888	8.48	42.0

2 PUMPS

Q (gpm)	Q (mgd)	ADJ Curve Head (ft)
0	0.00	131.6
1600	2.30	129.7
3200	4.61	123.2
4800	6.91	114.3
6400	9.22	103.9
8000	11.52	90.3
9600	13.82	72.9
11200	16.13	50.9
11776	16.96	42.0

Bridgehead Pump Station with AFM101

Pump and Suction and Discharge Loss Curves – Main Pumps

Reduced Speed Curves @ 70% Speed

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
0	0.00	100.744
700	1.01	99.4798
1400	2.02	95.0404
2100	3.02	89.131
2800	4.03	82.369
3500	5.04	73.5
4200	6.05	62.0928
4900	7.06	47.5202
5152	7.42	41.65

S&D Losses S&D
(ft)
0.0000
0.1795
0.7112
1.5919
2.8200
4.3947
6.3151
8.5807
9.4807

Adjusted Pump Curves

1 PUMP		
Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	100.7
700	1.01	99.3
1400	2.02	94.3
2100	3.02	87.5
2800	4.03	79.5
3500	5.04	69.1
4200	6.05	55.8
4900	7.06	38.9
5152	7.42	32.2

2 PUMPS		
Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	100.7
1400	2.02	99.3
2800	4.03	94.3
4200	6.05	87.5
5600	8.06	79.5
7000	10.08	69.1
8400	12.10	55.8
9800	14.11	38.9
10304	14.84	32.2

Reduced Speed Curves @ 68% Speed

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
0	0.00	95.06944
680	0.98	93.876448
1360	1.96	89.687104
2040	2.94	84.11056
2720	3.92	77.72944
3400	4.90	69.36
4080	5.88	58.595328
4760	6.85	44.843552
5005	7.21	39.304

S&D Losses S&D
(ft)
0.0000
0.1695
0.6714
1.5027
2.6621
4.1486
5.9614
8.1000
8.9496

Adjusted Pump Curves

1 PUMP		
Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	95.1
680	0.98	93.7
1360	1.96	89.0
2040	2.94	82.6
2720	3.92	75.1
3400	4.90	65.2
4080	5.88	52.6
4760	6.85	36.7
5005	7.21	30.4

2 PUMPS		
Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	95.1
1360	1.96	93.7
2720	3.92	89.0
4080	5.88	82.6
5440	7.83	75.1
6800	9.79	65.2
8160	11.75	52.6
9520	13.71	36.7
10010	14.41	30.4

Reduced Speed Curves @ 60% Speed

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
0	0.00	74.016
600	0.86	73.0872
1200	1.73	69.8256
1800	2.59	65.484
2400	3.46	60.516
3000	4.32	54
3600	5.18	45.6192
4200	6.05	34.9128
4416	6.36	30.6

S&D Losses S&D
(ft)
0.0000
0.1322
0.5236
1.1718
2.0757
3.2346
4.6479
6.3151
6.9774

Adjusted Pump Curves

1 PUMP		
Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	74.0
600	0.86	73.0
1200	1.73	69.3
1800	2.59	64.3
2400	3.46	58.4
3000	4.32	50.8
3600	5.18	41.0
4200	6.05	28.6
4416	6.36	23.6

2 PUMPS		
Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	74.0
1200	1.73	73.0
2400	3.46	69.3
3600	5.18	64.3
4800	6.91	58.4
6000	8.64	50.8
7200	10.37	41.0
8400	12.10	28.6
8832	12.72	23.6

Reduced Speed Curves @ 50% Speed

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
0	0.00	51.4
500	0.72	50.755
1000	1.44	48.49
1500	2.16	45.475
2000	2.88	42.025
2500	3.60	37.5
3000	4.32	31.68
3500	5.04	24.245
3680	5.30	21.25

S&D Losses S&D
(ft)
0.0000
0.0920
0.3645
0.8157
1.4447
2.2512
3.2346
4.3947
4.8555

Adjusted Pump Curves

1 PUMP		
Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	51.4
500	0.72	50.7
1000	1.44	48.1
1500	2.16	44.7
2000	2.88	40.6
2500	3.60	35.2
3000	4.32	28.4
3500	5.04	19.9
3680	5.30	16.4

2 PUMPS		
Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	51.4
1000	1.44	50.7
2000	2.88	48.1
3000	4.32	44.7
4000	5.76	40.6
5000	7.20	35.2
6000	8.64	28.4
7000	10.08	19.9
7360	10.60	16.4

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – First High Point

FM System Curve - 24"

Diameter = 24 in
Area = 3.141593 ft^2
RH= 0.5
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – First High Point

13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve - 24" (14" parallel FM portion)

Diameter = 24 in

Area = 3.141593 ft^2

RH= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	316.00	100	0.0000	0.0000	3.8	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	316.00	100	0.0000	0.0034	3.8	0.002	0.0053
500.0	0.72	1.11	24.00	0.35	0.00	316.00	100	0.0000	0.0123	3.8	0.007	0.0198
750.0	1.08	1.67	24.00	0.53	0.00	316.00	100	0.0001	0.0261	3.8	0.017	0.0428
1000.0	1.44	2.23	24.00	0.71	0.01	316.00	100	0.0001	0.0445	3.8	0.030	0.0742
1250.0	1.80	2.79	24.00	0.89	0.01	316.00	100	0.0002	0.0673	3.8	0.046	0.1137
1500.0	2.16	3.34	24.00	1.06	0.02	316.00	100	0.0003	0.0943	3.8	0.067	0.1611
1750.0	2.52	3.90	24.00	1.24	0.02	316.00	100	0.0004	0.1255	3.8	0.091	0.2164
2000.0	2.88	4.46	24.00	1.42	0.03	316.00	100	0.0005	0.1607	3.8	0.119	0.2794
2250.0	3.24	5.01	24.00	1.60	0.04	316.00	100	0.0006	0.1999	3.8	0.150	0.3501
2500.0	3.60	5.57	24.00	1.77	0.05	316.00	100	0.0008	0.2429	3.8	0.186	0.4284
2750.0	3.96	6.13	24.00	1.95	0.06	316.00	100	0.0009	0.2898	3.8	0.224	0.5143
3000.0	4.32	6.68	24.00	2.13	0.07	316.00	100	0.0011	0.3405	3.8	0.267	0.6077
3250.0	4.68	7.24	24.00	2.31	0.08	316.00	100	0.0012	0.3949	3.8	0.314	0.7084
3500.0	5.04	7.80	24.00	2.48	0.10	316.00	100	0.0014	0.4530	3.8	0.364	0.8166
3750.0	5.40	8.36	24.00	2.66	0.11	316.00	100	0.0016	0.5148	3.8	0.417	0.9322
4000.0	5.76	8.91	24.00	2.84	0.12	316.00	100	0.0018	0.5801	3.8	0.475	1.0550
4250.0	6.12	9.47	24.00	3.01	0.14	316.00	100	0.0021	0.6491	3.8	0.536	1.1852
4500.0	6.48	10.03	24.00	3.19	0.16	316.00	100	0.0023	0.7215	3.8	0.601	1.3226
4750.0	6.84	10.58	24.00	3.37	0.18	316.00	100	0.0025	0.7975	3.8	0.670	1.4672
5000.0	7.20	11.14	24.00	3.55	0.20	316.00	100	0.0028	0.8770	3.8	0.742	1.6191
5250.0	7.56	11.70	24.00	3.72	0.22	316.00	100	0.0030	0.9599	3.8	0.818	1.7781
5500.0	7.92	12.25	24.00	3.90	0.24	316.00	100	0.0033	1.0463	3.8	0.898	1.9442
5750.0	8.28	12.81	24.00	4.08	0.26	316.00	100	0.0036	1.1361	3.8	0.981	2.1175
6000.0	8.64	13.37	24.00	4.26	0.28	316.00	100	0.0039	1.2293	3.8	1.069	2.2978
6250.0	9.00	13.93	24.00	4.43	0.31	316.00	100	0.0042	1.3258	3.8	1.159	2.4853
6500.0	9.36	14.48	24.00	4.61	0.33	316.00	100	0.0045	1.4257	3.8	1.254	2.6798
6750.0	9.72	15.04	24.00	4.79	0.36	316.00	100	0.0048	1.5289	3.8	1.352	2.8813
7000.0	10.08	15.60	24.00	4.96	0.38	316.00	100	0.0052	1.6354	3.8	1.454	3.0898
7250.0	10.44	16.15	24.00	5.14	0.41	316.00	100	0.0055	1.7452	3.8	1.560	3.3054
7500.0	10.80	16.71	24.00	5.32	0.44	316.00	100	0.0059	1.8583	3.8	1.670	3.5279
7750.0	11.16	17.27	24.00	5.50	0.47	316.00	100	0.0062	1.9747	3.8	1.783	3.7575
8000.0	11.52	17.83	24.00	5.67	0.50	316.00	100	0.0066	2.0943	3.8	1.900	3.9939
8250.0	11.88	18.38	24.00	5.85	0.53	316.00	100	0.0070	2.2171	3.8	2.020	4.2373
8500.0	12.24	18.94	24.00	6.03	0.56	316.00	100	0.0074	2.3431	3.8	2.145	4.4876
8750.0	12.60	19.50	24.00	6.21	0.60	316.00	100	0.0078	2.4723	3.8	2.273	4.7449
9000.0	12.96	20.05	24.00	6.38	0.63	316.00	100	0.0082	2.6048	3.8	2.404	5.0090
9250.0	13.32	20.61	24.00	6.56	0.67	316.00	100	0.0087	2.7403	3.8	2.540	5.2800
9500.0	13.68	21.17	24.00	6.74	0.70	316.00	100	0.0091	2.8791	3.8	2.679	5.5579
9750.0	14.04	21.72	24.00	6.92	0.74	316.00	100	0.0096	3.0210	3.8	2.822	5.8426
10000.0	14.40	22.28	24.00	7.09	0.78	316.00	100	0.0100	3.1660	3.8	2.968	6.1342

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – First High Point

10250.0	14.76	22.84	24.00	7.27	0.82	316.00	100	0.0105	3.3141	3.8	3.118	6.4326
10500.0	15.12	23.40	24.00	7.45	0.86	316.00	100	0.0110	3.4654	3.8	3.272	6.7378
10750.0	15.48	23.95	24.00	7.62	0.90	316.00	100	0.0115	3.6197	3.8	3.430	7.0499
11000.0	15.84	24.51	24.00	7.80	0.95	316.00	100	0.0120	3.7772	3.8	3.592	7.3687
11250.0	16.20	25.07	24.00	7.98	0.99	316.00	100	0.0125	3.9377	3.8	3.757	7.6943
11500.0	16.56	25.62	24.00	8.16	1.03	316.00	100	0.0130	4.1013	3.8	3.925	8.0267
11750.0	16.92	26.18	24.00	8.33	1.08	316.00	100	0.0135	4.2680	3.8	4.098	8.3659
12000.0	17.28	26.74	24.00	8.51	1.12	316.00	100	0.0140	4.4377	3.8	4.274	8.7119
12250.0	17.64	27.30	24.00	8.69	1.17	316.00	100	0.0146	4.6104	3.8	4.454	9.0645
12500.0	18.00	27.85	24.00	8.87	1.22	316.00	100	0.0151	4.7862	3.8	4.638	9.4240
12750.0	18.36	28.41	24.00	9.04	1.27	316.00	100	0.0157	4.9650	3.8	4.825	9.7901
13000.0	18.72	28.97	24.00	9.22	1.32	316.00	100	0.0163	5.1468	3.8	5.016	10.1630
13250.0	19.08	29.52	24.00	9.40	1.37	316.00	100	0.0169	5.3316	3.8	5.211	10.5426
13500.0	19.44	30.08	24.00	9.57	1.42	316.00	100	0.0175	5.5194	3.8	5.410	10.9289
13750.0	19.80	30.64	24.00	9.75	1.48	316.00	100	0.0181	5.7101	3.8	5.612	11.3219
14000.0	20.16	31.19	24.00	9.93	1.53	316.00	100	0.0187	5.9039	3.8	5.818	11.7216
14250.0	20.52	31.75	24.00	10.11	1.59	316.00	100	0.0193	6.1006	3.8	6.027	12.1279
14500.0	20.88	32.31	24.00	10.28	1.64	316.00	100	0.0199	6.3003	3.8	6.241	12.5410
14750.0	21.24	32.87	24.00	10.46	1.70	316.00	100	0.0206	6.5030	3.8	6.458	12.9607
15000.0	21.60	33.42	24.00	10.64	1.76	316.00	100	0.0212	6.7086	3.8	6.678	13.3870
15250.0	21.96	33.98	24.00	10.82	1.82	316.00	100	0.0219	6.9171	3.8	6.903	13.8200
15500.0	22.32	34.54	24.00	10.99	1.88	316.00	100	0.0226	7.1286	3.8	7.131	14.2597
15750.0	22.68	35.09	24.00	11.17	1.94	316.00	100	0.0232	7.3430	3.8	7.363	14.7060
16000.0	23.04	35.65	24.00	11.35	2.00	316.00	100	0.0239	7.5603	3.8	7.599	15.1589

FM System Curve - 14" (14" parallel FM portion)

Diameter = 14 in

Area = 1.069 ft^2

RH= 0.2917

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	14.00	0.00	0.00	68.50	100	0.0000	0.0000	1.72	0.000	0.0000
250.0	0.36	0.56	14.00	0.52	0.00	68.50	100	0.0001	0.0102	1.72	0.007	0.0175
500.0	0.72	1.11	14.00	1.04	0.02	68.50	100	0.0005	0.0369	1.72	0.029	0.0659
750.0	1.08	1.67	14.00	1.56	0.04	68.50	100	0.0011	0.0782	1.72	0.065	0.1435
1000.0	1.44	2.23	14.00	2.08	0.07	68.50	100	0.0019	0.1333	1.72	0.116	0.2493
1250.0	1.80	2.79	14.00	2.61	0.11	68.50	100	0.0029	0.2014	1.72	0.181	0.3827
1500.0	2.16	3.34	14.00	3.13	0.15	68.50	100	0.0041	0.2824	1.72	0.261	0.5434
1750.0	2.52	3.90	14.00	3.65	0.21	68.50	100	0.0055	0.3756	1.72	0.355	0.7310
2000.0	2.88	4.46	14.00	4.17	0.27	68.50	100	0.0070	0.4810	1.72	0.464	0.9452
2250.0	3.24	5.01	14.00	4.69	0.34	68.50	100	0.0087	0.5983	1.72	0.587	1.1857
2500.0	3.60	5.57	14.00	5.21	0.42	68.50	100	0.0106	0.7272	1.72	0.725	1.4524
2750.0	3.96	6.13	14.00	5.73	0.51	68.50	100	0.0127	0.8676	1.72	0.877	1.7451
3000.0	4.32	6.68	14.00	6.25	0.61	68.50	100	0.0149	1.0193	1.72	1.044	2.0636
3250.0	4.68	7.24	14.00	6.77	0.71	68.50	100	0.0173	1.1822	1.72	1.226	2.4077
3500.0	5.04	7.80	14.00	7.30	0.83	68.50	100	0.0198	1.3561	1.72	1.421	2.7775
3750.0	5.40	8.36	14.00	7.82	0.95	68.50	100	0.0225	1.5409	1.72	1.632	3.1726
4000.0	5.76	8.91	14.00	8.34	1.08	68.50	100	0.0254	1.7366	1.72	1.856	3.5930
4250.0	6.12	9.47	14.00	8.86	1.22	68.50	100	0.0284	1.9429	1.72	2.096	4.0387
4500.0	6.48	10.03	14.00	9.38	1.37	68.50	100	0.0315	2.1599	1.72	2.350	4.5095
4750.0	6.84	10.58	14.00	9.90	1.52	68.50	100	0.0349	2.3873	1.72	2.618	5.0053
5000.0	7.20	11.14	14.00	10.42	1.69	68.50	100	0.0383	2.6252	1.72	2.901	5.5260
5250.0	7.56	11.70	14.00	10.94	1.86	68.50	100	0.0419	2.8735	1.72	3.198	6.0716
5500.0	7.92	12.25	14.00	11.46	2.04	68.50	100	0.0457	3.1320	1.72	3.510	6.6420
5750.0	8.28	12.81	14.00	11.98	2.23	68.50	100	0.0496	3.4008	1.72	3.836	7.2370
6000.0	8.64	13.37	14.00	12.51	2.43	68.50	100	0.0537	3.6797	1.72	4.177	7.8568
6250.0	9.00	13.93	14.00	13.03	2.64	68.50	100	0.0579	3.9687	1.72	4.532	8.5011
6500.0	9.36	14.48	14.00	13.55	2.85	68.50	100	0.0623	4.2677	1.72	4.902	9.1699
6750.0	9.72	15.04	14.00	14.07	3.07	68.50	100	0.0668	4.5766	1.72	5.287	9.8633

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – First High Point

7000.0	10.08	15.60	14.00	14.59	3.31	68.50	100	0.0715	4.8955	1.72	5.685	10.5810
7250.0	10.44	16.15	14.00	15.11	3.55	68.50	100	0.0763	5.2242	1.72	6.099	11.3231
7500.0	10.80	16.71	14.00	15.63	3.79	68.50	100	0.0812	5.5628	1.72	6.527	12.0894
7750.0	11.16	17.27	14.00	16.15	4.05	68.50	100	0.0863	5.9110	1.72	6.969	12.8801
8000.0	11.52	17.83	14.00	16.67	4.32	68.50	100	0.0915	6.2690	1.72	7.426	13.6949
8250.0	11.88	18.38	14.00	17.20	4.59	68.50	100	0.0969	6.6367	1.72	7.897	14.5339
8500.0	12.24	18.94	14.00	17.72	4.87	68.50	100	0.1024	7.0139	1.72	8.383	15.3971
8750.0	12.60	19.50	14.00	18.24	5.16	68.50	100	0.1080	7.4007	1.72	8.884	16.2843
9000.0	12.96	20.05	14.00	18.76	5.46	68.50	100	0.1138	7.7971	1.72	9.398	17.1955
9250.0	13.32	20.61	14.00	19.28	5.77	68.50	100	0.1198	8.2030	1.72	9.928	18.1308
9500.0	13.68	21.17	14.00	19.80	6.09	68.50	100	0.1258	8.6183	1.72	10.472	19.0900
9750.0	14.04	21.72	14.00	20.32	6.41	68.50	100	0.1320	9.0430	1.72	11.030	20.0731
10000.0	14.40	22.28	14.00	20.84	6.75	68.50	100	0.1384	9.4771	1.72	11.603	21.0801
10250.0	14.76	22.84	14.00	21.36	7.09	68.50	100	0.1448	9.9206	1.72	12.190	22.1110
10500.0	15.12	23.40	14.00	21.89	7.44	68.50	100	0.1514	10.3734	1.72	12.792	23.1657
10750.0	15.48	23.95	14.00	22.41	7.80	68.50	100	0.1582	10.8354	1.72	13.409	24.2441
11000.0	15.84	24.51	14.00	22.93	8.16	68.50	100	0.1651	11.3067	1.72	14.040	25.3463
11250.0	16.20	25.07	14.00	23.45	8.54	68.50	100	0.1721	11.7872	1.72	14.685	26.4722
11500.0	16.56	25.62	14.00	23.97	8.92	68.50	100	0.1792	12.2769	1.72	15.345	27.6219
11750.0	16.92	26.18	14.00	24.49	9.31	68.50	100	0.1865	12.7758	1.72	16.019	28.7951
12000.0	17.28	26.74	14.00	25.01	9.71	68.50	100	0.1939	13.2837	1.72	16.708	29.9920
12250.0	17.64	27.30	14.00	25.53	10.12	68.50	100	0.2015	13.8008	1.72	17.412	31.2126
12500.0	18.00	27.85	14.00	26.05	10.54	68.50	100	0.2092	14.3270	1.72	18.130	32.4566
12750.0	18.36	28.41	14.00	26.58	10.97	68.50	100	0.2170	14.8621	1.72	18.862	33.7243
13000.0	18.72	28.97	14.00	27.10	11.40	68.50	100	0.2249	15.4063	1.72	19.609	35.0154
13250.0	19.08	29.52	14.00	27.62	11.84	68.50	100	0.2330	15.9595	1.72	20.371	36.3300
13500.0	19.44	30.08	14.00	28.14	12.29	68.50	100	0.2412	16.5217	1.72	21.146	37.6682
13750.0	19.80	30.64	14.00	28.66	12.75	68.50	100	0.2495	17.0928	1.72	21.937	39.0297
14000.0	20.16	31.19	14.00	29.18	13.22	68.50	100	0.2580	17.6728	1.72	22.742	40.4147
14250.0	20.52	31.75	14.00	29.70	13.70	68.50	100	0.2666	18.2617	1.72	23.561	41.8230
14500.0	20.88	32.31	14.00	30.22	14.18	68.50	100	0.2753	18.8595	1.72	24.395	43.2548
14750.0	21.24	32.87	14.00	30.74	14.68	68.50	100	0.2842	19.4661	1.72	25.244	44.7099
15000.0	21.60	33.42	14.00	31.26	15.18	68.50	100	0.2932	20.0816	1.72	26.107	46.1883
15250.0	21.96	33.98	14.00	31.79	15.69	68.50	100	0.3023	20.7058	1.72	26.984	47.6900
15500.0	22.32	34.54	14.00	32.31	16.21	68.50	100	0.3115	21.3388	1.72	27.876	49.2150
15750.0	22.68	35.09	14.00	32.83	16.73	68.50	100	0.3209	21.9806	1.72	28.783	50.7633
16000.0	23.04	35.65	14.00	33.35	17.27	68.50	100	0.3304	22.6312	1.72	29.704	52.3348

FM System Curve – 13.5" (14" PVC) (14" parallel FM portion)

Diameter = 13.5 in

Area = 0.99402 ft^2

RH= 0.28125

C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	13.50	0.00	0.00	10640.50	120	0.0000	0.0000	3.1	0.000	0.0000
250.0	0.36	0.56	13.50	0.56	0.00	10640.50	120	0.0001	1.3528	3.1	0.015	1.3679
500.0	0.72	1.11	13.50	1.12	0.02	10640.50	120	0.0005	4.8835	3.1	0.060	4.9439
750.0	1.08	1.67	13.50	1.68	0.04	10640.50	120	0.0010	10.3478	3.1	0.136	10.4839
1000.0	1.44	2.23	13.50	2.24	0.08	10640.50	120	0.0017	17.6293	3.1	0.242	17.8711
1250.0	1.80	2.79	13.50	2.80	0.12	10640.50	120	0.0025	26.6509	3.1	0.378	27.0288
1500.0	2.16	3.34	13.50	3.36	0.18	10640.50	120	0.0035	37.3556	3.1	0.544	37.8998
1750.0	2.52	3.90	13.50	3.92	0.24	10640.50	120	0.0047	49.6982	3.1	0.741	50.4390
2000.0	2.88	4.46	13.50	4.48	0.31	10640.50	120	0.0060	63.6417	3.1	0.967	64.6092
2250.0	3.24	5.01	13.50	5.04	0.39	10640.50	120	0.0074	79.1547	3.1	1.224	80.3791
2500.0	3.60	5.57	13.50	5.60	0.49	10640.50	120	0.0090	96.2098	3.1	1.512	97.7215
2750.0	3.96	6.13	13.50	6.16	0.59	10640.50	120	0.0108	114.7833	3.1	1.829	116.6124
3000.0	4.32	6.68	13.50	6.72	0.70	10640.50	120	0.0127	134.8538	3.1	2.177	137.0306
3250.0	4.68	7.24	13.50	7.29	0.82	10640.50	120	0.0147	156.4021	3.1	2.555	158.9568
3500.0	5.04	7.80	13.50	7.85	0.96	10640.50	120	0.0169	179.4108	3.1	2.963	182.3737
3750.0	5.40	8.36	13.50	8.41	1.10	10640.50	120	0.0192	203.8640	3.1	3.401	207.2652
4000.0	5.76	8.91	13.50	8.97	1.25	10640.50	120	0.0216	229.7469	3.1	3.870	233.6168

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – First High Point

4250.0	6.12	9.47	13.50	9.53	1.41	10640.50	120	0.0242	257.0460	3.1	4.369	261.4148
4500.0	6.48	10.03	13.50	10.09	1.58	10640.50	120	0.0269	285.7486	3.1	4.898	290.6465
4750.0	6.84	10.58	13.50	10.65	1.76	10640.50	120	0.0297	315.8429	3.1	5.457	321.3001
5000.0	7.20	11.14	13.50	11.21	1.95	10640.50	120	0.0326	347.3178	3.1	6.047	353.3645
5250.0	7.56	11.70	13.50	11.77	2.15	10640.50	120	0.0357	380.1628	3.1	6.667	386.8293
5500.0	7.92	12.25	13.50	12.33	2.36	10640.50	120	0.0389	414.3680	3.1	7.317	421.6846
5750.0	8.28	12.81	13.50	12.89	2.58	10640.50	120	0.0423	449.9242	3.1	7.997	457.9210
6000.0	8.64	13.37	13.50	13.45	2.81	10640.50	120	0.0458	486.8225	3.1	8.707	495.5298
6250.0	9.00	13.93	13.50	14.01	3.05	10640.50	120	0.0493	525.0544	3.1	9.448	534.5025
6500.0	9.36	14.48	13.50	14.57	3.30	10640.50	120	0.0531	564.6120	3.1	10.219	574.8309
6750.0	9.72	15.04	13.50	15.13	3.55	10640.50	120	0.0569	605.4874	3.1	11.020	616.5076
7000.0	10.08	15.60	13.50	15.69	3.82	10640.50	120	0.0609	647.6735	3.1	11.852	659.5251
7250.0	10.44	16.15	13.50	16.25	4.10	10640.50	120	0.0650	691.1631	3.1	12.713	703.8763
7500.0	10.80	16.71	13.50	16.81	4.39	10640.50	120	0.0692	735.9495	3.1	13.605	749.5546
7750.0	11.16	17.27	13.50	17.37	4.69	10640.50	120	0.0735	782.0262	3.1	14.527	796.5535
8000.0	11.52	17.83	13.50	17.93	4.99	10640.50	120	0.0779	829.3870	3.1	15.480	844.8666
8250.0	11.88	18.38	13.50	18.49	5.31	10640.50	120	0.0825	878.0258	3.1	16.462	894.4880
8500.0	12.24	18.94	13.50	19.05	5.64	10640.50	120	0.0872	927.9368	3.1	17.475	945.4118
8750.0	12.60	19.50	13.50	19.61	5.97	10640.50	120	0.0920	979.1145	3.1	18.518	997.6326
9000.0	12.96	20.05	13.50	20.17	6.32	10640.50	120	0.0969	1031.5533	3.1	19.591	1051.1447
9250.0	13.32	20.61	13.50	20.73	6.68	10640.50	120	0.1020	1085.2481	3.1	20.695	1105.9430
9500.0	13.68	21.17	13.50	21.29	7.04	10640.50	120	0.1072	1140.1938	3.1	21.829	1162.0225
9750.0	14.04	21.72	13.50	21.86	7.42	10640.50	120	0.1124	1196.3854	3.1	22.993	1219.3781
10000.0	14.40	22.28	13.50	22.42	7.80	10640.50	120	0.1178	1253.8181	3.1	24.187	1278.0050
10250.0	14.76	22.84	13.50	22.98	8.20	10640.50	120	0.1233	1312.4874	3.1	25.411	1337.8988
10500.0	15.12	23.40	13.50	23.54	8.60	10640.50	120	0.1290	1372.3887	3.1	26.666	1399.0548
10750.0	15.48	23.95	13.50	24.10	9.02	10640.50	120	0.1347	1433.5176	3.1	27.951	1461.4686
11000.0	15.84	24.51	13.50	24.66	9.44	10640.50	120	0.1406	1495.8698	3.1	29.266	1525.1360
11250.0	16.20	25.07	13.50	25.22	9.87	10640.50	120	0.1466	1559.4413	3.1	30.612	1590.0528
11500.0	16.56	25.62	13.50	25.78	10.32	10640.50	120	0.1526	1624.2278	3.1	31.987	1656.2150
11750.0	16.92	26.18	13.50	26.34	10.77	10640.50	120	0.1588	1690.2256	3.1	33.393	1723.6187
12000.0	17.28	26.74	13.50	26.90	11.24	10640.50	120	0.1652	1757.4307	3.1	34.829	1792.2599
12250.0	17.64	27.30	13.50	27.46	11.71	10640.50	120	0.1716	1825.8394	3.1	36.295	1862.1349
12500.0	18.00	27.85	13.50	28.02	12.19	10640.50	120	0.1781	1895.4481	3.1	37.792	1933.2401
12750.0	18.36	28.41	13.50	28.58	12.68	10640.50	120	0.1848	1966.2531	3.1	39.319	2005.5719
13000.0	18.72	28.97	13.50	29.14	13.19	10640.50	120	0.1916	2038.2509	3.1	40.876	2079.1267
13250.0	19.08	29.52	13.50	29.70	13.70	10640.50	120	0.1984	2111.4381	3.1	42.463	2153.9012
13500.0	19.44	30.08	13.50	30.26	14.22	10640.50	120	0.2054	2185.8114	3.1	44.081	2229.8920
13750.0	19.80	30.64	13.50	30.82	14.75	10640.50	120	0.2125	2261.3675	3.1	45.728	2307.0959
14000.0	20.16	31.19	13.50	31.38	15.29	10640.50	120	0.2197	2338.1032	3.1	47.406	2385.5095
14250.0	20.52	31.75	13.50	31.94	15.84	10640.50	120	0.2271	2416.0153	3.1	49.115	2465.1298
14500.0	20.88	32.31	13.50	32.50	16.40	10640.50	120	0.2345	2495.1008	3.1	50.853	2545.9537
14750.0	21.24	32.87	13.50	33.06	16.97	10640.50	120	0.2420	2575.3566	3.1	52.622	2627.9782
15000.0	21.60	33.42	13.50	33.62	17.56	10640.50	120	0.2497	2656.7798	3.1	54.421	2711.2003
15250.0	21.96	33.98	13.50	34.18	18.15	10640.50	120	0.2574	2739.3675	3.1	56.250	2795.6172
15500.0	22.32	34.54	13.50	34.74	18.74	10640.50	120	0.2653	2823.1168	3.1	58.109	2881.2259
15750.0	22.68	35.09	13.50	35.30	19.35	10640.50	120	0.2733	2908.0250	3.1	59.999	2968.0237
16000.0	23.04	35.65	13.50	35.87	19.97	10640.50	120	0.2814	2994.0893	3.1	61.918	3056.0078

FM System Curve - 23.85" (28" HDPE)

Diameter =	23.85	in
Area =	3.1024	ft^2
RH=D/4=	0.4969	
C=	120	

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	619.99	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	619.99	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	619.99	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	619.99	120	0.0001	0.0377	2.7	0.012	0.0499

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – First High Point

1000.0	1.44	2.23	23.85	0.72	0.01	619.99	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	619.99	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	619.99	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	619.99	120	0.0003	0.1811	2.7	0.066	0.2473
2000.0	2.88	4.46	23.85	1.44	0.03	619.99	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	619.99	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	619.99	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	619.99	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	619.99	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	619.99	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	619.99	120	0.0011	0.6538	2.7	0.265	0.9187
3750.0	5.40	8.36	23.85	2.69	0.11	619.99	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	619.99	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	619.99	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	619.99	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	619.99	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	619.99	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	619.99	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	619.99	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	619.99	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	619.99	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	619.99	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	619.99	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	619.99	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	619.99	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	619.99	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	619.99	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	619.99	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	619.99	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	619.99	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	619.99	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	619.99	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	619.99	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	619.99	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	619.99	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	619.99	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	619.99	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	619.99	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	619.99	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	619.99	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	619.99	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	619.99	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	619.99	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	619.99	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	619.99	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	619.99	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	619.99	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	619.99	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	619.99	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	619.99	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	619.99	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	619.99	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	619.99	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	619.99	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	619.99	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	619.99	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	619.99	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	619.99	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	619.99	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	619.99	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	619.99	120	0.0176	10.9108	2.7	5.536	16.4469

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – First High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	1.40
500.0	0.72	5.06
750.0	1.08	10.73
1000.0	1.44	18.30
1250.0	1.80	27.69
1500.0	2.16	38.84
1750.0	2.52	51.70
2000.0	2.88	66.24
2250.0	3.24	82.42
2500.0	3.60	100.22
2750.0	3.96	119.62
3000.0	4.32	140.58
3250.0	4.68	163.10
3500.0	5.04	187.15
3750.0	5.40	212.71
4000.0	5.76	239.78
4250.0	6.12	268.35
4500.0	6.48	298.38
4750.0	6.84	329.88
5000.0	7.20	362.84
5250.0	7.56	397.23
5500.0	7.92	433.06
5750.0	8.28	470.31
6000.0	8.64	508.98
6250.0	9.00	549.05
6500.0	9.36	590.52
6750.0	9.72	633.38
7000.0	10.08	677.62
7250.0	10.44	723.24
7500.0	10.80	770.22
7750.0	11.16	818.57
8000.0	11.52	868.27
8250.0	11.88	919.32
8500.0	12.24	971.71
8750.0	12.60	1025.44
9000.0	12.96	1080.50
9250.0	13.32	1136.89
9500.0	13.68	1194.61
9750.0	14.04	1253.63
10000.0	14.40	1313.97
10250.0	14.76	1375.62
10500.0	15.12	1438.57
10750.0	15.48	1502.81
11000.0	15.84	1568.35
11250.0	16.20	1635.18
11500.0	16.56	1703.30
11750.0	16.92	1772.70
12000.0	17.28	1843.37
12250.0	17.64	1915.32
12500.0	18.00	1988.54
12750.0	18.36	2063.02
13000.0	18.72	2138.77
13250.0	19.08	2215.77
13500.0	19.44	2294.03
13750.0	19.80	2373.55
14000.0	20.16	2454.31
14250.0	20.52	2536.32
14500.0	20.88	2619.57
14750.0	21.24	2704.07
15000.0	21.60	2789.80
15250.0	21.96	2876.76
15500.0	22.32	2964.95
15750.0	22.68	3054.38
16000.0	23.04	3145.02

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	58.13	62.63
250.0	0.36	59.53	64.03
500.0	0.72	63.19	67.69
750.0	1.08	68.86	73.36
1000.0	1.44	76.43	80.93
1250.0	1.80	85.82	90.32
1500.0	2.16	96.97	101.47
1750.0	2.52	109.83	114.33
2000.0	2.88	124.37	128.87
2250.0	3.24	140.55	145.05
2500.0	3.60	158.35	162.85
2750.0	3.96	177.75	182.25
3000.0	4.32	198.71	203.21
3250.0	4.68	221.23	225.73
3500.0	5.04	245.28	249.78
3750.0	5.40	270.84	275.34
4000.0	5.76	297.91	302.41
4250.0	6.12	326.48	330.98
4500.0	6.48	356.51	361.01
4750.0	6.84	388.01	392.51
5000.0	7.20	420.97	425.47
5250.0	7.56	455.36	459.86
5500.0	7.92	491.19	495.69
5750.0	8.28	528.44	532.94
6000.0	8.64	567.11	571.61
6250.0	9.00	607.18	611.68
6500.0	9.36	648.65	653.15
6750.0	9.72	691.51	696.01
7000.0	10.08	735.75	740.25
7250.0	10.44	781.37	785.87
7500.0	10.80	828.35	832.85
7750.0	11.16	876.70	881.20
8000.0	11.52	926.40	930.90
8250.0	11.88	977.45	981.95
8500.0	12.24	1029.84	1034.34
8750.0	12.60	1083.57	1088.07
9000.0	12.96	1138.63	1143.13
9250.0	13.32	1195.02	1199.52
9500.0	13.68	1252.74	1257.24
9750.0	14.04	1311.76	1316.26
10000.0	14.40	1372.10	1376.60
10250.0	14.76	1433.75	1438.25
10500.0	15.12	1496.70	1501.20
10750.0	15.48	1560.94	1565.44
11000.0	15.84	1626.48	1630.98
11250.0	16.20	1693.31	1697.81
11500.0	16.56	1761.43	1765.93
11750.0	16.92	1830.83	1835.33
12000.0	17.28	1901.50	1906.00
12250.0	17.64	1973.45	1977.95
12500.0	18.00	2046.67	2051.17
12750.0	18.36	2121.15	2125.65
13000.0	18.72	2196.90	2201.40
13250.0	19.08	2273.90	2278.40
13500.0	19.44	2352.16	2356.66
13750.0	19.80	2431.68	2436.18
14000.0	20.16	2512.44	2516.94
14250.0	20.52	2594.45	2598.95
14500.0	20.88	2677.70	2682.20
14750.0	21.24	2762.20	2766.70
15000.0	21.60	2847.93	2852.43
15250.0	21.96	2934.89	2939.39
15500.0	22.32	3023.08	3027.58
15750.0	22.68	3112.51	3117.01
16000.0	23.04	3203.15	3207.65

MIN Static Head = 58.13
MAX Static Head = 62.63

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only –A Modified High Point

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FM System Curve - 24"

Diameter = 24 in

Area = 3.141593 ft^2

RH= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071
13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only –A Modified High Point

13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve - 24" (14" parallel FM portion)

Diameter = 24 in

Area = 3.141593 ft^2

RH= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	316.00	100	0.0000	0.0000	3.8	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	316.00	100	0.0000	0.0034	3.8	0.002	0.0053
500.0	0.72	1.11	24.00	0.35	0.00	316.00	100	0.0000	0.0123	3.8	0.007	0.0198
750.0	1.08	1.67	24.00	0.53	0.00	316.00	100	0.0001	0.0261	3.8	0.017	0.0428
1000.0	1.44	2.23	24.00	0.71	0.01	316.00	100	0.0001	0.0445	3.8	0.030	0.0742
1250.0	1.80	2.79	24.00	0.89	0.01	316.00	100	0.0002	0.0673	3.8	0.046	0.1137
1500.0	2.16	3.34	24.00	1.06	0.02	316.00	100	0.0003	0.0943	3.8	0.067	0.1611
1750.0	2.52	3.90	24.00	1.24	0.02	316.00	100	0.0004	0.1255	3.8	0.091	0.2164
2000.0	2.88	4.46	24.00	1.42	0.03	316.00	100	0.0005	0.1607	3.8	0.119	0.2794
2250.0	3.24	5.01	24.00	1.60	0.04	316.00	100	0.0006	0.1999	3.8	0.150	0.3501
2500.0	3.60	5.57	24.00	1.77	0.05	316.00	100	0.0008	0.2429	3.8	0.186	0.4284
2750.0	3.96	6.13	24.00	1.95	0.06	316.00	100	0.0009	0.2898	3.8	0.224	0.5143
3000.0	4.32	6.68	24.00	2.13	0.07	316.00	100	0.0011	0.3405	3.8	0.267	0.6077
3250.0	4.68	7.24	24.00	2.31	0.08	316.00	100	0.0012	0.3949	3.8	0.314	0.7084
3500.0	5.04	7.80	24.00	2.48	0.10	316.00	100	0.0014	0.4530	3.8	0.364	0.8166
3750.0	5.40	8.36	24.00	2.66	0.11	316.00	100	0.0016	0.5148	3.8	0.417	0.9322
4000.0	5.76	8.91	24.00	2.84	0.12	316.00	100	0.0018	0.5801	3.8	0.475	1.0550
4250.0	6.12	9.47	24.00	3.01	0.14	316.00	100	0.0021	0.6491	3.8	0.536	1.1852
4500.0	6.48	10.03	24.00	3.19	0.16	316.00	100	0.0023	0.7215	3.8	0.601	1.3226
4750.0	6.84	10.58	24.00	3.37	0.18	316.00	100	0.0025	0.7975	3.8	0.670	1.4672
5000.0	7.20	11.14	24.00	3.55	0.20	316.00	100	0.0028	0.8770	3.8	0.742	1.6191
5250.0	7.56	11.70	24.00	3.72	0.22	316.00	100	0.0030	0.9599	3.8	0.818	1.7781
5500.0	7.92	12.25	24.00	3.90	0.24	316.00	100	0.0033	1.0463	3.8	0.898	1.9442
5750.0	8.28	12.81	24.00	4.08	0.26	316.00	100	0.0036	1.1361	3.8	0.981	2.1175
6000.0	8.64	13.37	24.00	4.26	0.28	316.00	100	0.0039	1.2293	3.8	1.069	2.2978
6250.0	9.00	13.93	24.00	4.43	0.31	316.00	100	0.0042	1.3258	3.8	1.159	2.4853
6500.0	9.36	14.48	24.00	4.61	0.33	316.00	100	0.0045	1.4257	3.8	1.254	2.6798
6750.0	9.72	15.04	24.00	4.79	0.36	316.00	100	0.0048	1.5289	3.8	1.352	2.8813
7000.0	10.08	15.60	24.00	4.96	0.38	316.00	100	0.0052	1.6354	3.8	1.454	3.0898
7250.0	10.44	16.15	24.00	5.14	0.41	316.00	100	0.0055	1.7452	3.8	1.560	3.3054
7500.0	10.80	16.71	24.00	5.32	0.44	316.00	100	0.0059	1.8583	3.8	1.670	3.5279
7750.0	11.16	17.27	24.00	5.50	0.47	316.00	100	0.0062	1.9747	3.8	1.783	3.7575
8000.0	11.52	17.83	24.00	5.67	0.50	316.00	100	0.0066	2.0943	3.8	1.900	3.9939
8250.0	11.88	18.38	24.00	5.85	0.53	316.00	100	0.0070	2.2171	3.8	2.020	4.2373
8500.0	12.24	18.94	24.00	6.03	0.56	316.00	100	0.0074	2.3431	3.8	2.145	4.4876
8750.0	12.60	19.50	24.00	6.21	0.60	316.00	100	0.0078	2.4723	3.8	2.273	4.7449
9000.0	12.96	20.05	24.00	6.38	0.63	316.00	100	0.0082	2.6048	3.8	2.404	5.0090
9250.0	13.32	20.61	24.00	6.56	0.67	316.00	100	0.0087	2.7403	3.8	2.540	5.2800
9500.0	13.68	21.17	24.00	6.74	0.70	316.00	100	0.0091	2.8791	3.8	2.679	5.5579
9750.0	14.04	21.72	24.00	6.92	0.74	316.00	100	0.0096	3.0210	3.8	2.822	5.8426
10000.0	14.40	22.28	24.00	7.09	0.78	316.00	100	0.0100	3.1660	3.8	2.968	6.1342
10250.0	14.76	22.84	24.00	7.27	0.82	316.00	100	0.0105	3.3141	3.8	3.118	6.4326
10500.0	15.12	23.40	24.00	7.45	0.86	316.00	100	0.0110	3.4654	3.8	3.272	6.7378
10750.0	15.48	23.95	24.00	7.62	0.90	316.00	100	0.0115	3.6197	3.8	3.430	7.0499

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only –A Modified High Point

11000.0	15.84	24.51	24.00	7.80	0.95	316.00	100	0.0120	3.7772	3.8	3.592	7.3687
11250.0	16.20	25.07	24.00	7.98	0.99	316.00	100	0.0125	3.9377	3.8	3.757	7.6943
11500.0	16.56	25.62	24.00	8.16	1.03	316.00	100	0.0130	4.1013	3.8	3.925	8.0267
11750.0	16.92	26.18	24.00	8.33	1.08	316.00	100	0.0135	4.2680	3.8	4.098	8.3659
12000.0	17.28	26.74	24.00	8.51	1.12	316.00	100	0.0140	4.4377	3.8	4.274	8.7119
12250.0	17.64	27.30	24.00	8.69	1.17	316.00	100	0.0146	4.6104	3.8	4.454	9.0645
12500.0	18.00	27.85	24.00	8.87	1.22	316.00	100	0.0151	4.7862	3.8	4.638	9.4240
12750.0	18.36	28.41	24.00	9.04	1.27	316.00	100	0.0157	4.9650	3.8	4.825	9.7901
13000.0	18.72	28.97	24.00	9.22	1.32	316.00	100	0.0163	5.1468	3.8	5.016	10.1630
13250.0	19.08	29.52	24.00	9.40	1.37	316.00	100	0.0169	5.3316	3.8	5.211	10.5426
13500.0	19.44	30.08	24.00	9.57	1.42	316.00	100	0.0175	5.5194	3.8	5.410	10.9289
13750.0	19.80	30.64	24.00	9.75	1.48	316.00	100	0.0181	5.7101	3.8	5.612	11.3219
14000.0	20.16	31.19	24.00	9.93	1.53	316.00	100	0.0187	5.9039	3.8	5.818	11.7216
14250.0	20.52	31.75	24.00	10.11	1.59	316.00	100	0.0193	6.1006	3.8	6.027	12.1279
14500.0	20.88	32.31	24.00	10.28	1.64	316.00	100	0.0199	6.3003	3.8	6.241	12.5410
14750.0	21.24	32.87	24.00	10.46	1.70	316.00	100	0.0206	6.5030	3.8	6.458	12.9607
15000.0	21.60	33.42	24.00	10.64	1.76	316.00	100	0.0212	6.7086	3.8	6.678	13.3870
15250.0	21.96	33.98	24.00	10.82	1.82	316.00	100	0.0219	6.9171	3.8	6.903	13.8200
15500.0	22.32	34.54	24.00	10.99	1.88	316.00	100	0.0226	7.1286	3.8	7.131	14.2597
15750.0	22.68	35.09	24.00	11.17	1.94	316.00	100	0.0232	7.3430	3.8	7.363	14.7060
16000.0	23.04	35.65	24.00	11.35	2.00	316.00	100	0.0239	7.5603	3.8	7.599	15.1589

FM System Curve - 14" (14" parallel FM portion)

Diameter = 14 in

Area = 1.069 ft^2

RH= 0.2917

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	14.00	0.00	0.00	68.50	100	0.0000	0.0000	1.72	0.000	0.0000
250.0	0.36	0.56	14.00	0.52	0.00	68.50	100	0.0001	0.0102	1.72	0.007	0.0175
500.0	0.72	1.11	14.00	1.04	0.02	68.50	100	0.0005	0.0369	1.72	0.029	0.0659
750.0	1.08	1.67	14.00	1.56	0.04	68.50	100	0.0011	0.0782	1.72	0.065	0.1435
1000.0	1.44	2.23	14.00	2.08	0.07	68.50	100	0.0019	0.1333	1.72	0.116	0.2493
1250.0	1.80	2.79	14.00	2.61	0.11	68.50	100	0.0029	0.2014	1.72	0.181	0.3827
1500.0	2.16	3.34	14.00	3.13	0.15	68.50	100	0.0041	0.2824	1.72	0.261	0.5434
1750.0	2.52	3.90	14.00	3.65	0.21	68.50	100	0.0055	0.3756	1.72	0.355	0.7310
2000.0	2.88	4.46	14.00	4.17	0.27	68.50	100	0.0070	0.4810	1.72	0.464	0.9452
2250.0	3.24	5.01	14.00	4.69	0.34	68.50	100	0.0087	0.5983	1.72	0.587	1.1857
2500.0	3.60	5.57	14.00	5.21	0.42	68.50	100	0.0106	0.7272	1.72	0.725	1.4524
2750.0	3.96	6.13	14.00	5.73	0.51	68.50	100	0.0127	0.8676	1.72	0.877	1.7451
3000.0	4.32	6.68	14.00	6.25	0.61	68.50	100	0.0149	1.0193	1.72	1.044	2.0636
3250.0	4.68	7.24	14.00	6.77	0.71	68.50	100	0.0173	1.1822	1.72	1.226	2.4077
3500.0	5.04	7.80	14.00	7.30	0.83	68.50	100	0.0198	1.3561	1.72	1.421	2.7775
3750.0	5.40	8.36	14.00	7.82	0.95	68.50	100	0.0225	1.5409	1.72	1.632	3.1726
4000.0	5.76	8.91	14.00	8.34	1.08	68.50	100	0.0254	1.7366	1.72	1.856	3.5930
4250.0	6.12	9.47	14.00	8.86	1.22	68.50	100	0.0284	1.9429	1.72	2.096	4.0387
4500.0	6.48	10.03	14.00	9.38	1.37	68.50	100	0.0315	2.1599	1.72	2.350	4.5095
4750.0	6.84	10.58	14.00	9.90	1.52	68.50	100	0.0349	2.3873	1.72	2.618	5.0053
5000.0	7.20	11.14	14.00	10.42	1.69	68.50	100	0.0383	2.6252	1.72	2.901	5.5260
5250.0	7.56	11.70	14.00	10.94	1.86	68.50	100	0.0419	2.8735	1.72	3.198	6.0716
5500.0	7.92	12.25	14.00	11.46	2.04	68.50	100	0.0457	3.1320	1.72	3.510	6.6420
5750.0	8.28	12.81	14.00	11.98	2.23	68.50	100	0.0496	3.4008	1.72	3.836	7.2370
6000.0	8.64	13.37	14.00	12.51	2.43	68.50	100	0.0537	3.6797	1.72	4.177	7.8568
6250.0	9.00	13.93	14.00	13.03	2.64	68.50	100	0.0579	3.9687	1.72	4.532	8.5011
6500.0	9.36	14.48	14.00	13.55	2.85	68.50	100	0.0623	4.2677	1.72	4.902	9.1699
6750.0	9.72	15.04	14.00	14.07	3.07	68.50	100	0.0668	4.5766	1.72	5.287	9.8633
7000.0	10.08	15.60	14.00	14.59	3.31	68.50	100	0.0715	4.8955	1.72	5.685	10.5810
7250.0	10.44	16.15	14.00	15.11	3.55	68.50	100	0.0763	5.2242	1.72	6.099	11.3231
7500.0	10.80	16.71	14.00	15.63	3.79	68.50	100	0.0812	5.5628	1.72	6.527	12.0894
7750.0	11.16	17.27	14.00	16.15	4.05	68.50	100	0.0863	5.9110	1.72	6.969	12.8801
8000.0	11.52	17.83	14.00	16.67	4.32	68.50	100	0.0915	6.2690	1.72	7.426	13.6949

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only –A Modified High Point

8250.0	11.88	18.38	14.00	17.20	4.59	68.50	100	0.0969	6.6367	1.72	7.897	14.5339
8500.0	12.24	18.94	14.00	17.72	4.87	68.50	100	0.1024	7.0139	1.72	8.383	15.3971
8750.0	12.60	19.50	14.00	18.24	5.16	68.50	100	0.1080	7.4007	1.72	8.884	16.2843
9000.0	12.96	20.05	14.00	18.76	5.46	68.50	100	0.1138	7.7971	1.72	9.398	17.1955
9250.0	13.32	20.61	14.00	19.28	5.77	68.50	100	0.1198	8.2030	1.72	9.928	18.1308
9500.0	13.68	21.17	14.00	19.80	6.09	68.50	100	0.1258	8.6183	1.72	10.472	19.0900
9750.0	14.04	21.72	14.00	20.32	6.41	68.50	100	0.1320	9.0430	1.72	11.030	20.0731
10000.0	14.40	22.28	14.00	20.84	6.75	68.50	100	0.1384	9.4771	1.72	11.603	21.0801
10250.0	14.76	22.84	14.00	21.36	7.09	68.50	100	0.1448	9.9206	1.72	12.190	22.1110
10500.0	15.12	23.40	14.00	21.89	7.44	68.50	100	0.1514	10.3734	1.72	12.792	23.1657
10750.0	15.48	23.95	14.00	22.41	7.80	68.50	100	0.1582	10.8354	1.72	13.409	24.2441
11000.0	15.84	24.51	14.00	22.93	8.16	68.50	100	0.1651	11.3067	1.72	14.040	25.3463
11250.0	16.20	25.07	14.00	23.45	8.54	68.50	100	0.1721	11.7872	1.72	14.685	26.4722
11500.0	16.56	25.62	14.00	23.97	8.92	68.50	100	0.1792	12.2769	1.72	15.345	27.6219
11750.0	16.92	26.18	14.00	24.49	9.31	68.50	100	0.1865	12.7758	1.72	16.019	28.7951
12000.0	17.28	26.74	14.00	25.01	9.71	68.50	100	0.1939	13.2837	1.72	16.708	29.9920
12250.0	17.64	27.30	14.00	25.53	10.12	68.50	100	0.2015	13.8008	1.72	17.412	31.2126
12500.0	18.00	27.85	14.00	26.05	10.54	68.50	100	0.2092	14.3270	1.72	18.130	32.4566
12750.0	18.36	28.41	14.00	26.58	10.97	68.50	100	0.2170	14.8621	1.72	18.862	33.7243
13000.0	18.72	28.97	14.00	27.10	11.40	68.50	100	0.2249	15.4063	1.72	19.609	35.0154
13250.0	19.08	29.52	14.00	27.62	11.84	68.50	100	0.2330	15.9595	1.72	20.371	36.3300
13500.0	19.44	30.08	14.00	28.14	12.29	68.50	100	0.2412	16.5217	1.72	21.146	37.6682
13750.0	19.80	30.64	14.00	28.66	12.75	68.50	100	0.2495	17.0928	1.72	21.937	39.0297
14000.0	20.16	31.19	14.00	29.18	13.22	68.50	100	0.2580	17.6728	1.72	22.742	40.4147
14250.0	20.52	31.75	14.00	29.70	13.70	68.50	100	0.2666	18.2617	1.72	23.561	41.8230
14500.0	20.88	32.31	14.00	30.22	14.18	68.50	100	0.2753	18.8595	1.72	24.395	43.2548
14750.0	21.24	32.87	14.00	30.74	14.68	68.50	100	0.2842	19.4661	1.72	25.244	44.7099
15000.0	21.60	33.42	14.00	31.26	15.18	68.50	100	0.2932	20.0816	1.72	26.107	46.1883
15250.0	21.96	33.98	14.00	31.79	15.69	68.50	100	0.3023	20.7058	1.72	26.984	47.6900
15500.0	22.32	34.54	14.00	32.31	16.21	68.50	100	0.3115	21.3388	1.72	27.876	49.2150
15750.0	22.68	35.09	14.00	32.83	16.73	68.50	100	0.3209	21.9806	1.72	28.783	50.7633
16000.0	23.04	35.65	14.00	33.35	17.27	68.50	100	0.3304	22.6312	1.72	29.704	52.3348

FM System Curve – 13.5" (14" PVC) (14" parallel FM portion)

Diameter = 14 in

Area = 1.069 ft^2

RH= 0.2917

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	13.50	0.00	0.00	10640.50	120	0.0000	0.0000	3.1	0.000	0.0000
250.0	0.36	0.56	13.50	0.56	0.00	10640.50	120	0.0001	1.3528	3.1	0.015	1.3679
500.0	0.72	1.11	13.50	1.12	0.02	10640.50	120	0.0005	4.8835	3.1	0.060	4.9439
750.0	1.08	1.67	13.50	1.68	0.04	10640.50	120	0.0010	10.3478	3.1	0.136	10.4839
1000.0	1.44	2.23	13.50	2.24	0.08	10640.50	120	0.0017	17.6293	3.1	0.242	17.8711
1250.0	1.80	2.79	13.50	2.80	0.12	10640.50	120	0.0025	26.6509	3.1	0.378	27.0288
1500.0	2.16	3.34	13.50	3.36	0.18	10640.50	120	0.0035	37.3556	3.1	0.544	37.8998
1750.0	2.52	3.90	13.50	3.92	0.24	10640.50	120	0.0047	49.6982	3.1	0.741	50.4390
2000.0	2.88	4.46	13.50	4.48	0.31	10640.50	120	0.0060	63.6417	3.1	0.967	64.6092
2250.0	3.24	5.01	13.50	5.04	0.39	10640.50	120	0.0074	79.1547	3.1	1.224	80.3791
2500.0	3.60	5.57	13.50	5.60	0.49	10640.50	120	0.0090	96.2098	3.1	1.512	97.7215
2750.0	3.96	6.13	13.50	6.16	0.59	10640.50	120	0.0108	114.7833	3.1	1.829	116.6124
3000.0	4.32	6.68	13.50	6.72	0.70	10640.50	120	0.0127	134.8538	3.1	2.177	137.0306
3250.0	4.68	7.24	13.50	7.29	0.82	10640.50	120	0.0147	156.4021	3.1	2.555	158.9568
3500.0	5.04	7.80	13.50	7.85	0.96	10640.50	120	0.0169	179.4108	3.1	2.963	182.3737
3750.0	5.40	8.36	13.50	8.41	1.10	10640.50	120	0.0192	203.8640	3.1	3.401	207.2652
4000.0	5.76	8.91	13.50	8.97	1.25	10640.50	120	0.0216	229.7469	3.1	3.870	233.6168
4250.0	6.12	9.47	13.50	9.53	1.41	10640.50	120	0.0242	257.0460	3.1	4.369	261.4148
4500.0	6.48	10.03	13.50	10.09	1.58	10640.50	120	0.0269	285.7486	3.1	4.898	290.6465
4750.0	6.84	10.58	13.50	10.65	1.76	10640.50	120	0.0297	315.8429	3.1	5.457	321.3001
5000.0	7.20	11.14	13.50	11.21	1.95	10640.50	120	0.0326	347.3178	3.1	6.047	353.3645
5250.0	7.56	11.70	13.50	11.77	2.15	10640.50	120	0.0357	380.1628	3.1	6.667	386.8293
5500.0	7.92	12.25	13.50	12.33	2.36	10640.50	120	0.0389	414.3680	3.1	7.317	421.6846

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only –A Modified High Point

5750.0	8.28	12.81	13.50	12.89	2.58	10640.50	120	0.0423	449.9242	3.1	7.997	457.9210
6000.0	8.64	13.37	13.50	13.45	2.81	10640.50	120	0.0458	486.8225	3.1	8.707	495.5298
6250.0	9.00	13.93	13.50	14.01	3.05	10640.50	120	0.0493	525.0544	3.1	9.448	534.5025
6500.0	9.36	14.48	13.50	14.57	3.30	10640.50	120	0.0531	564.6120	3.1	10.219	574.8309
6750.0	9.72	15.04	13.50	15.13	3.55	10640.50	120	0.0569	605.4874	3.1	11.020	616.5076
7000.0	10.08	15.60	13.50	15.69	3.82	10640.50	120	0.0609	647.6735	3.1	11.852	659.5251
7250.0	10.44	16.15	13.50	16.25	4.10	10640.50	120	0.0650	691.1631	3.1	12.713	703.8763
7500.0	10.80	16.71	13.50	16.81	4.39	10640.50	120	0.0692	735.9495	3.1	13.605	749.5546
7750.0	11.16	17.27	13.50	17.37	4.69	10640.50	120	0.0735	782.0262	3.1	14.527	796.5535
8000.0	11.52	17.83	13.50	17.93	4.99	10640.50	120	0.0779	829.3870	3.1	15.480	844.8666
8250.0	11.88	18.38	13.50	18.49	5.31	10640.50	120	0.0825	878.0258	3.1	16.462	894.4880
8500.0	12.24	18.94	13.50	19.05	5.64	10640.50	120	0.0872	927.9368	3.1	17.475	945.4118
8750.0	12.60	19.50	13.50	19.61	5.97	10640.50	120	0.0920	979.1145	3.1	18.518	997.6326
9000.0	12.96	20.05	13.50	20.17	6.32	10640.50	120	0.0969	1031.5533	3.1	19.591	1051.1447
9250.0	13.32	20.61	13.50	20.73	6.68	10640.50	120	0.1020	1085.2481	3.1	20.695	1105.9430
9500.0	13.68	21.17	13.50	21.29	7.04	10640.50	120	0.1072	1140.1938	3.1	21.829	1162.0225
9750.0	14.04	21.72	13.50	21.86	7.42	10640.50	120	0.1124	1196.3854	3.1	22.993	1219.3781
10000.0	14.40	22.28	13.50	22.42	7.80	10640.50	120	0.1178	1253.8181	3.1	24.187	1278.0050
10250.0	14.76	22.84	13.50	22.98	8.20	10640.50	120	0.1233	1312.4874	3.1	25.411	1337.8988
10500.0	15.12	23.40	13.50	23.54	8.60	10640.50	120	0.1290	1372.3887	3.1	26.666	1399.0548
10750.0	15.48	23.95	13.50	24.10	9.02	10640.50	120	0.1347	1433.5176	3.1	27.951	1461.4686
11000.0	15.84	24.51	13.50	24.66	9.44	10640.50	120	0.1406	1495.8698	3.1	29.266	1525.1360
11250.0	16.20	25.07	13.50	25.22	9.87	10640.50	120	0.1466	1559.4413	3.1	30.612	1590.0528
11500.0	16.56	25.62	13.50	25.78	10.32	10640.50	120	0.1526	1624.2278	3.1	31.987	1656.2150
11750.0	16.92	26.18	13.50	26.34	10.77	10640.50	120	0.1588	1690.2256	3.1	33.393	1723.6187
12000.0	17.28	26.74	13.50	26.90	11.24	10640.50	120	0.1652	1757.4307	3.1	34.829	1792.2599
12250.0	17.64	27.30	13.50	27.46	11.71	10640.50	120	0.1716	1825.8394	3.1	36.295	1862.1349
12500.0	18.00	27.85	13.50	28.02	12.19	10640.50	120	0.1781	1895.4481	3.1	37.792	1933.2401
12750.0	18.36	28.41	13.50	28.58	12.68	10640.50	120	0.1848	1966.2531	3.1	39.319	2005.5719
13000.0	18.72	28.97	13.50	29.14	13.19	10640.50	120	0.1916	2038.2509	3.1	40.876	2079.1267
13250.0	19.08	29.52	13.50	29.70	13.70	10640.50	120	0.1984	2111.4381	3.1	42.463	2153.9012
13500.0	19.44	30.08	13.50	30.26	14.22	10640.50	120	0.2054	2185.8114	3.1	44.081	2229.8920
13750.0	19.80	30.64	13.50	30.82	14.75	10640.50	120	0.2125	2261.3675	3.1	45.728	2307.0959
14000.0	20.16	31.19	13.50	31.38	15.29	10640.50	120	0.2197	2338.1032	3.1	47.406	2385.5095
14250.0	20.52	31.75	13.50	31.94	15.84	10640.50	120	0.2271	2416.0153	3.1	49.115	2465.1298
14500.0	20.88	32.31	13.50	32.50	16.40	10640.50	120	0.2345	2495.1008	3.1	50.853	2545.9537
14750.0	21.24	32.87	13.50	33.06	16.97	10640.50	120	0.2420	2575.3566	3.1	52.622	2627.9782
15000.0	21.60	33.42	13.50	33.62	17.56	10640.50	120	0.2497	2656.7798	3.1	54.421	2711.2003
15250.0	21.96	33.98	13.50	34.18	18.15	10640.50	120	0.2574	2739.3675	3.1	56.250	2795.6172
15500.0	22.32	34.54	13.50	34.74	18.74	10640.50	120	0.2653	2823.1168	3.1	58.109	2881.2259
15750.0	22.68	35.09	13.50	35.30	19.35	10640.50	120	0.2733	2908.0250	3.1	59.999	2968.0237
16000.0	23.04	35.65	13.50	35.87	19.97	10640.50	120	0.2814	2994.0893	3.1	61.918	3056.0078

FM System Curve - 23.85" (28" HDPE)

Diameter =	23.85	in
Area =	3.1024	ft^2
RH=	0.4969	
C=	120	

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	619.99	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	619.99	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	619.99	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	619.99	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	619.99	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	619.99	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	619.99	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	619.99	120	0.0003	0.1811	2.7	0.066	0.2473
2000.0	2.88	4.46	23.85	1.44	0.03	619.99	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	619.99	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	619.99	120	0.0006	0.3506	2.7	0.135	0.4858

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only –A Modified High Point

2750.0	3.96	6.13	23.85	1.98	0.06	619.99	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	619.99	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	619.99	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	619.99	120	0.0011	0.6538	2.7	0.265	0.9187
3750.0	5.40	8.36	23.85	2.69	0.11	619.99	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	619.99	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	619.99	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	619.99	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	619.99	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	619.99	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	619.99	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	619.99	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	619.99	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	619.99	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	619.99	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	619.99	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	619.99	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	619.99	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	619.99	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	619.99	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	619.99	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	619.99	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	619.99	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	619.99	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	619.99	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	619.99	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	619.99	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	619.99	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	619.99	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	619.99	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	619.99	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	619.99	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	619.99	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	619.99	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	619.99	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	619.99	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	619.99	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	619.99	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	619.99	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	619.99	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	619.99	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	619.99	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	619.99	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	619.99	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	619.99	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	619.99	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	619.99	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	619.99	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	619.99	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	619.99	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	619.99	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	619.99	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	619.99	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	619.99	120	0.0176	10.9108	2.7	5.536	16.4469

FM System Curve – 25.14" (24" DIP)

Diameter = 25.14 in

Area = 3.4471 ft^2

RH= 0.5238

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only –A Modified High Point

0.0	0.00	0.00	25.14	0.00	0.00	625.00	100	0.0000	0.0000	0.6	0.000	0.0000
250.0	0.36	0.56	25.14	0.16	0.00	625.00	100	0.0000	0.0054	0.6	0.000	0.0056
500.0	0.72	1.11	25.14	0.32	0.00	625.00	100	0.0000	0.0195	0.6	0.001	0.0204
750.0	1.08	1.67	25.14	0.48	0.00	625.00	100	0.0001	0.0412	0.6	0.002	0.0434
1000.0	1.44	2.23	25.14	0.65	0.01	625.00	100	0.0001	0.0702	0.6	0.004	0.0741
1250.0	1.80	2.79	25.14	0.81	0.01	625.00	100	0.0002	0.1062	0.6	0.006	0.1123
1500.0	2.16	3.34	25.14	0.97	0.01	625.00	100	0.0002	0.1488	0.6	0.009	0.1576
1750.0	2.52	3.90	25.14	1.13	0.02	625.00	100	0.0003	0.1980	0.6	0.012	0.2099
2000.0	2.88	4.46	25.14	1.29	0.03	625.00	100	0.0004	0.2535	0.6	0.016	0.2691
2250.0	3.24	5.01	25.14	1.45	0.03	625.00	100	0.0005	0.3153	0.6	0.020	0.3350
2500.0	3.60	5.57	25.14	1.62	0.04	625.00	100	0.0006	0.3833	0.6	0.024	0.4076
2750.0	3.96	6.13	25.14	1.78	0.05	625.00	100	0.0007	0.4573	0.6	0.029	0.4867
3000.0	4.32	6.68	25.14	1.94	0.06	625.00	100	0.0009	0.5372	0.6	0.035	0.5723
3250.0	4.68	7.24	25.14	2.10	0.07	625.00	100	0.0010	0.6231	0.6	0.041	0.6642
3500.0	5.04	7.80	25.14	2.26	0.08	625.00	100	0.0011	0.7147	0.6	0.048	0.7624
3750.0	5.40	8.36	25.14	2.42	0.09	625.00	100	0.0013	0.8122	0.6	0.055	0.8669
4000.0	5.76	8.91	25.14	2.59	0.10	625.00	100	0.0015	0.9153	0.6	0.062	0.9776
4250.0	6.12	9.47	25.14	2.75	0.12	625.00	100	0.0016	1.0240	0.6	0.070	1.0943
4500.0	6.48	10.03	25.14	2.91	0.13	625.00	100	0.0018	1.1384	0.6	0.079	1.2172
4750.0	6.84	10.58	25.14	3.07	0.15	625.00	100	0.0020	1.2583	0.6	0.088	1.3461
5000.0	7.20	11.14	25.14	3.23	0.16	625.00	100	0.0022	1.3837	0.6	0.097	1.4810
5250.0	7.56	11.70	25.14	3.39	0.18	625.00	100	0.0024	1.5145	0.6	0.107	1.6218
5500.0	7.92	12.25	25.14	3.56	0.20	625.00	100	0.0026	1.6508	0.6	0.118	1.7685
5750.0	8.28	12.81	25.14	3.72	0.21	625.00	100	0.0029	1.7924	0.6	0.129	1.9211
6000.0	8.64	13.37	25.14	3.88	0.23	625.00	100	0.0031	1.9394	0.6	0.140	2.0796
6250.0	9.00	13.93	25.14	4.04	0.25	625.00	100	0.0033	2.0917	0.6	0.152	2.2438
6500.0	9.36	14.48	25.14	4.20	0.27	625.00	100	0.0036	2.2493	0.6	0.164	2.4138
6750.0	9.72	15.04	25.14	4.36	0.30	625.00	100	0.0039	2.4122	0.6	0.177	2.5895
7000.0	10.08	15.60	25.14	4.52	0.32	625.00	100	0.0041	2.5802	0.6	0.191	2.7710
7250.0	10.44	16.15	25.14	4.69	0.34	625.00	100	0.0044	2.7535	0.6	0.205	2.9581
7500.0	10.80	16.71	25.14	4.85	0.36	625.00	100	0.0047	2.9319	0.6	0.219	3.1509
7750.0	11.16	17.27	25.14	5.01	0.39	625.00	100	0.0050	3.1155	0.6	0.234	3.3493
8000.0	11.52	17.83	25.14	5.17	0.42	625.00	100	0.0053	3.3042	0.6	0.249	3.5533
8250.0	11.88	18.38	25.14	5.33	0.44	625.00	100	0.0056	3.4979	0.6	0.265	3.7629
8500.0	12.24	18.94	25.14	5.49	0.47	625.00	100	0.0059	3.6968	0.6	0.281	3.9780
8750.0	12.60	19.50	25.14	5.66	0.50	625.00	100	0.0062	3.9006	0.6	0.298	4.1987
9000.0	12.96	20.05	25.14	5.82	0.53	625.00	100	0.0066	4.1096	0.6	0.315	4.4249
9250.0	13.32	20.61	25.14	5.98	0.56	625.00	100	0.0069	4.3235	0.6	0.333	4.6565
9500.0	13.68	21.17	25.14	6.14	0.59	625.00	100	0.0073	4.5424	0.6	0.351	4.8937
9750.0	14.04	21.72	25.14	6.30	0.62	625.00	100	0.0076	4.7662	0.6	0.370	5.1363
10000.0	14.40	22.28	25.14	6.46	0.65	625.00	100	0.0080	4.9950	0.6	0.389	5.3843
10250.0	14.76	22.84	25.14	6.63	0.68	625.00	100	0.0084	5.2288	0.6	0.409	5.6377
10500.0	15.12	23.40	25.14	6.79	0.72	625.00	100	0.0087	5.4674	0.6	0.429	5.8966
10750.0	15.48	23.95	25.14	6.95	0.75	625.00	100	0.0091	5.7109	0.6	0.450	6.1608
11000.0	15.84	24.51	25.14	7.11	0.79	625.00	100	0.0095	5.9593	0.6	0.471	6.4303
11250.0	16.20	25.07	25.14	7.27	0.82	625.00	100	0.0099	6.2126	0.6	0.493	6.7052
11500.0	16.56	25.62	25.14	7.43	0.86	625.00	100	0.0104	6.4707	0.6	0.515	6.9855
11750.0	16.92	26.18	25.14	7.59	0.90	625.00	100	0.0108	6.7336	0.6	0.537	7.2710
12000.0	17.28	26.74	25.14	7.76	0.93	625.00	100	0.0112	7.0013	0.6	0.561	7.5619
12250.0	17.64	27.30	25.14	7.92	0.97	625.00	100	0.0116	7.2739	0.6	0.584	7.8580
12500.0	18.00	27.85	25.14	8.08	1.01	625.00	100	0.0121	7.5512	0.6	0.608	8.1594
12750.0	18.36	28.41	25.14	8.24	1.05	625.00	100	0.0125	7.8333	0.6	0.633	8.4661
13000.0	18.72	28.97	25.14	8.40	1.10	625.00	100	0.0130	8.1201	0.6	0.658	8.7779
13250.0	19.08	29.52	25.14	8.56	1.14	625.00	100	0.0135	8.4117	0.6	0.683	9.0951
13500.0	19.44	30.08	25.14	8.73	1.18	625.00	100	0.0139	8.7079	0.6	0.709	9.4174
13750.0	19.80	30.64	25.14	8.89	1.23	625.00	100	0.0144	9.0089	0.6	0.736	9.7449
14000.0	20.16	31.19	25.14	9.05	1.27	625.00	100	0.0149	9.3147	0.6	0.763	10.0776
14250.0	20.52	31.75	25.14	9.21	1.32	625.00	100	0.0154	9.6250	0.6	0.790	10.4155
14500.0	20.88	32.31	25.14	9.37	1.36	625.00	100	0.0159	9.9401	0.6	0.818	10.7585
14750.0	21.24	32.87	25.14	9.53	1.41	625.00	100	0.0164	10.2598	0.6	0.847	11.1067
15000.0	21.60	33.42	25.14	9.70	1.46	625.00	100	0.0169	10.5842	0.6	0.876	11.4601
15250.0	21.96	33.98	25.14	9.86	1.51	625.00	100	0.0175	10.9132	0.6	0.905	11.8185
15500.0	22.32	34.54	25.14	10.02	1.56	625.00	100	0.0180	11.2469	0.6	0.935	12.1821
15750.0	22.68	35.09	25.14	10.18	1.61	625.00	100	0.0185	11.5851	0.6	0.966	12.5508
16000.0	23.04	35.65	25.14	10.34	1.66	625.00	100	0.0191	11.9280	0.6	0.997	12.9245

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only –A Modified High Point

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FM System Curve– 25.3" (30" HDPE)

Diameter = 25.3 in

Area = 3.4911 ft^2

RH= 0.5271

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.30	0.00	0.00	3481.00	120	0.0000	0.0000	4.125	0.000	0.0000
250.0	0.36	0.56	25.30	0.16	0.00	3481.00	120	0.0000	0.0208	4.125	0.002	0.0224
500.0	0.72	1.11	25.30	0.32	0.00	3481.00	120	0.0000	0.0750	4.125	0.007	0.0815
750.0	1.08	1.67	25.30	0.48	0.00	3481.00	120	0.0000	0.1588	4.125	0.015	0.1735
1000.0	1.44	2.23	25.30	0.64	0.01	3481.00	120	0.0001	0.2706	4.125	0.026	0.2967
1250.0	1.80	2.79	25.30	0.80	0.01	3481.00	120	0.0001	0.4090	4.125	0.041	0.4498
1500.0	2.16	3.34	25.30	0.96	0.01	3481.00	120	0.0002	0.5733	4.125	0.059	0.6321
1750.0	2.52	3.90	25.30	1.12	0.02	3481.00	120	0.0002	0.7628	4.125	0.080	0.8427
2000.0	2.88	4.46	25.30	1.28	0.03	3481.00	120	0.0003	0.9768	4.125	0.104	1.0812
2250.0	3.24	5.01	25.30	1.44	0.03	3481.00	120	0.0003	1.2149	4.125	0.132	1.3470
2500.0	3.60	5.57	25.30	1.60	0.04	3481.00	120	0.0004	1.4767	4.125	0.163	1.6397
2750.0	3.96	6.13	25.30	1.76	0.05	3481.00	120	0.0005	1.7617	4.125	0.197	1.9591
3000.0	4.32	6.68	25.30	1.91	0.06	3481.00	120	0.0006	2.0698	4.125	0.235	2.3046
3250.0	4.68	7.24	25.30	2.07	0.07	3481.00	120	0.0007	2.4005	4.125	0.276	2.6761
3500.0	5.04	7.80	25.30	2.23	0.08	3481.00	120	0.0008	2.7537	4.125	0.320	3.0733
3750.0	5.40	8.36	25.30	2.39	0.09	3481.00	120	0.0009	3.1290	4.125	0.367	3.4959
4000.0	5.76	8.91	25.30	2.55	0.10	3481.00	120	0.0010	3.5262	4.125	0.417	3.9437
4250.0	6.12	9.47	25.30	2.71	0.11	3481.00	120	0.0011	3.9452	4.125	0.471	4.4165
4500.0	6.48	10.03	25.30	2.87	0.13	3481.00	120	0.0013	4.3858	4.125	0.528	4.9141
4750.0	6.84	10.58	25.30	3.03	0.14	3481.00	120	0.0014	4.8477	4.125	0.589	5.4364
5000.0	7.20	11.14	25.30	3.19	0.16	3481.00	120	0.0015	5.3308	4.125	0.652	5.9831
5250.0	7.56	11.70	25.30	3.35	0.17	3481.00	120	0.0017	5.8349	4.125	0.719	6.5540
5500.0	7.92	12.25	25.30	3.51	0.19	3481.00	120	0.0018	6.3599	4.125	0.789	7.1491
5750.0	8.28	12.81	25.30	3.67	0.21	3481.00	120	0.0020	6.9056	4.125	0.863	7.7683
6000.0	8.64	13.37	25.30	3.83	0.23	3481.00	120	0.0021	7.4719	4.125	0.939	8.4112
6250.0	9.00	13.93	25.30	3.99	0.25	3481.00	120	0.0023	8.0587	4.125	1.019	9.0779
6500.0	9.36	14.48	25.30	4.15	0.27	3481.00	120	0.0025	8.6659	4.125	1.102	9.7682
6750.0	9.72	15.04	25.30	4.31	0.29	3481.00	120	0.0027	9.2933	4.125	1.189	10.4820
7000.0	10.08	15.60	25.30	4.47	0.31	3481.00	120	0.0029	9.9408	4.125	1.278	11.2192
7250.0	10.44	16.15	25.30	4.63	0.33	3481.00	120	0.0030	10.6082	4.125	1.371	11.9797
7500.0	10.80	16.71	25.30	4.79	0.36	3481.00	120	0.0032	11.2956	4.125	1.468	12.7633
7750.0	11.16	17.27	25.30	4.95	0.38	3481.00	120	0.0034	12.0029	4.125	1.567	13.5700
8000.0	11.52	17.83	25.30	5.11	0.40	3481.00	120	0.0037	12.7298	4.125	1.670	14.3996
8250.0	11.88	18.38	25.30	5.27	0.43	3481.00	120	0.0039	13.4763	4.125	1.776	15.2521
8500.0	12.24	18.94	25.30	5.42	0.46	3481.00	120	0.0041	14.2423	4.125	1.885	16.1274
8750.0	12.60	19.50	25.30	5.58	0.48	3481.00	120	0.0043	15.0278	4.125	1.998	17.0255
9000.0	12.96	20.05	25.30	5.74	0.51	3481.00	120	0.0045	15.8327	4.125	2.113	17.9461
9250.0	13.32	20.61	25.30	5.90	0.54	3481.00	120	0.0048	16.6568	4.125	2.232	18.8893
9500.0	13.68	21.17	25.30	6.06	0.57	3481.00	120	0.0050	17.5002	4.125	2.355	19.8549
9750.0	14.04	21.72	25.30	6.22	0.60	3481.00	120	0.0053	18.3626	4.125	2.480	20.8429
10000.0	14.40	22.28	25.30	6.38	0.63	3481.00	120	0.0055	19.2441	4.125	2.609	21.8532
10250.0	14.76	22.84	25.30	6.54	0.66	3481.00	120	0.0058	20.1446	4.125	2.741	22.8858
10500.0	15.12	23.40	25.30	6.70	0.70	3481.00	120	0.0061	21.0640	4.125	2.877	23.9405
10750.0	15.48	23.95	25.30	6.86	0.73	3481.00	120	0.0063	22.0022	4.125	3.015	25.0174
11000.0	15.84	24.51	25.30	7.02	0.77	3481.00	120	0.0066	22.9592	4.125	3.157	26.1163
11250.0	16.20	25.07	25.30	7.18	0.80	3481.00	120	0.0069	23.9349	4.125	3.302	27.2371
11500.0	16.56	25.62	25.30	7.34	0.84	3481.00	120	0.0072	24.9293	4.125	3.451	28.3799
11750.0	16.92	26.18	25.30	7.50	0.87	3481.00	120	0.0075	25.9423	4.125	3.602	29.5445
12000.0	17.28	26.74	25.30	7.66	0.91	3481.00	120	0.0077	26.9738	4.125	3.757	30.7309
12250.0	17.64	27.30	25.30	7.82	0.95	3481.00	120	0.0081	28.0237	4.125	3.915	31.9390
12500.0	18.00	27.85	25.30	7.98	0.99	3481.00	120	0.0084	29.0921	4.125	4.077	33.1689
12750.0	18.36	28.41	25.30	8.14	1.03	3481.00	120	0.0087	30.1788	4.125	4.241	34.4203
13000.0	18.72	28.97	25.30	8.30	1.07	3481.00	120	0.0090	31.2839	4.125	4.409	35.6933
13250.0	19.08	29.52	25.30	8.46	1.11	3481.00	120	0.0093	32.4072	4.125	4.581	36.9879
13500.0	19.44	30.08	25.30	8.62	1.15	3481.00	120	0.0096	33.5487	4.125	4.755	38.3039

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only –A Modified High Point

13750.0	19.80	30.64	25.30	8.78	1.20	3481.00	120	0.0100	34.7084	4.125	4.933	39.6413
14000.0	20.16	31.19	25.30	8.94	1.24	3481.00	120	0.0103	35.8861	4.125	5.114	41.0000
14250.0	20.52	31.75	25.30	9.09	1.28	3481.00	120	0.0107	37.0820	4.125	5.298	42.3801
14500.0	20.88	32.31	25.30	9.25	1.33	3481.00	120	0.0110	38.2958	4.125	5.486	43.7815
14750.0	21.24	32.87	25.30	9.41	1.38	3481.00	120	0.0114	39.5276	4.125	5.676	45.2041
15000.0	21.60	33.42	25.30	9.57	1.42	3481.00	120	0.0117	40.7773	4.125	5.871	46.6479
15250.0	21.96	33.98	25.30	9.73	1.47	3481.00	120	0.0121	42.0449	4.125	6.068	48.1128
15500.0	22.32	34.54	25.30	9.89	1.52	3481.00	120	0.0124	43.3303	4.125	6.268	49.5988
15750.0	22.68	35.09	25.30	10.05	1.57	3481.00	120	0.0128	44.6335	4.125	6.472	51.1058
16000.0	23.04	35.65	25.30	10.21	1.62	3481.00	120	0.0132	45.9545	4.125	6.679	52.6339

FM System Curve – 24"

Diameter = 24 in

Area = 3.1416 ft^2

RH= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	3580.41	100	0.0000	0.0000	1.00	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	3580.41	100	0.0000	0.0387	1.00	0.000	0.0392
500.0	0.72	1.11	24.00	0.35	0.00	3580.41	100	0.0000	0.1397	1.00	0.002	0.1417
750.0	1.08	1.67	24.00	0.53	0.00	3580.41	100	0.0001	0.2961	1.00	0.004	0.3004
1000.0	1.44	2.23	24.00	0.71	0.01	3580.41	100	0.0001	0.5044	1.00	0.008	0.5122
1250.0	1.80	2.79	24.00	0.89	0.01	3580.41	100	0.0002	0.7625	1.00	0.012	0.7747
1500.0	2.16	3.34	24.00	1.06	0.02	3580.41	100	0.0003	1.0688	1.00	0.018	1.0863
1750.0	2.52	3.90	24.00	1.24	0.02	3580.41	100	0.0004	1.4219	1.00	0.024	1.4458
2000.0	2.88	4.46	24.00	1.42	0.03	3580.41	100	0.0005	1.8208	1.00	0.031	1.8520
2250.0	3.24	5.01	24.00	1.60	0.04	3580.41	100	0.0006	2.2646	1.00	0.040	2.3042
2500.0	3.60	5.57	24.00	1.77	0.05	3580.41	100	0.0008	2.7526	1.00	0.049	2.8014
2750.0	3.96	6.13	24.00	1.95	0.06	3580.41	100	0.0009	3.2840	1.00	0.059	3.3430
3000.0	4.32	6.68	24.00	2.13	0.07	3580.41	100	0.0011	3.8582	1.00	0.070	3.9285
3250.0	4.68	7.24	24.00	2.31	0.08	3580.41	100	0.0012	4.4747	1.00	0.083	4.5572
3500.0	5.04	7.80	24.00	2.48	0.10	3580.41	100	0.0014	5.1330	1.00	0.096	5.2287
3750.0	5.40	8.36	24.00	2.66	0.11	3580.41	100	0.0016	5.8326	1.00	0.110	5.9424
4000.0	5.76	8.91	24.00	2.84	0.12	3580.41	100	0.0018	6.5731	1.00	0.125	6.6981
4250.0	6.12	9.47	24.00	3.01	0.14	3580.41	100	0.0021	7.3541	1.00	0.141	7.4952
4500.0	6.48	10.03	24.00	3.19	0.16	3580.41	100	0.0023	8.1753	1.00	0.158	8.3335
4750.0	6.84	10.58	24.00	3.37	0.18	3580.41	100	0.0025	9.0363	1.00	0.176	9.2126
5000.0	7.20	11.14	24.00	3.55	0.20	3580.41	100	0.0028	9.9368	1.00	0.195	10.1321
5250.0	7.56	11.70	24.00	3.72	0.22	3580.41	100	0.0030	10.8765	1.00	0.215	11.0918
5500.0	7.92	12.25	24.00	3.90	0.24	3580.41	100	0.0033	11.8552	1.00	0.236	12.0914
5750.0	8.28	12.81	24.00	4.08	0.26	3580.41	100	0.0036	12.8724	1.00	0.258	13.1307
6000.0	8.64	13.37	24.00	4.26	0.28	3580.41	100	0.0039	13.9281	1.00	0.281	14.2093
6250.0	9.00	13.93	24.00	4.43	0.31	3580.41	100	0.0042	15.0219	1.00	0.305	15.3270
6500.0	9.36	14.48	24.00	4.61	0.33	3580.41	100	0.0045	16.1537	1.00	0.330	16.4837
6750.0	9.72	15.04	24.00	4.79	0.36	3580.41	100	0.0048	17.3231	1.00	0.356	17.6790
7000.0	10.08	15.60	24.00	4.96	0.38	3580.41	100	0.0052	18.5301	1.00	0.383	18.9128
7250.0	10.44	16.15	24.00	5.14	0.41	3580.41	100	0.0055	19.7743	1.00	0.411	20.1849
7500.0	10.80	16.71	24.00	5.32	0.44	3580.41	100	0.0059	21.0557	1.00	0.439	21.4950
7750.0	11.16	17.27	24.00	5.50	0.47	3580.41	100	0.0062	22.3739	1.00	0.469	22.8431
8000.0	11.52	17.83	24.00	5.67	0.50	3580.41	100	0.0066	23.7289	1.00	0.500	24.2288
8250.0	11.88	18.38	24.00	5.85	0.53	3580.41	100	0.0070	25.1205	1.00	0.532	25.6521
8500.0	12.24	18.94	24.00	6.03	0.56	3580.41	100	0.0074	26.5485	1.00	0.564	27.1128
8750.0	12.60	19.50	24.00	6.21	0.60	3580.41	100	0.0078	28.0127	1.00	0.598	28.6107
9000.0	12.96	20.05	24.00	6.38	0.63	3580.41	100	0.0082	29.5130	1.00	0.633	30.1457
9250.0	13.32	20.61	24.00	6.56	0.67	3580.41	100	0.0087	31.0492	1.00	0.668	31.7175
9500.0	13.68	21.17	24.00	6.74	0.70	3580.41	100	0.0091	32.6212	1.00	0.705	33.3261
9750.0	14.04	21.72	24.00	6.92	0.74	3580.41	100	0.0096	34.2288	1.00	0.743	34.9714
10000.0	14.40	22.28	24.00	7.09	0.78	3580.41	100	0.0100	35.8720	1.00	0.781	36.6531
10250.0	14.76	22.84	24.00	7.27	0.82	3580.41	100	0.0105	37.5506	1.00	0.821	38.3712
10500.0	15.12	23.40	24.00	7.45	0.86	3580.41	100	0.0110	39.2643	1.00	0.861	40.1255
10750.0	15.48	23.95	24.00	7.62	0.90	3580.41	100	0.0115	41.0133	1.00	0.903	41.9159

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only –A Modified High Point

11000.0	15.84	24.51	24.00	7.80	0.95	3580.41	100	0.0120	42.7972	1.00	0.945	43.7423
11250.0	16.20	25.07	24.00	7.98	0.99	3580.41	100	0.0125	44.6160	1.00	0.989	45.6045
11500.0	16.56	25.62	24.00	8.16	1.03	3580.41	100	0.0130	46.4695	1.00	1.033	47.5025
11750.0	16.92	26.18	24.00	8.33	1.08	3580.41	100	0.0135	48.3577	1.00	1.078	49.4361
12000.0	17.28	26.74	24.00	8.51	1.12	3580.41	100	0.0140	50.2805	1.00	1.125	51.4053
12250.0	17.64	27.30	24.00	8.69	1.17	3580.41	100	0.0146	52.2377	1.00	1.172	53.4098
12500.0	18.00	27.85	24.00	8.87	1.22	3580.41	100	0.0151	54.2292	1.00	1.220	55.4497
12750.0	18.36	28.41	24.00	9.04	1.27	3580.41	100	0.0157	56.2549	1.00	1.270	57.5247
13000.0	18.72	28.97	24.00	9.22	1.32	3580.41	100	0.0163	58.3148	1.00	1.320	59.6349
13250.0	19.08	29.52	24.00	9.40	1.37	3580.41	100	0.0169	60.4087	1.00	1.371	61.7800
13500.0	19.44	30.08	24.00	9.57	1.42	3580.41	100	0.0175	62.5365	1.00	1.424	63.9601
13750.0	19.80	30.64	24.00	9.75	1.48	3580.41	100	0.0181	64.6982	1.00	1.477	66.1750
14000.0	20.16	31.19	24.00	9.93	1.53	3580.41	100	0.0187	66.8936	1.00	1.531	68.4246
14250.0	20.52	31.75	24.00	10.11	1.59	3580.41	100	0.0193	69.1227	1.00	1.586	70.7089
14500.0	20.88	32.31	24.00	10.28	1.64	3580.41	100	0.0199	71.3854	1.00	1.642	73.0277
14750.0	21.24	32.87	24.00	10.46	1.70	3580.41	100	0.0206	73.6815	1.00	1.699	75.3809
15000.0	21.60	33.42	24.00	10.64	1.76	3580.41	100	0.0212	76.0111	1.00	1.757	77.7685
15250.0	21.96	33.98	24.00	10.82	1.82	3580.41	100	0.0219	78.3739	1.00	1.817	80.1905
15500.0	22.32	34.54	24.00	10.99	1.88	3580.41	100	0.0226	80.7700	1.00	1.877	82.6466
15750.0	22.68	35.09	24.00	11.17	1.94	3580.41	100	0.0232	83.1992	1.00	1.938	85.1369
16000.0	23.04	35.65	24.00	11.35	2.00	3580.41	100	0.0239	85.6616	1.00	2.000	87.6612

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only –A Modified High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	1.47
500.0	0.72	5.30
750.0	1.08	11.25
1000.0	1.44	19.19
1250.0	1.80	29.03
1500.0	2.16	40.71
1750.0	2.52	54.20
2000.0	2.88	69.44
2250.0	3.24	86.41
2500.0	3.60	105.07
2750.0	3.96	125.40
3000.0	4.32	147.39
3250.0	4.68	170.99
3500.0	5.04	196.21
3750.0	5.40	223.02
4000.0	5.76	251.40
4250.0	6.12	281.35
4500.0	6.48	312.85
4750.0	6.84	345.88
5000.0	7.20	380.43
5250.0	7.56	416.50
5500.0	7.92	454.07
5750.0	8.28	493.13
6000.0	8.64	533.68
6250.0	9.00	575.70
6500.0	9.36	619.19
6750.0	9.72	664.13
7000.0	10.08	710.52
7250.0	10.44	758.36
7500.0	10.80	807.63
7750.0	11.16	858.33
8000.0	11.52	910.45
8250.0	11.88	963.98
8500.0	12.24	1018.93
8750.0	12.60	1075.28
9000.0	12.96	1133.02
9250.0	13.32	1192.16
9500.0	13.68	1252.68
9750.0	14.04	1314.58
10000.0	14.40	1377.86
10250.0	14.76	1442.51
10500.0	15.12	1508.53
10750.0	15.48	1575.91
11000.0	15.84	1644.64
11250.0	16.20	1714.73
11500.0	16.56	1786.17
11750.0	16.92	1858.95
12000.0	17.28	1933.07
12250.0	17.64	2008.52
12500.0	18.00	2085.31
12750.0	18.36	2163.43
13000.0	18.72	2242.87
13250.0	19.08	2323.63
13500.0	19.44	2405.71
13750.0	19.80	2489.11
14000.0	20.16	2573.81
14250.0	20.52	2659.83
14500.0	20.88	2747.14
14750.0	21.24	2835.76
15000.0	21.60	2925.67
15250.0	21.96	3016.88
15500.0	22.32	3109.38
15750.0	22.68	3203.17
16000.0	23.04	3298.24

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	27.85	32.35
250.0	0.36	29.32	33.82
500.0	0.72	33.15	37.65
750.0	1.08	39.10	43.60
1000.0	1.44	47.04	51.54
1250.0	1.80	56.88	61.38
1500.0	2.16	68.56	73.06
1750.0	2.52	82.05	86.55
2000.0	2.88	97.29	101.79
2250.0	3.24	114.26	118.76
2500.0	3.60	132.92	137.42
2750.0	3.96	153.25	157.75
3000.0	4.32	175.24	179.74
3250.0	4.68	198.84	203.34
3500.0	5.04	224.06	228.56
3750.0	5.40	250.87	255.37
4000.0	5.76	279.25	283.75
4250.0	6.12	309.20	313.70
4500.0	6.48	340.70	345.20
4750.0	6.84	373.73	378.23
5000.0	7.20	408.28	412.78
5250.0	7.56	444.35	448.85
5500.0	7.92	481.92	486.42
5750.0	8.28	520.98	525.48
6000.0	8.64	561.53	566.03
6250.0	9.00	603.55	608.05
6500.0	9.36	647.04	651.54
6750.0	9.72	691.98	696.48
7000.0	10.08	738.37	742.87
7250.0	10.44	786.21	790.71
7500.0	10.80	835.48	839.98
7750.0	11.16	886.18	890.68
8000.0	11.52	938.30	942.80
8250.0	11.88	991.83	996.33
8500.0	12.24	1046.78	1051.28
8750.0	12.60	1103.13	1107.63
9000.0	12.96	1160.87	1165.37
9250.0	13.32	1220.01	1224.51
9500.0	13.68	1280.53	1285.03
9750.0	14.04	1342.43	1346.93
10000.0	14.40	1405.71	1410.21
10250.0	14.76	1470.36	1474.86
10500.0	15.12	1536.38	1540.88
10750.0	15.48	1603.76	1608.26
11000.0	15.84	1672.49	1676.99
11250.0	16.20	1742.58	1747.08
11500.0	16.56	1814.02	1818.52
11750.0	16.92	1886.80	1891.30
12000.0	17.28	1960.92	1965.42
12250.0	17.64	2036.37	2040.87
12500.0	18.00	2113.16	2117.66
12750.0	18.36	2191.28	2195.78
13000.0	18.72	2270.72	2275.22
13250.0	19.08	2351.48	2355.98
13500.0	19.44	2433.56	2438.06
13750.0	19.80	2516.96	2521.46
14000.0	20.16	2601.66	2606.16
14250.0	20.52	2687.68	2692.18
14500.0	20.88	2774.99	2779.49
14750.0	21.24	2863.61	2868.11
15000.0	21.60	2953.52	2958.02
15250.0	21.96	3044.73	3049.23
15500.0	22.32	3137.23	3141.73
15750.0	22.68	3231.02	3235.52
16000.0	23.04	3326.09	3330.59

MIN Static Head = 27.85
MAX Static Head = 32.35

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – B Modified High Point

FM System Curve - 24"

Diameter = 24 in
Area = 3.141593 ft^2
RH=D/4= 0.5
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – B Modified High Point

13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve - 24" (14" parallel FM portion)

Diameter = 24 in

Area = 3.141593 ft^2

RH= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	316.00	100	0.0000	0.0000	3.8	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	316.00	100	0.0000	0.0034	3.8	0.002	0.0053
500.0	0.72	1.11	24.00	0.35	0.00	316.00	100	0.0000	0.0123	3.8	0.007	0.0198
750.0	1.08	1.67	24.00	0.53	0.00	316.00	100	0.0001	0.0261	3.8	0.017	0.0428
1000.0	1.44	2.23	24.00	0.71	0.01	316.00	100	0.0001	0.0445	3.8	0.030	0.0742
1250.0	1.80	2.79	24.00	0.89	0.01	316.00	100	0.0002	0.0673	3.8	0.046	0.1137
1500.0	2.16	3.34	24.00	1.06	0.02	316.00	100	0.0003	0.0943	3.8	0.067	0.1611
1750.0	2.52	3.90	24.00	1.24	0.02	316.00	100	0.0004	0.1255	3.8	0.091	0.2164
2000.0	2.88	4.46	24.00	1.42	0.03	316.00	100	0.0005	0.1607	3.8	0.119	0.2794
2250.0	3.24	5.01	24.00	1.60	0.04	316.00	100	0.0006	0.1999	3.8	0.150	0.3501
2500.0	3.60	5.57	24.00	1.77	0.05	316.00	100	0.0008	0.2429	3.8	0.186	0.4284
2750.0	3.96	6.13	24.00	1.95	0.06	316.00	100	0.0009	0.2898	3.8	0.224	0.5143
3000.0	4.32	6.68	24.00	2.13	0.07	316.00	100	0.0011	0.3405	3.8	0.267	0.6077
3250.0	4.68	7.24	24.00	2.31	0.08	316.00	100	0.0012	0.3949	3.8	0.314	0.7084
3500.0	5.04	7.80	24.00	2.48	0.10	316.00	100	0.0014	0.4530	3.8	0.364	0.8166
3750.0	5.40	8.36	24.00	2.66	0.11	316.00	100	0.0016	0.5148	3.8	0.417	0.9322
4000.0	5.76	8.91	24.00	2.84	0.12	316.00	100	0.0018	0.5801	3.8	0.475	1.0550
4250.0	6.12	9.47	24.00	3.01	0.14	316.00	100	0.0021	0.6491	3.8	0.536	1.1852
4500.0	6.48	10.03	24.00	3.19	0.16	316.00	100	0.0023	0.7215	3.8	0.601	1.3226
4750.0	6.84	10.58	24.00	3.37	0.18	316.00	100	0.0025	0.7975	3.8	0.670	1.4672
5000.0	7.20	11.14	24.00	3.55	0.20	316.00	100	0.0028	0.8770	3.8	0.742	1.6191
5250.0	7.56	11.70	24.00	3.72	0.22	316.00	100	0.0030	0.9599	3.8	0.818	1.7781
5500.0	7.92	12.25	24.00	3.90	0.24	316.00	100	0.0033	1.0463	3.8	0.898	1.9442
5750.0	8.28	12.81	24.00	4.08	0.26	316.00	100	0.0036	1.1361	3.8	0.981	2.1175
6000.0	8.64	13.37	24.00	4.26	0.28	316.00	100	0.0039	1.2293	3.8	1.069	2.2978
6250.0	9.00	13.93	24.00	4.43	0.31	316.00	100	0.0042	1.3258	3.8	1.159	2.4853
6500.0	9.36	14.48	24.00	4.61	0.33	316.00	100	0.0045	1.4257	3.8	1.254	2.6798
6750.0	9.72	15.04	24.00	4.79	0.36	316.00	100	0.0048	1.5289	3.8	1.352	2.8813
7000.0	10.08	15.60	24.00	4.96	0.38	316.00	100	0.0052	1.6354	3.8	1.454	3.0898
7250.0	10.44	16.15	24.00	5.14	0.41	316.00	100	0.0055	1.7452	3.8	1.560	3.3054
7500.0	10.80	16.71	24.00	5.32	0.44	316.00	100	0.0059	1.8583	3.8	1.670	3.5279
7750.0	11.16	17.27	24.00	5.50	0.47	316.00	100	0.0062	1.9747	3.8	1.783	3.7575
8000.0	11.52	17.83	24.00	5.67	0.50	316.00	100	0.0066	2.0943	3.8	1.900	3.9939
8250.0	11.88	18.38	24.00	5.85	0.53	316.00	100	0.0070	2.2171	3.8	2.020	4.2373
8500.0	12.24	18.94	24.00	6.03	0.56	316.00	100	0.0074	2.3431	3.8	2.145	4.4876
8750.0	12.60	19.50	24.00	6.21	0.60	316.00	100	0.0078	2.4723	3.8	2.273	4.7449
9000.0	12.96	20.05	24.00	6.38	0.63	316.00	100	0.0082	2.6048	3.8	2.404	5.0090
9250.0	13.32	20.61	24.00	6.56	0.67	316.00	100	0.0087	2.7403	3.8	2.540	5.2800
9500.0	13.68	21.17	24.00	6.74	0.70	316.00	100	0.0091	2.8791	3.8	2.679	5.5579
9750.0	14.04	21.72	24.00	6.92	0.74	316.00	100	0.0096	3.0210	3.8	2.822	5.8426
10000.0	14.40	22.28	24.00	7.09	0.78	316.00	100	0.0100	3.1660	3.8	2.968	6.1342

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – B Modified High Point

10250.0	14.76	22.84	24.00	7.27	0.82	316.00	100	0.0105	3.3141	3.8	3.118	6.4326
10500.0	15.12	23.40	24.00	7.45	0.86	316.00	100	0.0110	3.4654	3.8	3.272	6.7378
10750.0	15.48	23.95	24.00	7.62	0.90	316.00	100	0.0115	3.6197	3.8	3.430	7.0499
11000.0	15.84	24.51	24.00	7.80	0.95	316.00	100	0.0120	3.7772	3.8	3.592	7.3687
11250.0	16.20	25.07	24.00	7.98	0.99	316.00	100	0.0125	3.9377	3.8	3.757	7.6943
11500.0	16.56	25.62	24.00	8.16	1.03	316.00	100	0.0130	4.1013	3.8	3.925	8.0267
11750.0	16.92	26.18	24.00	8.33	1.08	316.00	100	0.0135	4.2680	3.8	4.098	8.3659
12000.0	17.28	26.74	24.00	8.51	1.12	316.00	100	0.0140	4.4377	3.8	4.274	8.7119
12250.0	17.64	27.30	24.00	8.69	1.17	316.00	100	0.0146	4.6104	3.8	4.454	9.0645
12500.0	18.00	27.85	24.00	8.87	1.22	316.00	100	0.0151	4.7862	3.8	4.638	9.4240
12750.0	18.36	28.41	24.00	9.04	1.27	316.00	100	0.0157	4.9650	3.8	4.825	9.7901
13000.0	18.72	28.97	24.00	9.22	1.32	316.00	100	0.0163	5.1468	3.8	5.016	10.1630
13250.0	19.08	29.52	24.00	9.40	1.37	316.00	100	0.0169	5.3316	3.8	5.211	10.5426
13500.0	19.44	30.08	24.00	9.57	1.42	316.00	100	0.0175	5.5194	3.8	5.410	10.9289
13750.0	19.80	30.64	24.00	9.75	1.48	316.00	100	0.0181	5.7101	3.8	5.612	11.3219
14000.0	20.16	31.19	24.00	9.93	1.53	316.00	100	0.0187	5.9039	3.8	5.818	11.7216
14250.0	20.52	31.75	24.00	10.11	1.59	316.00	100	0.0193	6.1006	3.8	6.027	12.1279
14500.0	20.88	32.31	24.00	10.28	1.64	316.00	100	0.0199	6.3003	3.8	6.241	12.5410
14750.0	21.24	32.87	24.00	10.46	1.70	316.00	100	0.0206	6.5030	3.8	6.458	12.9607
15000.0	21.60	33.42	24.00	10.64	1.76	316.00	100	0.0212	6.7086	3.8	6.678	13.3870
15250.0	21.96	33.98	24.00	10.82	1.82	316.00	100	0.0219	6.9171	3.8	6.903	13.8200
15500.0	22.32	34.54	24.00	10.99	1.88	316.00	100	0.0226	7.1286	3.8	7.131	14.2597
15750.0	22.68	35.09	24.00	11.17	1.94	316.00	100	0.0232	7.3430	3.8	7.363	14.7060
16000.0	23.04	35.65	24.00	11.35	2.00	316.00	100	0.0239	7.5603	3.8	7.599	15.1589

FM System Curve - 14" (14" parallel FM portion)

Diameter = 14 in

Area = 1.069 ft^2

RH = 0.2917

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	14.00	0.00	0.00	68.50	100	0.0000	0.0000	1.72	0.000	0.0000
250.0	0.36	0.56	14.00	0.52	0.00	68.50	100	0.0001	0.0102	1.72	0.007	0.0175
500.0	0.72	1.11	14.00	1.04	0.02	68.50	100	0.0005	0.0369	1.72	0.029	0.0659
750.0	1.08	1.67	14.00	1.56	0.04	68.50	100	0.0011	0.0782	1.72	0.065	0.1435
1000.0	1.44	2.23	14.00	2.08	0.07	68.50	100	0.0019	0.1333	1.72	0.116	0.2493
1250.0	1.80	2.79	14.00	2.61	0.11	68.50	100	0.0029	0.2014	1.72	0.181	0.3827
1500.0	2.16	3.34	14.00	3.13	0.15	68.50	100	0.0041	0.2824	1.72	0.261	0.5434
1750.0	2.52	3.90	14.00	3.65	0.21	68.50	100	0.0055	0.3756	1.72	0.355	0.7310
2000.0	2.88	4.46	14.00	4.17	0.27	68.50	100	0.0070	0.4810	1.72	0.464	0.9452
2250.0	3.24	5.01	14.00	4.69	0.34	68.50	100	0.0087	0.5983	1.72	0.587	1.1857
2500.0	3.60	5.57	14.00	5.21	0.42	68.50	100	0.0106	0.7272	1.72	0.725	1.4524
2750.0	3.96	6.13	14.00	5.73	0.51	68.50	100	0.0127	0.8676	1.72	0.877	1.7451
3000.0	4.32	6.68	14.00	6.25	0.61	68.50	100	0.0149	1.0193	1.72	1.044	2.0636
3250.0	4.68	7.24	14.00	6.77	0.71	68.50	100	0.0173	1.1822	1.72	1.226	2.4077
3500.0	5.04	7.80	14.00	7.30	0.83	68.50	100	0.0198	1.3561	1.72	1.421	2.7775
3750.0	5.40	8.36	14.00	7.82	0.95	68.50	100	0.0225	1.5409	1.72	1.632	3.1726
4000.0	5.76	8.91	14.00	8.34	1.08	68.50	100	0.0254	1.7366	1.72	1.856	3.5930
4250.0	6.12	9.47	14.00	8.86	1.22	68.50	100	0.0284	1.9429	1.72	2.096	4.0387
4500.0	6.48	10.03	14.00	9.38	1.37	68.50	100	0.0315	2.1599	1.72	2.350	4.5095
4750.0	6.84	10.58	14.00	9.90	1.52	68.50	100	0.0349	2.3873	1.72	2.618	5.0053
5000.0	7.20	11.14	14.00	10.42	1.69	68.50	100	0.0383	2.6252	1.72	2.901	5.5260
5250.0	7.56	11.70	14.00	10.94	1.86	68.50	100	0.0419	2.8735	1.72	3.198	6.0716
5500.0	7.92	12.25	14.00	11.46	2.04	68.50	100	0.0457	3.1320	1.72	3.510	6.6420
5750.0	8.28	12.81	14.00	11.98	2.23	68.50	100	0.0496	3.4008	1.72	3.836	7.2370
6000.0	8.64	13.37	14.00	12.51	2.43	68.50	100	0.0537	3.6797	1.72	4.177	7.8568
6250.0	9.00	13.93	14.00	13.03	2.64	68.50	100	0.0579	3.9687	1.72	4.532	8.5011
6500.0	9.36	14.48	14.00	13.55	2.85	68.50	100	0.0623	4.2677	1.72	4.902	9.1699
6750.0	9.72	15.04	14.00	14.07	3.07	68.50	100	0.0668	4.5766	1.72	5.287	9.8633

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – B Modified High Point

7000.0	10.08	15.60	14.00	14.59	3.31	68.50	100	0.0715	4.8955	1.72	5.685	10.5810
7250.0	10.44	16.15	14.00	15.11	3.55	68.50	100	0.0763	5.2242	1.72	6.099	11.3231
7500.0	10.80	16.71	14.00	15.63	3.79	68.50	100	0.0812	5.5628	1.72	6.527	12.0894
7750.0	11.16	17.27	14.00	16.15	4.05	68.50	100	0.0863	5.9110	1.72	6.969	12.8801
8000.0	11.52	17.83	14.00	16.67	4.32	68.50	100	0.0915	6.2690	1.72	7.426	13.6949
8250.0	11.88	18.38	14.00	17.20	4.59	68.50	100	0.0969	6.6367	1.72	7.897	14.5339
8500.0	12.24	18.94	14.00	17.72	4.87	68.50	100	0.1024	7.0139	1.72	8.383	15.3971
8750.0	12.60	19.50	14.00	18.24	5.16	68.50	100	0.1080	7.4007	1.72	8.884	16.2843
9000.0	12.96	20.05	14.00	18.76	5.46	68.50	100	0.1138	7.7971	1.72	9.398	17.1955
9250.0	13.32	20.61	14.00	19.28	5.77	68.50	100	0.1198	8.2030	1.72	9.928	18.1308
9500.0	13.68	21.17	14.00	19.80	6.09	68.50	100	0.1258	8.6183	1.72	10.472	19.0900
9750.0	14.04	21.72	14.00	20.32	6.41	68.50	100	0.1320	9.0430	1.72	11.030	20.0731
10000.0	14.40	22.28	14.00	20.84	6.75	68.50	100	0.1384	9.4771	1.72	11.603	21.0801
10250.0	14.76	22.84	14.00	21.36	7.09	68.50	100	0.1448	9.9206	1.72	12.190	22.1110
10500.0	15.12	23.40	14.00	21.89	7.44	68.50	100	0.1514	10.3734	1.72	12.792	23.1657
10750.0	15.48	23.95	14.00	22.41	7.80	68.50	100	0.1582	10.8354	1.72	13.409	24.2441
11000.0	15.84	24.51	14.00	22.93	8.16	68.50	100	0.1651	11.3067	1.72	14.040	25.3463
11250.0	16.20	25.07	14.00	23.45	8.54	68.50	100	0.1721	11.7872	1.72	14.685	26.4722
11500.0	16.56	25.62	14.00	23.97	8.92	68.50	100	0.1792	12.2769	1.72	15.345	27.6219
11750.0	16.92	26.18	14.00	24.49	9.31	68.50	100	0.1865	12.7758	1.72	16.019	28.7951
12000.0	17.28	26.74	14.00	25.01	9.71	68.50	100	0.1939	13.2837	1.72	16.708	29.9920
12250.0	17.64	27.30	14.00	25.53	10.12	68.50	100	0.2015	13.8008	1.72	17.412	31.2126
12500.0	18.00	27.85	14.00	26.05	10.54	68.50	100	0.2092	14.3270	1.72	18.130	32.4566
12750.0	18.36	28.41	14.00	26.58	10.97	68.50	100	0.2170	14.8621	1.72	18.862	33.7243
13000.0	18.72	28.97	14.00	27.10	11.40	68.50	100	0.2249	15.4063	1.72	19.609	35.0154
13250.0	19.08	29.52	14.00	27.62	11.84	68.50	100	0.2330	15.9595	1.72	20.371	36.3300
13500.0	19.44	30.08	14.00	28.14	12.29	68.50	100	0.2412	16.5217	1.72	21.146	37.6682
13750.0	19.80	30.64	14.00	28.66	12.75	68.50	100	0.2495	17.0928	1.72	21.937	39.0297
14000.0	20.16	31.19	14.00	29.18	13.22	68.50	100	0.2580	17.6728	1.72	22.742	40.4147
14250.0	20.52	31.75	14.00	29.70	13.70	68.50	100	0.2666	18.2617	1.72	23.561	41.8230
14500.0	20.88	32.31	14.00	30.22	14.18	68.50	100	0.2753	18.8595	1.72	24.395	43.2548
14750.0	21.24	32.87	14.00	30.74	14.68	68.50	100	0.2842	19.4661	1.72	25.244	44.7099
15000.0	21.60	33.42	14.00	31.26	15.18	68.50	100	0.2932	20.0816	1.72	26.107	46.1883
15250.0	21.96	33.98	14.00	31.79	15.69	68.50	100	0.3023	20.7058	1.72	26.984	47.6900
15500.0	22.32	34.54	14.00	32.31	16.21	68.50	100	0.3115	21.3388	1.72	27.876	49.2150
15750.0	22.68	35.09	14.00	32.83	16.73	68.50	100	0.3209	21.9806	1.72	28.783	50.7633
16000.0	23.04	35.65	14.00	33.35	17.27	68.50	100	0.3304	22.6312	1.72	29.704	52.3348

FM System Curve – 13.5" (14" PVC) (14" parallel FM portion)

Diameter = 13.5 in

Area = 0.99402 ft^2

RH= 0.28125

C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	13.50	0.00	0.00	10640.50	120	0.0000	0.0000	3.1	0.000	0.0000
250.0	0.36	0.56	13.50	0.56	0.00	10640.50	120	0.0001	1.3528	3.1	0.015	1.3679
500.0	0.72	1.11	13.50	1.12	0.02	10640.50	120	0.0005	4.8835	3.1	0.060	4.9439
750.0	1.08	1.67	13.50	1.68	0.04	10640.50	120	0.0010	10.3478	3.1	0.136	10.4839
1000.0	1.44	2.23	13.50	2.24	0.08	10640.50	120	0.0017	17.6293	3.1	0.242	17.8711
1250.0	1.80	2.79	13.50	2.80	0.12	10640.50	120	0.0025	26.6509	3.1	0.378	27.0288
1500.0	2.16	3.34	13.50	3.36	0.18	10640.50	120	0.0035	37.3556	3.1	0.544	37.8998
1750.0	2.52	3.90	13.50	3.92	0.24	10640.50	120	0.0047	49.6982	3.1	0.741	50.4390
2000.0	2.88	4.46	13.50	4.48	0.31	10640.50	120	0.0060	63.6417	3.1	0.967	64.6092
2250.0	3.24	5.01	13.50	5.04	0.39	10640.50	120	0.0074	79.1547	3.1	1.224	80.3791
2500.0	3.60	5.57	13.50	5.60	0.49	10640.50	120	0.0090	96.2098	3.1	1.512	97.7215
2750.0	3.96	6.13	13.50	6.16	0.59	10640.50	120	0.0108	114.7833	3.1	1.829	116.6124
3000.0	4.32	6.68	13.50	6.72	0.70	10640.50	120	0.0127	134.8538	3.1	2.177	137.0306
3250.0	4.68	7.24	13.50	7.29	0.82	10640.50	120	0.0147	156.4021	3.1	2.555	158.9568
3500.0	5.04	7.80	13.50	7.85	0.96	10640.50	120	0.0169	179.4108	3.1	2.963	182.3737
3750.0	5.40	8.36	13.50	8.41	1.10	10640.50	120	0.0192	203.8640	3.1	3.401	207.2652
4000.0	5.76	8.91	13.50	8.97	1.25	10640.50	120	0.0216	229.7469	3.1	3.870	233.6168

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – B Modified High Point

4250.0	6.12	9.47	13.50	9.53	1.41	10640.50	120	0.0242	257.0460	3.1	4.369	261.4148
4500.0	6.48	10.03	13.50	10.09	1.58	10640.50	120	0.0269	285.7486	3.1	4.898	290.6465
4750.0	6.84	10.58	13.50	10.65	1.76	10640.50	120	0.0297	315.8429	3.1	5.457	321.3001
5000.0	7.20	11.14	13.50	11.21	1.95	10640.50	120	0.0326	347.3178	3.1	6.047	353.3645
5250.0	7.56	11.70	13.50	11.77	2.15	10640.50	120	0.0357	380.1628	3.1	6.667	386.8293
5500.0	7.92	12.25	13.50	12.33	2.36	10640.50	120	0.0389	414.3680	3.1	7.317	421.6846
5750.0	8.28	12.81	13.50	12.89	2.58	10640.50	120	0.0423	449.9242	3.1	7.997	457.9210
6000.0	8.64	13.37	13.50	13.45	2.81	10640.50	120	0.0458	486.8225	3.1	8.707	495.5298
6250.0	9.00	13.93	13.50	14.01	3.05	10640.50	120	0.0493	525.0544	3.1	9.448	534.5025
6500.0	9.36	14.48	13.50	14.57	3.30	10640.50	120	0.0531	564.6120	3.1	10.219	574.8309
6750.0	9.72	15.04	13.50	15.13	3.55	10640.50	120	0.0569	605.4874	3.1	11.020	616.5076
7000.0	10.08	15.60	13.50	15.69	3.82	10640.50	120	0.0609	647.6735	3.1	11.852	659.5251
7250.0	10.44	16.15	13.50	16.25	4.10	10640.50	120	0.0650	691.1631	3.1	12.713	703.8763
7500.0	10.80	16.71	13.50	16.81	4.39	10640.50	120	0.0692	735.9495	3.1	13.605	749.5546
7750.0	11.16	17.27	13.50	17.37	4.69	10640.50	120	0.0735	782.0262	3.1	14.527	796.5535
8000.0	11.52	17.83	13.50	17.93	4.99	10640.50	120	0.0779	829.3870	3.1	15.480	844.8666
8250.0	11.88	18.38	13.50	18.49	5.31	10640.50	120	0.0825	878.0258	3.1	16.462	894.4880
8500.0	12.24	18.94	13.50	19.05	5.64	10640.50	120	0.0872	927.9368	3.1	17.475	945.4118
8750.0	12.60	19.50	13.50	19.61	5.97	10640.50	120	0.0920	979.1145	3.1	18.518	997.6326
9000.0	12.96	20.05	13.50	20.17	6.32	10640.50	120	0.0969	1031.5533	3.1	19.591	1051.1447
9250.0	13.32	20.61	13.50	20.73	6.68	10640.50	120	0.1020	1085.2481	3.1	20.695	1105.9430
9500.0	13.68	21.17	13.50	21.29	7.04	10640.50	120	0.1072	1140.1938	3.1	21.829	1162.0225
9750.0	14.04	21.72	13.50	21.86	7.42	10640.50	120	0.1124	1196.3854	3.1	22.993	1219.3781
10000.0	14.40	22.28	13.50	22.42	7.80	10640.50	120	0.1178	1253.8181	3.1	24.187	1278.0050
10250.0	14.76	22.84	13.50	22.98	8.20	10640.50	120	0.1233	1312.4874	3.1	25.411	1337.8988
10500.0	15.12	23.40	13.50	23.54	8.60	10640.50	120	0.1290	1372.3887	3.1	26.666	1399.0548
10750.0	15.48	23.95	13.50	24.10	9.02	10640.50	120	0.1347	1433.5176	3.1	27.951	1461.4686
11000.0	15.84	24.51	13.50	24.66	9.44	10640.50	120	0.1406	1495.8698	3.1	29.266	1525.1360
11250.0	16.20	25.07	13.50	25.22	9.87	10640.50	120	0.1466	1559.4413	3.1	30.612	1590.0528
11500.0	16.56	25.62	13.50	25.78	10.32	10640.50	120	0.1526	1624.2278	3.1	31.987	1656.2150
11750.0	16.92	26.18	13.50	26.34	10.77	10640.50	120	0.1588	1690.2256	3.1	33.393	1723.6187
12000.0	17.28	26.74	13.50	26.90	11.24	10640.50	120	0.1652	1757.4307	3.1	34.829	1792.2599
12250.0	17.64	27.30	13.50	27.46	11.71	10640.50	120	0.1716	1825.8394	3.1	36.295	1862.1349
12500.0	18.00	27.85	13.50	28.02	12.19	10640.50	120	0.1781	1895.4481	3.1	37.792	1933.2401
12750.0	18.36	28.41	13.50	28.58	12.68	10640.50	120	0.1848	1966.2531	3.1	39.319	2005.5719
13000.0	18.72	28.97	13.50	29.14	13.19	10640.50	120	0.1916	2038.2509	3.1	40.876	2079.1267
13250.0	19.08	29.52	13.50	29.70	13.70	10640.50	120	0.1984	2111.4381	3.1	42.463	2153.9012
13500.0	19.44	30.08	13.50	30.26	14.22	10640.50	120	0.2054	2185.8114	3.1	44.081	2229.8920
13750.0	19.80	30.64	13.50	30.82	14.75	10640.50	120	0.2125	2261.3675	3.1	45.728	2307.0959
14000.0	20.16	31.19	13.50	31.38	15.29	10640.50	120	0.2197	2338.1032	3.1	47.406	2385.5095
14250.0	20.52	31.75	13.50	31.94	15.84	10640.50	120	0.2271	2416.0153	3.1	49.115	2465.1298
14500.0	20.88	32.31	13.50	32.50	16.40	10640.50	120	0.2345	2495.1008	3.1	50.853	2545.9537
14750.0	21.24	32.87	13.50	33.06	16.97	10640.50	120	0.2420	2575.3566	3.1	52.622	2627.9782
15000.0	21.60	33.42	13.50	33.62	17.56	10640.50	120	0.2497	2656.7798	3.1	54.421	2711.2003
15250.0	21.96	33.98	13.50	34.18	18.15	10640.50	120	0.2574	2739.3675	3.1	56.250	2795.6172
15500.0	22.32	34.54	13.50	34.74	18.74	10640.50	120	0.2653	2823.1168	3.1	58.109	2881.2259
15750.0	22.68	35.09	13.50	35.30	19.35	10640.50	120	0.2733	2908.0250	3.1	59.999	2968.0237
16000.0	23.04	35.65	13.50	35.87	19.97	10640.50	120	0.2814	2994.0893	3.1	61.918	3056.0078

FM System Curve - 23.85" (28" HDPE)

Diameter =	23.85	in
Area =	3.1024	ft^2
RH=	0.4969	
C=	120	

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	619.99	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	619.99	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	619.99	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	619.99	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	619.99	120	0.0001	0.0642	2.7	0.022	0.0859

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – B Modified High Point

1250.0	1.80	2.79	23.85	0.90	0.01	619.99	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	619.99	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	619.99	120	0.0003	0.1811	2.7	0.066	0.2473
2000.0	2.88	4.46	23.85	1.44	0.03	619.99	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	619.99	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	619.99	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	619.99	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	619.99	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	619.99	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	619.99	120	0.0011	0.6538	2.7	0.265	0.9187
3750.0	5.40	8.36	23.85	2.69	0.11	619.99	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	619.99	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	619.99	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	619.99	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	619.99	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	619.99	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	619.99	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	619.99	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	619.99	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	619.99	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	619.99	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	619.99	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	619.99	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	619.99	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	619.99	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	619.99	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	619.99	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	619.99	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	619.99	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	619.99	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	619.99	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	619.99	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	619.99	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	619.99	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	619.99	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	619.99	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	619.99	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	619.99	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	619.99	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	619.99	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	619.99	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	619.99	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	619.99	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	619.99	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	619.99	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	619.99	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	619.99	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	619.99	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	619.99	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	619.99	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	619.99	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	619.99	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	619.99	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	619.99	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	619.99	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	619.99	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	619.99	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	619.99	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	619.99	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	619.99	120	0.0176	10.9108	2.7	5.536	16.4469

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – B Modified High Point

FM System Curve – 25.14" (28" DIP)

Diameter = 25.14 in
Area = 3.4471 ft^2
RH= 0.5238
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.14	0.00	0.00	625.00	100	0.0000	0.0000	0.6	0.000	0.0000
250.0	0.36	0.56	25.14	0.16	0.00	625.00	100	0.0000	0.0054	0.6	0.000	0.0056
500.0	0.72	1.11	25.14	0.32	0.00	625.00	100	0.0000	0.0195	0.6	0.001	0.0204
750.0	1.08	1.67	25.14	0.48	0.00	625.00	100	0.0001	0.0412	0.6	0.002	0.0434
1000.0	1.44	2.23	25.14	0.65	0.01	625.00	100	0.0001	0.0702	0.6	0.004	0.0741
1250.0	1.80	2.79	25.14	0.81	0.01	625.00	100	0.0002	0.1062	0.6	0.006	0.1123
1500.0	2.16	3.34	25.14	0.97	0.01	625.00	100	0.0002	0.1488	0.6	0.009	0.1576
1750.0	2.52	3.90	25.14	1.13	0.02	625.00	100	0.0003	0.1980	0.6	0.012	0.2099
2000.0	2.88	4.46	25.14	1.29	0.03	625.00	100	0.0004	0.2535	0.6	0.016	0.2691
2250.0	3.24	5.01	25.14	1.45	0.03	625.00	100	0.0005	0.3153	0.6	0.020	0.3350
2500.0	3.60	5.57	25.14	1.62	0.04	625.00	100	0.0006	0.3833	0.6	0.024	0.4076
2750.0	3.96	6.13	25.14	1.78	0.05	625.00	100	0.0007	0.4573	0.6	0.029	0.4867
3000.0	4.32	6.68	25.14	1.94	0.06	625.00	100	0.0009	0.5372	0.6	0.035	0.5723
3250.0	4.68	7.24	25.14	2.10	0.07	625.00	100	0.0010	0.6231	0.6	0.041	0.6642
3500.0	5.04	7.80	25.14	2.26	0.08	625.00	100	0.0011	0.7147	0.6	0.048	0.7624
3750.0	5.40	8.36	25.14	2.42	0.09	625.00	100	0.0013	0.8122	0.6	0.055	0.8669
4000.0	5.76	8.91	25.14	2.59	0.10	625.00	100	0.0015	0.9153	0.6	0.062	0.9776
4250.0	6.12	9.47	25.14	2.75	0.12	625.00	100	0.0016	1.0240	0.6	0.070	1.0943
4500.0	6.48	10.03	25.14	2.91	0.13	625.00	100	0.0018	1.1384	0.6	0.079	1.2172
4750.0	6.84	10.58	25.14	3.07	0.15	625.00	100	0.0020	1.2583	0.6	0.088	1.3461
5000.0	7.20	11.14	25.14	3.23	0.16	625.00	100	0.0022	1.3837	0.6	0.097	1.4810
5250.0	7.56	11.70	25.14	3.39	0.18	625.00	100	0.0024	1.5145	0.6	0.107	1.6218
5500.0	7.92	12.25	25.14	3.56	0.20	625.00	100	0.0026	1.6508	0.6	0.118	1.7685
5750.0	8.28	12.81	25.14	3.72	0.21	625.00	100	0.0029	1.7924	0.6	0.129	1.9211
6000.0	8.64	13.37	25.14	3.88	0.23	625.00	100	0.0031	1.9394	0.6	0.140	2.0796
6250.0	9.00	13.93	25.14	4.04	0.25	625.00	100	0.0033	2.0917	0.6	0.152	2.2438
6500.0	9.36	14.48	25.14	4.20	0.27	625.00	100	0.0036	2.2493	0.6	0.164	2.4138
6750.0	9.72	15.04	25.14	4.36	0.30	625.00	100	0.0039	2.4122	0.6	0.177	2.5895
7000.0	10.08	15.60	25.14	4.52	0.32	625.00	100	0.0041	2.5802	0.6	0.191	2.7710
7250.0	10.44	16.15	25.14	4.69	0.34	625.00	100	0.0044	2.7535	0.6	0.205	2.9581
7500.0	10.80	16.71	25.14	4.85	0.36	625.00	100	0.0047	2.9319	0.6	0.219	3.1509
7750.0	11.16	17.27	25.14	5.01	0.39	625.00	100	0.0050	3.1155	0.6	0.234	3.3493
8000.0	11.52	17.83	25.14	5.17	0.42	625.00	100	0.0053	3.3042	0.6	0.249	3.5533
8250.0	11.88	18.38	25.14	5.33	0.44	625.00	100	0.0056	3.4979	0.6	0.265	3.7629
8500.0	12.24	18.94	25.14	5.49	0.47	625.00	100	0.0059	3.6968	0.6	0.281	3.9780
8750.0	12.60	19.50	25.14	5.66	0.50	625.00	100	0.0062	3.9006	0.6	0.298	4.1987
9000.0	12.96	20.05	25.14	5.82	0.53	625.00	100	0.0066	4.1096	0.6	0.315	4.4249
9250.0	13.32	20.61	25.14	5.98	0.56	625.00	100	0.0069	4.3235	0.6	0.333	4.6565
9500.0	13.68	21.17	25.14	6.14	0.59	625.00	100	0.0073	4.5424	0.6	0.351	4.8937
9750.0	14.04	21.72	25.14	6.30	0.62	625.00	100	0.0076	4.7662	0.6	0.370	5.1363
10000.0	14.40	22.28	25.14	6.46	0.65	625.00	100	0.0080	4.9950	0.6	0.389	5.3843
10250.0	14.76	22.84	25.14	6.63	0.68	625.00	100	0.0084	5.2288	0.6	0.409	5.6377
10500.0	15.12	23.40	25.14	6.79	0.72	625.00	100	0.0087	5.4674	0.6	0.429	5.8966
10750.0	15.48	23.95	25.14	6.95	0.75	625.00	100	0.0091	5.7109	0.6	0.450	6.1608
11000.0	15.84	24.51	25.14	7.11	0.79	625.00	100	0.0095	5.9593	0.6	0.471	6.4303
11250.0	16.20	25.07	25.14	7.27	0.82	625.00	100	0.0099	6.2126	0.6	0.493	6.7052
11500.0	16.56	25.62	25.14	7.43	0.86	625.00	100	0.0104	6.4707	0.6	0.515	6.9855
11750.0	16.92	26.18	25.14	7.59	0.90	625.00	100	0.0108	6.7336	0.6	0.537	7.2710
12000.0	17.28	26.74	25.14	7.76	0.93	625.00	100	0.0112	7.0013	0.6	0.561	7.5619
12250.0	17.64	27.30	25.14	7.92	0.97	625.00	100	0.0116	7.2739	0.6	0.584	7.8580
12500.0	18.00	27.85	25.14	8.08	1.01	625.00	100	0.0121	7.5512	0.6	0.608	8.1594
12750.0	18.36	28.41	25.14	8.24	1.05	625.00	100	0.0125	7.8333	0.6	0.633	8.4661
13000.0	18.72	28.97	25.14	8.40	1.10	625.00	100	0.0130	8.1201	0.6	0.658	8.7779
13250.0	19.08	29.52	25.14	8.56	1.14	625.00	100	0.0135	8.4117	0.6	0.683	9.0951

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – B Modified High Point

13500.0	19.44	30.08	25.14	8.73	1.18	625.00	100	0.0139	8.7079	0.6	0.709	9.4174
13750.0	19.80	30.64	25.14	8.89	1.23	625.00	100	0.0144	9.0089	0.6	0.736	9.7449
14000.0	20.16	31.19	25.14	9.05	1.27	625.00	100	0.0149	9.3147	0.6	0.763	10.0776
14250.0	20.52	31.75	25.14	9.21	1.32	625.00	100	0.0154	9.6250	0.6	0.790	10.4155
14500.0	20.88	32.31	25.14	9.37	1.36	625.00	100	0.0159	9.9401	0.6	0.818	10.7585
14750.0	21.24	32.87	25.14	9.53	1.41	625.00	100	0.0164	10.2598	0.6	0.847	11.1067
15000.0	21.60	33.42	25.14	9.70	1.46	625.00	100	0.0169	10.5842	0.6	0.876	11.4601
15250.0	21.96	33.98	25.14	9.86	1.51	625.00	100	0.0175	10.9132	0.6	0.905	11.8185
15500.0	22.32	34.54	25.14	10.02	1.56	625.00	100	0.0180	11.2469	0.6	0.935	12.1821
15750.0	22.68	35.09	25.14	10.18	1.61	625.00	100	0.0185	11.5851	0.6	0.966	12.5508
16000.0	23.04	35.65	25.14	10.34	1.66	625.00	100	0.0191	11.9280	0.6	0.997	12.9245

FM System Curve – 25.3" (30" HDPE)

Diameter = 25.3 in

Area = 3.4911 ft^2

RH= 0.5271

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.30	0.00	0.00	3481.00	120	0.0000	0.0000	4.125	0.000	0.0000
250.0	0.36	0.56	25.30	0.16	0.00	3481.00	120	0.0000	0.0208	4.125	0.002	0.0224
500.0	0.72	1.11	25.30	0.32	0.00	3481.00	120	0.0000	0.0750	4.125	0.007	0.0815
750.0	1.08	1.67	25.30	0.48	0.00	3481.00	120	0.0000	0.1588	4.125	0.015	0.1735
1000.0	1.44	2.23	25.30	0.64	0.01	3481.00	120	0.0001	0.2706	4.125	0.026	0.2967
1250.0	1.80	2.79	25.30	0.80	0.01	3481.00	120	0.0001	0.4090	4.125	0.041	0.4498
1500.0	2.16	3.34	25.30	0.96	0.01	3481.00	120	0.0002	0.5733	4.125	0.059	0.6321
1750.0	2.52	3.90	25.30	1.12	0.02	3481.00	120	0.0002	0.7628	4.125	0.080	0.8427
2000.0	2.88	4.46	25.30	1.28	0.03	3481.00	120	0.0003	0.9768	4.125	0.104	1.0812
2250.0	3.24	5.01	25.30	1.44	0.03	3481.00	120	0.0003	1.2149	4.125	0.132	1.3470
2500.0	3.60	5.57	25.30	1.60	0.04	3481.00	120	0.0004	1.4767	4.125	0.163	1.6397
2750.0	3.96	6.13	25.30	1.76	0.05	3481.00	120	0.0005	1.7617	4.125	0.197	1.9591
3000.0	4.32	6.68	25.30	1.91	0.06	3481.00	120	0.0006	2.0698	4.125	0.235	2.3046
3250.0	4.68	7.24	25.30	2.07	0.07	3481.00	120	0.0007	2.4005	4.125	0.276	2.6761
3500.0	5.04	7.80	25.30	2.23	0.08	3481.00	120	0.0008	2.7537	4.125	0.320	3.0733
3750.0	5.40	8.36	25.30	2.39	0.09	3481.00	120	0.0009	3.1290	4.125	0.367	3.4959
4000.0	5.76	8.91	25.30	2.55	0.10	3481.00	120	0.0010	3.5262	4.125	0.417	3.9437
4250.0	6.12	9.47	25.30	2.71	0.11	3481.00	120	0.0011	3.9452	4.125	0.471	4.4165
4500.0	6.48	10.03	25.30	2.87	0.13	3481.00	120	0.0013	4.3858	4.125	0.528	4.9141
4750.0	6.84	10.58	25.30	3.03	0.14	3481.00	120	0.0014	4.8477	4.125	0.589	5.4364
5000.0	7.20	11.14	25.30	3.19	0.16	3481.00	120	0.0015	5.3308	4.125	0.652	5.9831
5250.0	7.56	11.70	25.30	3.35	0.17	3481.00	120	0.0017	5.8349	4.125	0.719	6.5540
5500.0	7.92	12.25	25.30	3.51	0.19	3481.00	120	0.0018	6.3599	4.125	0.789	7.1491
5750.0	8.28	12.81	25.30	3.67	0.21	3481.00	120	0.0020	6.9056	4.125	0.863	7.7683
6000.0	8.64	13.37	25.30	3.83	0.23	3481.00	120	0.0021	7.4719	4.125	0.939	8.4112
6250.0	9.00	13.93	25.30	3.99	0.25	3481.00	120	0.0023	8.0587	4.125	1.019	9.0779
6500.0	9.36	14.48	25.30	4.15	0.27	3481.00	120	0.0025	8.6659	4.125	1.102	9.7682
6750.0	9.72	15.04	25.30	4.31	0.29	3481.00	120	0.0027	9.2933	4.125	1.189	10.4820
7000.0	10.08	15.60	25.30	4.47	0.31	3481.00	120	0.0029	9.9408	4.125	1.278	11.2192
7250.0	10.44	16.15	25.30	4.63	0.33	3481.00	120	0.0030	10.6082	4.125	1.371	11.9797
7500.0	10.80	16.71	25.30	4.79	0.36	3481.00	120	0.0032	11.2956	4.125	1.468	12.7633
7750.0	11.16	17.27	25.30	4.95	0.38	3481.00	120	0.0034	12.0029	4.125	1.567	13.5700
8000.0	11.52	17.83	25.30	5.11	0.40	3481.00	120	0.0037	12.7298	4.125	1.670	14.3996
8250.0	11.88	18.38	25.30	5.27	0.43	3481.00	120	0.0039	13.4763	4.125	1.776	15.2521
8500.0	12.24	18.94	25.30	5.42	0.46	3481.00	120	0.0041	14.2423	4.125	1.885	16.1274
8750.0	12.60	19.50	25.30	5.58	0.48	3481.00	120	0.0043	15.0278	4.125	1.998	17.0255
9000.0	12.96	20.05	25.30	5.74	0.51	3481.00	120	0.0045	15.8327	4.125	2.113	17.9461
9250.0	13.32	20.61	25.30	5.90	0.54	3481.00	120	0.0048	16.6568	4.125	2.232	18.8893
9500.0	13.68	21.17	25.30	6.06	0.57	3481.00	120	0.0050	17.5002	4.125	2.355	19.8549
9750.0	14.04	21.72	25.30	6.22	0.60	3481.00	120	0.0053	18.3626	4.125	2.480	20.8429
10000.0	14.40	22.28	25.30	6.38	0.63	3481.00	120	0.0055	19.2441	4.125	2.609	21.8532
10250.0	14.76	22.84	25.30	6.54	0.66	3481.00	120	0.0058	20.1446	4.125	2.741	22.8858

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – B Modified High Point

10500.0	15.12	23.40	25.30	6.70	0.70	3481.00	120	0.0061	21.0640	4.125	2.877	23.9405
10750.0	15.48	23.95	25.30	6.86	0.73	3481.00	120	0.0063	22.0022	4.125	3.015	25.0174
11000.0	15.84	24.51	25.30	7.02	0.77	3481.00	120	0.0066	22.9592	4.125	3.157	26.1163
11250.0	16.20	25.07	25.30	7.18	0.80	3481.00	120	0.0069	23.9349	4.125	3.302	27.2371
11500.0	16.56	25.62	25.30	7.34	0.84	3481.00	120	0.0072	24.9293	4.125	3.451	28.3799
11750.0	16.92	26.18	25.30	7.50	0.87	3481.00	120	0.0075	25.9423	4.125	3.602	29.5445
12000.0	17.28	26.74	25.30	7.66	0.91	3481.00	120	0.0077	26.9738	4.125	3.757	30.7309
12250.0	17.64	27.30	25.30	7.82	0.95	3481.00	120	0.0081	28.0237	4.125	3.915	31.9390
12500.0	18.00	27.85	25.30	7.98	0.99	3481.00	120	0.0084	29.0921	4.125	4.077	33.1689
12750.0	18.36	28.41	25.30	8.14	1.03	3481.00	120	0.0087	30.1788	4.125	4.241	34.4203
13000.0	18.72	28.97	25.30	8.30	1.07	3481.00	120	0.0090	31.2839	4.125	4.409	35.6933
13250.0	19.08	29.52	25.30	8.46	1.11	3481.00	120	0.0093	32.4072	4.125	4.581	36.9879
13500.0	19.44	30.08	25.30	8.62	1.15	3481.00	120	0.0096	33.5487	4.125	4.755	38.3039
13750.0	19.80	30.64	25.30	8.78	1.20	3481.00	120	0.0100	34.7084	4.125	4.933	39.6413
14000.0	20.16	31.19	25.30	8.94	1.24	3481.00	120	0.0103	35.8861	4.125	5.114	41.0000
14250.0	20.52	31.75	25.30	9.09	1.28	3481.00	120	0.0107	37.0820	4.125	5.298	42.3801
14500.0	20.88	32.31	25.30	9.25	1.33	3481.00	120	0.0110	38.2958	4.125	5.486	43.7815
14750.0	21.24	32.87	25.30	9.41	1.38	3481.00	120	0.0114	39.5276	4.125	5.676	45.2041
15000.0	21.60	33.42	25.30	9.57	1.42	3481.00	120	0.0117	40.7773	4.125	5.871	46.6479
15250.0	21.96	33.98	25.30	9.73	1.47	3481.00	120	0.0121	42.0449	4.125	6.068	48.1128
15500.0	22.32	34.54	25.30	9.89	1.52	3481.00	120	0.0124	43.3303	4.125	6.268	49.5988
15750.0	22.68	35.09	25.30	10.05	1.57	3481.00	120	0.0128	44.6335	4.125	6.472	51.1058
16000.0	23.04	35.65	25.30	10.21	1.62	3481.00	120	0.0132	45.9545	4.125	6.679	52.6339

FM System Curve – 24"

Diameter =	24	in
Area for 25.3-inch =	3.1416	ft^2
RH=D/4=	0.5	
C=	100	

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	13542.30	100	0.0000	0.0000	3.03	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	13542.30	100	0.0000	0.1464	3.03	0.001	0.1479
500.0	0.72	1.11	24.00	0.35	0.00	13542.30	100	0.0000	0.5285	3.03	0.006	0.5344
750.0	1.08	1.67	24.00	0.53	0.00	13542.30	100	0.0001	1.1198	3.03	0.013	1.1331
1000.0	1.44	2.23	24.00	0.71	0.01	13542.30	100	0.0001	1.9077	3.03	0.024	1.9314
1250.0	1.80	2.79	24.00	0.89	0.01	13542.30	100	0.0002	2.8840	3.03	0.037	2.9210
1500.0	2.16	3.34	24.00	1.06	0.02	13542.30	100	0.0003	4.0424	3.03	0.053	4.0956
1750.0	2.52	3.90	24.00	1.24	0.02	13542.30	100	0.0004	5.3780	3.03	0.072	5.4505
2000.0	2.88	4.46	24.00	1.42	0.03	13542.30	100	0.0005	6.8869	3.03	0.095	6.9816
2250.0	3.24	5.01	24.00	1.60	0.04	13542.30	100	0.0006	8.5656	3.03	0.120	8.6854
2500.0	3.60	5.57	24.00	1.77	0.05	13542.30	100	0.0008	10.4112	3.03	0.148	10.5591
2750.0	3.96	6.13	24.00	1.95	0.06	13542.30	100	0.0009	12.4211	3.03	0.179	12.6001
3000.0	4.32	6.68	24.00	2.13	0.07	13542.30	100	0.0011	14.5930	3.03	0.213	14.8060
3250.0	4.68	7.24	24.00	2.31	0.08	13542.30	100	0.0012	16.9248	3.03	0.250	17.1748
3500.0	5.04	7.80	24.00	2.48	0.10	13542.30	100	0.0014	19.4146	3.03	0.290	19.7046
3750.0	5.40	8.36	24.00	2.66	0.11	13542.30	100	0.0016	22.0608	3.03	0.333	22.3936
4000.0	5.76	8.91	24.00	2.84	0.12	13542.30	100	0.0018	24.8617	3.03	0.379	25.2404
4250.0	6.12	9.47	24.00	3.01	0.14	13542.30	100	0.0021	27.8158	3.03	0.427	28.2433
4500.0	6.48	10.03	24.00	3.19	0.16	13542.30	100	0.0023	30.9218	3.03	0.479	31.4011
4750.0	6.84	10.58	24.00	3.37	0.18	13542.30	100	0.0025	34.1784	3.03	0.534	34.7124
5000.0	7.20	11.14	24.00	3.55	0.20	13542.30	100	0.0028	37.5844	3.03	0.592	38.1761
5250.0	7.56	11.70	24.00	3.72	0.22	13542.30	100	0.0030	41.1387	3.03	0.652	41.7910
5500.0	7.92	12.25	24.00	3.90	0.24	13542.30	100	0.0033	44.8402	3.03	0.716	45.5561
5750.0	8.28	12.81	24.00	4.08	0.26	13542.30	100	0.0036	48.6878	3.03	0.783	49.4703
6000.0	8.64	13.37	24.00	4.26	0.28	13542.30	100	0.0039	52.6807	3.03	0.852	53.5327
6250.0	9.00	13.93	24.00	4.43	0.31	13542.30	100	0.0042	56.8179	3.03	0.925	57.7424
6500.0	9.36	14.48	24.00	4.61	0.33	13542.30	100	0.0045	61.0986	3.03	1.000	62.0985
6750.0	9.72	15.04	24.00	4.79	0.36	13542.30	100	0.0048	65.5218	3.03	1.078	66.6002
7000.0	10.08	15.60	24.00	4.96	0.38	13542.30	100	0.0052	70.0869	3.03	1.160	71.2466
7250.0	10.44	16.15	24.00	5.14	0.41	13542.30	100	0.0055	74.7931	3.03	1.244	76.0371

Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – B Modified High Point

7500.0	10.80	16.71	24.00	5.32	0.44	13542.30	100	0.0059	79.6396	3.03	1.331	80.9709
7750.0	11.16	17.27	24.00	5.50	0.47	13542.30	100	0.0062	84.6257	3.03	1.422	86.0472
8000.0	11.52	17.83	24.00	5.67	0.50	13542.30	100	0.0066	89.7507	3.03	1.515	91.2655
8250.0	11.88	18.38	24.00	5.85	0.53	13542.30	100	0.0070	95.0141	3.03	1.611	96.6250
8500.0	12.24	18.94	24.00	6.03	0.56	13542.30	100	0.0074	100.4152	3.03	1.710	102.1251
8750.0	12.60	19.50	24.00	6.21	0.60	13542.30	100	0.0078	105.9533	3.03	1.812	107.7653
9000.0	12.96	20.05	24.00	6.38	0.63	13542.30	100	0.0082	111.6278	3.03	1.917	113.5449
9250.0	13.32	20.61	24.00	6.56	0.67	13542.30	100	0.0087	117.4383	3.03	2.025	119.4634
9500.0	13.68	21.17	24.00	6.74	0.70	13542.30	100	0.0091	123.3842	3.03	2.136	125.5202
9750.0	14.04	21.72	24.00	6.92	0.74	13542.30	100	0.0096	129.4649	3.03	2.250	131.7148
10000.0	14.40	22.28	24.00	7.09	0.78	13542.30	100	0.0100	135.6799	3.03	2.367	138.0466
10250.0	14.76	22.84	24.00	7.27	0.82	13542.30	100	0.0105	142.0287	3.03	2.487	144.5152
10500.0	15.12	23.40	24.00	7.45	0.86	13542.30	100	0.0110	148.5108	3.03	2.609	151.1201
10750.0	15.48	23.95	24.00	7.62	0.90	13542.30	100	0.0115	155.1257	3.03	2.735	157.8608
11000.0	15.84	24.51	24.00	7.80	0.95	13542.30	100	0.0120	161.8731	3.03	2.864	164.7369
11250.0	16.20	25.07	24.00	7.98	0.99	13542.30	100	0.0125	168.7524	3.03	2.995	171.7478
11500.0	16.56	25.62	24.00	8.16	1.03	13542.30	100	0.0130	175.7631	3.03	3.130	178.8932
11750.0	16.92	26.18	24.00	8.33	1.08	13542.30	100	0.0135	182.9050	3.03	3.268	186.1726
12000.0	17.28	26.74	24.00	8.51	1.12	13542.30	100	0.0140	190.1775	3.03	3.408	193.5856
12250.0	17.64	27.30	24.00	8.69	1.17	13542.30	100	0.0146	197.5802	3.03	3.552	201.1318
12500.0	18.00	27.85	24.00	8.87	1.22	13542.30	100	0.0151	205.1128	3.03	3.698	208.8108
12750.0	18.36	28.41	24.00	9.04	1.27	13542.30	100	0.0157	212.7748	3.03	3.847	216.6223
13000.0	18.72	28.97	24.00	9.22	1.32	13542.30	100	0.0163	220.5660	3.03	4.000	224.5658
13250.0	19.08	29.52	24.00	9.40	1.37	13542.30	100	0.0169	228.4858	3.03	4.155	232.6409
13500.0	19.44	30.08	24.00	9.57	1.42	13542.30	100	0.0175	236.5340	3.03	4.313	240.8474
13750.0	19.80	30.64	24.00	9.75	1.48	13542.30	100	0.0181	244.7102	3.03	4.475	249.1848
14000.0	20.16	31.19	24.00	9.93	1.53	13542.30	100	0.0187	253.0140	3.03	4.639	257.6528
14250.0	20.52	31.75	24.00	10.11	1.59	13542.30	100	0.0193	261.4451	3.03	4.806	266.2511
14500.0	20.88	32.31	24.00	10.28	1.64	13542.30	100	0.0199	270.0032	3.03	4.976	274.9793
14750.0	21.24	32.87	24.00	10.46	1.70	13542.30	100	0.0206	278.6880	3.03	5.149	283.8371
15000.0	21.60	33.42	24.00	10.64	1.76	13542.30	100	0.0212	287.4991	3.03	5.325	292.8242
15250.0	21.96	33.98	24.00	10.82	1.82	13542.30	100	0.0219	296.4361	3.03	5.504	301.9403
15500.0	22.32	34.54	24.00	10.99	1.88	13542.30	100	0.0226	305.4989	3.03	5.686	311.1850
15750.0	22.68	35.09	24.00	11.17	1.94	13542.30	100	0.0232	314.6871	3.03	5.871	320.5582
16000.0	23.04	35.65	24.00	11.35	2.00	13542.30	100	0.0239	324.0005	3.03	6.059	330.0593

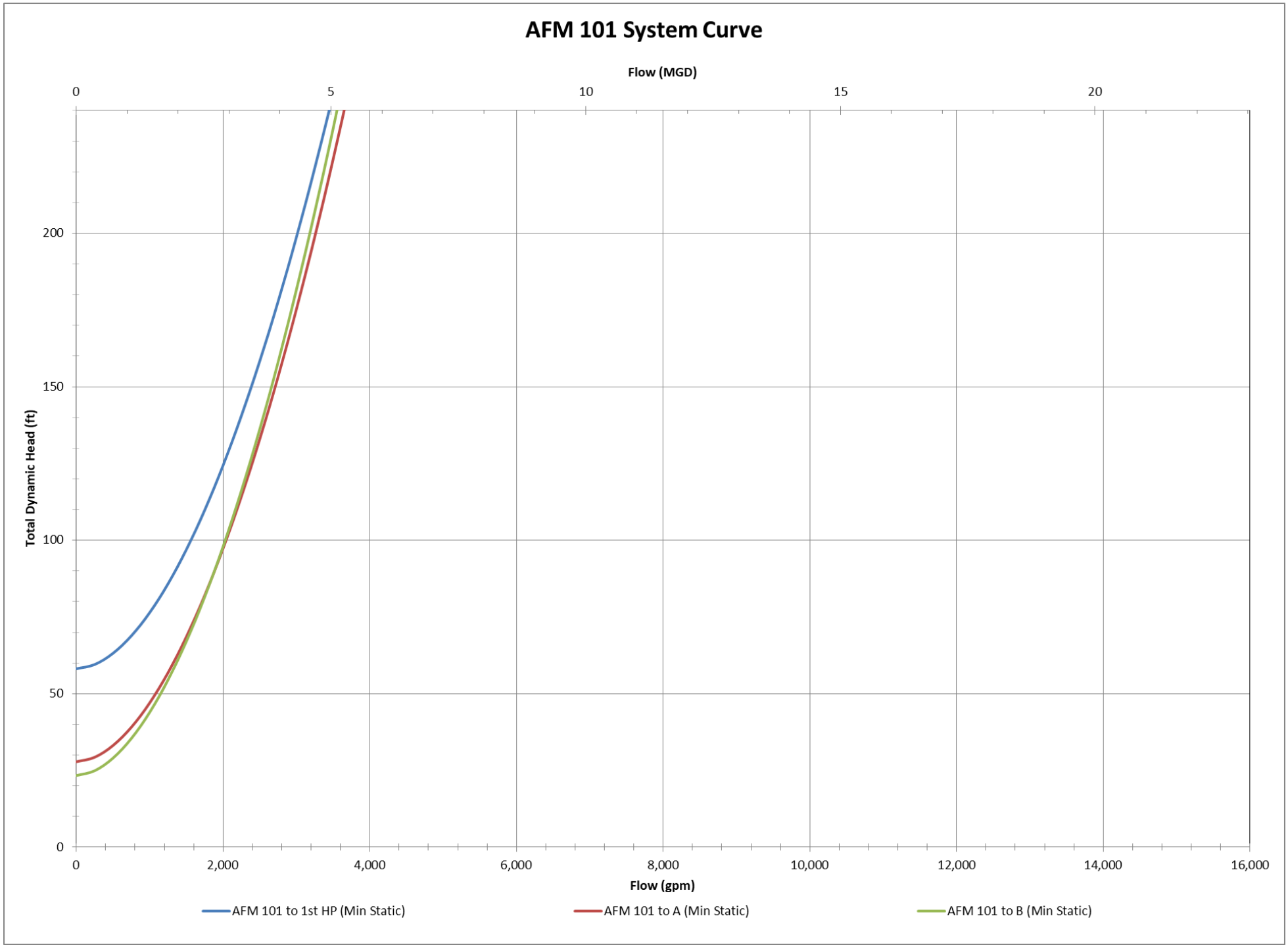
Bridgehead Pump Station with AFM101

14-inch Parallel Forcemain Portion Only – B Modified High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	1.57
500.0	0.72	5.69
750.0	1.08	12.08
1000.0	1.44	20.61
1250.0	1.80	31.17
1500.0	2.16	43.72
1750.0	2.52	58.20
2000.0	2.88	74.57
2250.0	3.24	92.79
2500.0	3.60	112.83
2750.0	3.96	134.66
3000.0	4.32	158.26
3250.0	4.68	183.61
3500.0	5.04	210.69
3750.0	5.40	239.47
4000.0	5.76	269.95
4250.0	6.12	302.10
4500.0	6.48	335.91
4750.0	6.84	371.38
5000.0	7.20	408.48
5250.0	7.56	447.20
5500.0	7.92	487.54
5750.0	8.28	529.47
6000.0	8.64	573.00
6250.0	9.00	618.12
6500.0	9.36	664.80
6750.0	9.72	713.05
7000.0	10.08	762.86
7250.0	10.44	814.21
7500.0	10.80	867.11
7750.0	11.16	921.53
8000.0	11.52	977.49
8250.0	11.88	1034.96
8500.0	12.24	1093.94
8750.0	12.60	1154.43
9000.0	12.96	1216.42
9250.0	13.32	1279.90
9500.0	13.68	1344.87
9750.0	14.04	1411.33
10000.0	14.40	1479.26
10250.0	14.76	1548.66
10500.0	15.12	1619.52
10750.0	15.48	1691.85
11000.0	15.84	1765.64
11250.0	16.20	1840.87
11500.0	16.56	1917.56
11750.0	16.92	1995.68
12000.0	17.28	2075.25
12250.0	17.64	2156.25
12500.0	18.00	2238.67
12750.0	18.36	2322.53
13000.0	18.72	2407.80
13250.0	19.08	2494.50
13500.0	19.44	2582.60
13750.0	19.80	2672.12
14000.0	20.16	2763.04
14250.0	20.52	2855.37
14500.0	20.88	2949.09
14750.0	21.24	3044.21
15000.0	21.60	3140.73
15250.0	21.96	3238.63
15500.0	22.32	3337.92
15750.0	22.68	3438.59
16000.0	23.04	3540.64

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	23.35	27.85
250.0	0.36	24.92	29.42
500.0	0.72	29.04	33.54
750.0	1.08	35.43	39.93
1000.0	1.44	43.96	48.46
1250.0	1.80	54.52	59.02
1500.0	2.16	67.07	71.57
1750.0	2.52	81.55	86.05
2000.0	2.88	97.92	102.42
2250.0	3.24	116.14	120.64
2500.0	3.60	136.18	140.68
2750.0	3.96	158.01	162.51
3000.0	4.32	181.61	186.11
3250.0	4.68	206.96	211.46
3500.0	5.04	234.04	238.54
3750.0	5.40	262.82	267.32
4000.0	5.76	293.30	297.80
4250.0	6.12	325.45	329.95
4500.0	6.48	359.26	363.76
4750.0	6.84	394.73	399.23
5000.0	7.20	431.83	436.33
5250.0	7.56	470.55	475.05
5500.0	7.92	510.89	515.39
5750.0	8.28	552.82	557.32
6000.0	8.64	596.35	600.85
6250.0	9.00	641.47	645.97
6500.0	9.36	688.15	692.65
6750.0	9.72	736.40	740.90
7000.0	10.08	786.21	790.71
7250.0	10.44	837.56	842.06
7500.0	10.80	890.46	894.96
7750.0	11.16	944.88	949.38
8000.0	11.52	1000.84	1005.34
8250.0	11.88	1058.31	1062.81
8500.0	12.24	1117.29	1121.79
8750.0	12.60	1177.78	1182.28
9000.0	12.96	1239.77	1244.27
9250.0	13.32	1303.25	1307.75
9500.0	13.68	1368.22	1372.72
9750.0	14.04	1434.68	1439.18
10000.0	14.40	1502.61	1507.11
10250.0	14.76	1572.01	1576.51
10500.0	15.12	1642.87	1647.37
10750.0	15.48	1715.20	1719.70
11000.0	15.84	1788.99	1793.49
11250.0	16.20	1864.22	1868.72
11500.0	16.56	1940.91	1945.41
11750.0	16.92	2019.03	2023.53
12000.0	17.28	2098.60	2103.10
12250.0	17.64	2179.60	2184.10
12500.0	18.00	2262.02	2266.52
12750.0	18.36	2345.88	2350.38
13000.0	18.72	2431.15	2435.65
13250.0	19.08	2517.85	2522.35
13500.0	19.44	2605.95	2610.45
13750.0	19.80	2695.47	2699.97
14000.0	20.16	2786.39	2790.89
14250.0	20.52	2878.72	2883.22
14500.0	20.88	2972.44	2976.94
14750.0	21.24	3067.56	3072.06
15000.0	21.60	3164.08	3168.58
15250.0	21.96	3261.98	3266.48
15500.0	22.32	3361.27	3365.77
15750.0	22.68	3461.94	3466.44
16000.0	23.04	3563.99	3568.49

MIN Static Head = 23.35
MAX Static Head = 27.85


AFM 101 System Curve
Flow (MGD)
0
5
10
15
20
Total Dynamic Head (ft)
0
50
100
150
200
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
Flow (gpm)
AFM 101 to 1st HP (Min Static)
AFM 101 to A (Min Static)
AFM 101 to B (Min Static)

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – First High Point

FM System Curve - 24"

Diameter = 24 in
Area for = 3.141593 ft^2
RH= 0.5
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – First High Point

13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071
13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve - 24" (24" Parallel FM Portion)

Diameter = 24 in

Area for = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	36.00	100	0.0000	0.0000	1.9	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	36.00	100	0.0000	0.0004	1.9	0.001	0.0013
500.0	0.72	1.11	24.00	0.35	0.00	36.00	100	0.0000	0.0014	1.9	0.004	0.0051
750.0	1.08	1.67	24.00	0.53	0.00	36.00	100	0.0001	0.0030	1.9	0.008	0.0113
1000.0	1.44	2.23	24.00	0.71	0.01	36.00	100	0.0001	0.0051	1.9	0.015	0.0199
1250.0	1.80	2.79	24.00	0.89	0.01	36.00	100	0.0002	0.0077	1.9	0.023	0.0309
1500.0	2.16	3.34	24.00	1.06	0.02	36.00	100	0.0003	0.0107	1.9	0.033	0.0441
1750.0	2.52	3.90	24.00	1.24	0.02	36.00	100	0.0004	0.0143	1.9	0.045	0.0597
2000.0	2.88	4.46	24.00	1.42	0.03	36.00	100	0.0005	0.0183	1.9	0.059	0.0777
2250.0	3.24	5.01	24.00	1.60	0.04	36.00	100	0.0006	0.0228	1.9	0.075	0.0979
2500.0	3.60	5.57	24.00	1.77	0.05	36.00	100	0.0008	0.0277	1.9	0.093	0.1204
2750.0	3.96	6.13	24.00	1.95	0.06	36.00	100	0.0009	0.0330	1.9	0.112	0.1453
3000.0	4.32	6.68	24.00	2.13	0.07	36.00	100	0.0011	0.0388	1.9	0.134	0.1724
3250.0	4.68	7.24	24.00	2.31	0.08	36.00	100	0.0012	0.0450	1.9	0.157	0.2017
3500.0	5.04	7.80	24.00	2.48	0.10	36.00	100	0.0014	0.0516	1.9	0.182	0.2334
3750.0	5.40	8.36	24.00	2.66	0.11	36.00	100	0.0016	0.0586	1.9	0.209	0.2673
4000.0	5.76	8.91	24.00	2.84	0.12	36.00	100	0.0018	0.0661	1.9	0.237	0.3035
4250.0	6.12	9.47	24.00	3.01	0.14	36.00	100	0.0021	0.0739	1.9	0.268	0.3420
4500.0	6.48	10.03	24.00	3.19	0.16	36.00	100	0.0023	0.0822	1.9	0.301	0.3827
4750.0	6.84	10.58	24.00	3.37	0.18	36.00	100	0.0025	0.0909	1.9	0.335	0.4257
5000.0	7.20	11.14	24.00	3.55	0.20	36.00	100	0.0028	0.0999	1.9	0.371	0.4709
5250.0	7.56	11.70	24.00	3.72	0.22	36.00	100	0.0030	0.1094	1.9	0.409	0.5184
5500.0	7.92	12.25	24.00	3.90	0.24	36.00	100	0.0033	0.1192	1.9	0.449	0.5681
5750.0	8.28	12.81	24.00	4.08	0.26	36.00	100	0.0036	0.1294	1.9	0.491	0.6201
6000.0	8.64	13.37	24.00	4.26	0.28	36.00	100	0.0039	0.1400	1.9	0.534	0.6743
6250.0	9.00	13.93	24.00	4.43	0.31	36.00	100	0.0042	0.1510	1.9	0.580	0.7308
6500.0	9.36	14.48	24.00	4.61	0.33	36.00	100	0.0045	0.1624	1.9	0.627	0.7895
6750.0	9.72	15.04	24.00	4.79	0.36	36.00	100	0.0048	0.1742	1.9	0.676	0.8504
7000.0	10.08	15.60	24.00	4.96	0.38	36.00	100	0.0052	0.1863	1.9	0.727	0.9135
7250.0	10.44	16.15	24.00	5.14	0.41	36.00	100	0.0055	0.1988	1.9	0.780	0.9789
7500.0	10.80	16.71	24.00	5.32	0.44	36.00	100	0.0059	0.2117	1.9	0.835	1.0465
7750.0	11.16	17.27	24.00	5.50	0.47	36.00	100	0.0062	0.2250	1.9	0.891	1.1163
8000.0	11.52	17.83	24.00	5.67	0.50	36.00	100	0.0066	0.2386	1.9	0.950	1.1884
8250.0	11.88	18.38	24.00	5.85	0.53	36.00	100	0.0070	0.2526	1.9	1.010	1.2627
8500.0	12.24	18.94	24.00	6.03	0.56	36.00	100	0.0074	0.2669	1.9	1.072	1.3392
8750.0	12.60	19.50	24.00	6.21	0.60	36.00	100	0.0078	0.2817	1.9	1.136	1.4179
9000.0	12.96	20.05	24.00	6.38	0.63	36.00	100	0.0082	0.2967	1.9	1.202	1.4989
9250.0	13.32	20.61	24.00	6.56	0.67	36.00	100	0.0087	0.3122	1.9	1.270	1.5820
9500.0	13.68	21.17	24.00	6.74	0.70	36.00	100	0.0091	0.3280	1.9	1.339	1.6674
9750.0	14.04	21.72	24.00	6.92	0.74	36.00	100	0.0096	0.3442	1.9	1.411	1.7550
10000.0	14.40	22.28	24.00	7.09	0.78	36.00	100	0.0100	0.3607	1.9	1.484	1.8448

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – First High Point

10250.0	14.76	22.84	24.00	7.27	0.82	36.00	100	0.0105	0.3776	1.9	1.559	1.9368
10500.0	15.12	23.40	24.00	7.45	0.86	36.00	100	0.0110	0.3948	1.9	1.636	2.0310
10750.0	15.48	23.95	24.00	7.62	0.90	36.00	100	0.0115	0.4124	1.9	1.715	2.1274
11000.0	15.84	24.51	24.00	7.80	0.95	36.00	100	0.0120	0.4303	1.9	1.796	2.2261
11250.0	16.20	25.07	24.00	7.98	0.99	36.00	100	0.0125	0.4486	1.9	1.878	2.3269
11500.0	16.56	25.62	24.00	8.16	1.03	36.00	100	0.0130	0.4672	1.9	1.963	2.4300
11750.0	16.92	26.18	24.00	8.33	1.08	36.00	100	0.0135	0.4862	1.9	2.049	2.5352
12000.0	17.28	26.74	24.00	8.51	1.12	36.00	100	0.0140	0.5056	1.9	2.137	2.6427
12250.0	17.64	27.30	24.00	8.69	1.17	36.00	100	0.0146	0.5252	1.9	2.227	2.7523
12500.0	18.00	27.85	24.00	8.87	1.22	36.00	100	0.0151	0.5453	1.9	2.319	2.8642
12750.0	18.36	28.41	24.00	9.04	1.27	36.00	100	0.0157	0.5656	1.9	2.413	2.9782
13000.0	18.72	28.97	24.00	9.22	1.32	36.00	100	0.0163	0.5863	1.9	2.508	3.0945
13250.0	19.08	29.52	24.00	9.40	1.37	36.00	100	0.0169	0.6074	1.9	2.606	3.2129
13500.0	19.44	30.08	24.00	9.57	1.42	36.00	100	0.0175	0.6288	1.9	2.705	3.3336
13750.0	19.80	30.64	24.00	9.75	1.48	36.00	100	0.0181	0.6505	1.9	2.806	3.4564
14000.0	20.16	31.19	24.00	9.93	1.53	36.00	100	0.0187	0.6726	1.9	2.909	3.5814
14250.0	20.52	31.75	24.00	10.11	1.59	36.00	100	0.0193	0.6950	1.9	3.014	3.7087
14500.0	20.88	32.31	24.00	10.28	1.64	36.00	100	0.0199	0.7178	1.9	3.120	3.8381
14750.0	21.24	32.87	24.00	10.46	1.70	36.00	100	0.0206	0.7408	1.9	3.229	3.9697
15000.0	21.60	33.42	24.00	10.64	1.76	36.00	100	0.0212	0.7643	1.9	3.339	4.1035
15250.0	21.96	33.98	24.00	10.82	1.82	36.00	100	0.0219	0.7880	1.9	3.451	4.2395
15500.0	22.32	34.54	24.00	10.99	1.88	36.00	100	0.0226	0.8121	1.9	3.566	4.3777
15750.0	22.68	35.09	24.00	11.17	1.94	36.00	100	0.0232	0.8365	1.9	3.681	4.5180
16000.0	23.04	35.65	24.00	11.35	2.00	36.00	100	0.0239	0.8613	1.9	3.799	4.6606

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area for = 3.102445 ft^2

RH= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	10260	120	0.0000	0.0000	4.5	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	10260	120	0.0000	0.0816	4.5	0.002	0.0838
500.0	0.72	1.11	23.85	0.36	0.00	10260	120	0.0000	0.2945	4.5	0.009	0.3035
750.0	1.08	1.67	23.85	0.54	0.00	10260	120	0.0001	0.6240	4.5	0.020	0.6443
1000.0	1.44	2.23	23.85	0.72	0.01	10260	120	0.0001	1.0631	4.5	0.036	1.0992
1250.0	1.80	2.79	23.85	0.90	0.01	10260	120	0.0002	1.6072	4.5	0.056	1.6635
1500.0	2.16	3.34	23.85	1.08	0.02	10260	120	0.0002	2.2527	4.5	0.081	2.3338
1750.0	2.52	3.90	23.85	1.26	0.02	10260	120	0.0003	2.9971	4.5	0.110	3.1074
2000.0	2.88	4.46	23.85	1.44	0.03	10260	120	0.0004	3.8379	4.5	0.144	3.9821
2250.0	3.24	5.01	23.85	1.62	0.04	10260	120	0.0005	4.7734	4.5	0.182	4.9559
2500.0	3.60	5.57	23.85	1.80	0.05	10260	120	0.0006	5.8019	4.5	0.225	6.0272
2750.0	3.96	6.13	23.85	1.98	0.06	10260	120	0.0007	6.9220	4.5	0.273	7.1946
3000.0	4.32	6.68	23.85	2.15	0.07	10260	120	0.0008	8.1324	4.5	0.324	8.4568
3250.0	4.68	7.24	23.85	2.33	0.08	10260	120	0.0009	9.4319	4.5	0.381	9.8126
3500.0	5.04	7.80	23.85	2.51	0.10	10260	120	0.0011	10.8194	4.5	0.442	11.2609
3750.0	5.40	8.36	23.85	2.69	0.11	10260	120	0.0012	12.2940	4.5	0.507	12.8009
4000.0	5.76	8.91	23.85	2.87	0.13	10260	120	0.0014	13.8549	4.5	0.577	14.4316
4250.0	6.12	9.47	23.85	3.05	0.14	10260	120	0.0015	15.5012	4.5	0.651	16.1522
4500.0	6.48	10.03	23.85	3.23	0.16	10260	120	0.0017	17.2321	4.5	0.730	17.9620
4750.0	6.84	10.58	23.85	3.41	0.18	10260	120	0.0019	19.0470	4.5	0.813	19.8602
5000.0	7.20	11.14	23.85	3.59	0.20	10260	120	0.0020	20.9451	4.5	0.901	21.8461
5250.0	7.56	11.70	23.85	3.77	0.22	10260	120	0.0022	22.9258	4.5	0.993	23.9192
5500.0	7.92	12.25	23.85	3.95	0.24	10260	120	0.0024	24.9885	4.5	1.090	26.0788
5750.0	8.28	12.81	23.85	4.13	0.26	10260	120	0.0026	27.1328	4.5	1.192	28.3244
6000.0	8.64	13.37	23.85	4.31	0.29	10260	120	0.0029	29.3579	4.5	1.298	30.6554
6250.0	9.00	13.93	23.85	4.49	0.31	10260	120	0.0031	31.6635	4.5	1.408	33.0714
6500.0	9.36	14.48	23.85	4.67	0.34	10260	120	0.0033	34.0490	4.5	1.523	35.5718
6750.0	9.72	15.04	23.85	4.85	0.36	10260	120	0.0036	36.5140	4.5	1.642	38.1562

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – First High Point

7000.0	10.08	15.60	23.85	5.03	0.39	10260	120	0.0038	39.0581	4.5	1.766	40.8241
7250.0	10.44	16.15	23.85	5.21	0.42	10260	120	0.0041	41.6807	4.5	1.894	43.5752
7500.0	10.80	16.71	23.85	5.39	0.45	10260	120	0.0043	44.3816	4.5	2.027	46.4089
7750.0	11.16	17.27	23.85	5.57	0.48	10260	120	0.0046	47.1602	4.5	2.165	49.3250
8000.0	11.52	17.83	23.85	5.75	0.51	10260	120	0.0049	50.0163	4.5	2.307	52.3230
8250.0	11.88	18.38	23.85	5.93	0.55	10260	120	0.0052	52.9495	4.5	2.453	55.4026
8500.0	12.24	18.94	23.85	6.10	0.58	10260	120	0.0055	55.9594	4.5	2.604	58.5634
8750.0	12.60	19.50	23.85	6.28	0.61	10260	120	0.0058	59.0457	4.5	2.759	61.8051
9000.0	12.96	20.05	23.85	6.46	0.65	10260	120	0.0061	62.2080	4.5	2.919	65.1274
9250.0	13.32	20.61	23.85	6.64	0.69	10260	120	0.0064	65.4461	4.5	3.084	68.5299
9500.0	13.68	21.17	23.85	6.82	0.72	10260	120	0.0067	68.7596	4.5	3.253	72.0124
9750.0	14.04	21.72	23.85	7.00	0.76	10260	120	0.0070	72.1482	4.5	3.426	75.5745
10000.0	14.40	22.28	23.85	7.18	0.80	10260	120	0.0074	75.6117	4.5	3.604	79.2159
10250.0	14.76	22.84	23.85	7.36	0.84	10260	120	0.0077	79.1498	4.5	3.787	82.9365
10500.0	15.12	23.40	23.85	7.54	0.88	10260	120	0.0081	82.7621	4.5	3.974	86.7358
10750.0	15.48	23.95	23.85	7.72	0.93	10260	120	0.0084	86.4485	4.5	4.165	90.6137
11000.0	15.84	24.51	23.85	7.90	0.97	10260	120	0.0088	90.2087	4.5	4.361	94.5698
11250.0	16.20	25.07	23.85	8.08	1.01	10260	120	0.0092	94.0424	4.5	4.562	98.6040
11500.0	16.56	25.62	23.85	8.26	1.06	10260	120	0.0095	97.9493	4.5	4.767	102.7159
11750.0	16.92	26.18	23.85	8.44	1.11	10260	120	0.0099	101.9293	4.5	4.976	106.9054
12000.0	17.28	26.74	23.85	8.62	1.15	10260	120	0.0103	105.9822	4.5	5.190	111.1722
12250.0	17.64	27.30	23.85	8.80	1.20	10260	120	0.0107	110.1075	4.5	5.409	115.5161
12500.0	18.00	27.85	23.85	8.98	1.25	10260	120	0.0111	114.3053	4.5	5.632	119.9369
12750.0	18.36	28.41	23.85	9.16	1.30	10260	120	0.0116	118.5752	4.5	5.859	124.4343
13000.0	18.72	28.97	23.85	9.34	1.35	10260	120	0.0120	122.9171	4.5	6.091	129.0082
13250.0	19.08	29.52	23.85	9.52	1.41	10260	120	0.0124	127.3306	4.5	6.328	133.6583
13500.0	19.44	30.08	23.85	9.70	1.46	10260	120	0.0128	131.8157	4.5	6.569	138.3844
13750.0	19.80	30.64	23.85	9.88	1.51	10260	120	0.0133	136.3721	4.5	6.814	143.1864
14000.0	20.16	31.19	23.85	10.05	1.57	10260	120	0.0137	140.9997	4.5	7.064	148.0640
14250.0	20.52	31.75	23.85	10.23	1.63	10260	120	0.0142	145.6982	4.5	7.319	153.0170
14500.0	20.88	32.31	23.85	10.41	1.68	10260	120	0.0147	150.4675	4.5	7.578	158.0454
14750.0	21.24	32.87	23.85	10.59	1.74	10260	120	0.0151	155.3073	4.5	7.841	163.1488
15000.0	21.60	33.42	23.85	10.77	1.80	10260	120	0.0156	160.2175	4.5	8.110	168.3271
15250.0	21.96	33.98	23.85	10.95	1.86	10260	120	0.0161	165.1980	4.5	8.382	173.5801
15500.0	22.32	34.54	23.85	11.13	1.92	10260	120	0.0166	170.2485	4.5	8.659	178.9077
15750.0	22.68	35.09	23.85	11.31	1.99	10260	120	0.0171	175.3689	4.5	8.941	184.3097
16000.0	23.04	35.65	23.85	11.49	2.05	10260	120	0.0176	180.5591	4.5	9.227	189.7859

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area for = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	619.99	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	619.99	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	619.99	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	619.99	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	619.99	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	619.99	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	619.99	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	619.99	120	0.0003	0.1811	2.7	0.066	0.2473
2000.0	2.88	4.46	23.85	1.44	0.03	619.99	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	619.99	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	619.99	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	619.99	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	619.99	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	619.99	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	619.99	120	0.0011	0.6538	2.7	0.265	0.9187

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – First High Point

3750.0	5.40	8.36	23.85	2.69	0.11	619.99	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	619.99	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	619.99	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	619.99	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	619.99	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	619.99	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	619.99	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	619.99	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	619.99	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	619.99	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	619.99	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	619.99	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	619.99	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	619.99	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	619.99	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	619.99	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	619.99	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	619.99	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	619.99	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	619.99	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	619.99	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	619.99	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	619.99	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	619.99	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	619.99	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	619.99	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	619.99	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	619.99	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	619.99	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	619.99	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	619.99	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	619.99	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	619.99	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	619.99	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	619.99	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	619.99	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	619.99	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	619.99	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	619.99	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	619.99	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	619.99	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	619.99	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	619.99	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	619.99	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	619.99	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	619.99	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	619.99	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	619.99	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	619.99	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	619.99	120	0.0176	10.9108	2.7	5.536	16.4469

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – First High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	0.09
500.0	0.72	0.34
750.0	1.08	0.72
1000.0	1.44	1.23
1250.0	1.80	1.86
1500.0	2.16	2.61
1750.0	2.52	3.48
2000.0	2.88	4.47
2250.0	3.24	5.56
2500.0	3.60	6.77
2750.0	3.96	8.08
3000.0	4.32	9.51
3250.0	4.68	11.04
3500.0	5.04	12.67
3750.0	5.40	14.41
4000.0	5.76	16.26
4250.0	6.12	18.20
4500.0	6.48	20.25
4750.0	6.84	22.40
5000.0	7.20	24.64
5250.0	7.56	26.99
5500.0	7.92	29.44
5750.0	8.28	31.98
6000.0	8.64	34.63
6250.0	9.00	37.37
6500.0	9.36	40.20
6750.0	9.72	43.13
7000.0	10.08	46.16
7250.0	10.44	49.29
7500.0	10.80	52.50
7750.0	11.16	55.82
8000.0	11.52	59.22
8250.0	11.88	62.72
8500.0	12.24	66.32
8750.0	12.60	70.00
9000.0	12.96	73.78
9250.0	13.32	77.65
9500.0	13.68	81.61
9750.0	14.04	85.67
10000.0	14.40	89.81
10250.0	14.76	94.05
10500.0	15.12	98.38
10750.0	15.48	102.79
11000.0	15.84	107.30
11250.0	16.20	111.90
11500.0	16.56	116.58
11750.0	16.92	121.36
12000.0	17.28	126.22
12250.0	17.64	131.17
12500.0	18.00	136.22
12750.0	18.36	141.35
13000.0	18.72	146.56
13250.0	19.08	151.87
13500.0	19.44	157.26
13750.0	19.80	162.74
14000.0	20.16	168.31
14250.0	20.52	173.97
14500.0	20.88	179.71
14750.0	21.24	185.54
15000.0	21.60	191.45
15250.0	21.96	197.45
15500.0	22.32	203.54
15750.0	22.68	209.71
16000.0	23.04	215.97

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	58.13	62.63
250.0	0.36	58.22	62.72
500.0	0.72	58.47	62.97
750.0	1.08	58.85	63.35
1000.0	1.44	59.36	63.86
1250.0	1.80	59.99	64.49
1500.0	2.16	60.74	65.24
1750.0	2.52	61.61	66.11
2000.0	2.88	62.60	67.10
2250.0	3.24	63.69	68.19
2500.0	3.60	64.90	69.40
2750.0	3.96	66.21	70.71
3000.0	4.32	67.64	72.14
3250.0	4.68	69.17	73.67
3500.0	5.04	70.80	75.30
3750.0	5.40	72.54	77.04
4000.0	5.76	74.39	78.89
4250.0	6.12	76.33	80.83
4500.0	6.48	78.38	82.88
4750.0	6.84	80.53	85.03
5000.0	7.20	82.77	87.27
5250.0	7.56	85.12	89.62
5500.0	7.92	87.57	92.07
5750.0	8.28	90.11	94.61
6000.0	8.64	92.76	97.26
6250.0	9.00	95.50	100.00
6500.0	9.36	98.33	102.83
6750.0	9.72	101.26	105.76
7000.0	10.08	104.29	108.79
7250.0	10.44	107.42	111.92
7500.0	10.80	110.63	115.13
7750.0	11.16	113.95	118.45
8000.0	11.52	117.35	121.85
8250.0	11.88	120.85	125.35
8500.0	12.24	124.45	128.95
8750.0	12.60	128.13	132.63
9000.0	12.96	131.91	136.41
9250.0	13.32	135.78	140.28
9500.0	13.68	139.74	144.24
9750.0	14.04	143.80	148.30
10000.0	14.40	147.94	152.44
10250.0	14.76	152.18	156.68
10500.0	15.12	156.51	161.01
10750.0	15.48	160.92	165.42
11000.0	15.84	165.43	169.93
11250.0	16.20	170.03	174.53
11500.0	16.56	174.71	179.21
11750.0	16.92	179.49	183.99
12000.0	17.28	184.35	188.85
12250.0	17.64	189.30	193.80
12500.0	18.00	194.35	198.85
12750.0	18.36	199.48	203.98
13000.0	18.72	204.69	209.19
13250.0	19.08	210.00	214.50
13500.0	19.44	215.39	219.89
13750.0	19.80	220.87	225.37
14000.0	20.16	226.44	230.94
14250.0	20.52	232.10	236.60
14500.0	20.88	237.84	242.34
14750.0	21.24	243.67	248.17
15000.0	21.60	249.58	254.08
15250.0	21.96	255.58	260.08
15500.0	22.32	261.67	266.17
15750.0	22.68	267.84	272.34
16000.0	23.04	274.10	278.60

MIN Static Head = 58.13
MAX Static Head = 62.63

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – A Modified High Point

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FM System Curve - 24"

Diameter = 24 in
Area for = 3.141593 ft^2
RH=D/4= 0.5
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – A Modified High Point

13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071
13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve - 24" (24" Parallel FM Portion)

Diameter = 24 in

Area for = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	36.00	100	0.0000	0.0000	1.9	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	36.00	100	0.0000	0.0004	1.9	0.001	0.0013
500.0	0.72	1.11	24.00	0.35	0.00	36.00	100	0.0000	0.0014	1.9	0.004	0.0051
750.0	1.08	1.67	24.00	0.53	0.00	36.00	100	0.0001	0.0030	1.9	0.008	0.0113
1000.0	1.44	2.23	24.00	0.71	0.01	36.00	100	0.0001	0.0051	1.9	0.015	0.0199
1250.0	1.80	2.79	24.00	0.89	0.01	36.00	100	0.0002	0.0077	1.9	0.023	0.0309
1500.0	2.16	3.34	24.00	1.06	0.02	36.00	100	0.0003	0.0107	1.9	0.033	0.0441
1750.0	2.52	3.90	24.00	1.24	0.02	36.00	100	0.0004	0.0143	1.9	0.045	0.0597
2000.0	2.88	4.46	24.00	1.42	0.03	36.00	100	0.0005	0.0183	1.9	0.059	0.0777
2250.0	3.24	5.01	24.00	1.60	0.04	36.00	100	0.0006	0.0228	1.9	0.075	0.0979
2500.0	3.60	5.57	24.00	1.77	0.05	36.00	100	0.0008	0.0277	1.9	0.093	0.1204
2750.0	3.96	6.13	24.00	1.95	0.06	36.00	100	0.0009	0.0330	1.9	0.112	0.1453
3000.0	4.32	6.68	24.00	2.13	0.07	36.00	100	0.0011	0.0388	1.9	0.134	0.1724
3250.0	4.68	7.24	24.00	2.31	0.08	36.00	100	0.0012	0.0450	1.9	0.157	0.2017
3500.0	5.04	7.80	24.00	2.48	0.10	36.00	100	0.0014	0.0516	1.9	0.182	0.2334
3750.0	5.40	8.36	24.00	2.66	0.11	36.00	100	0.0016	0.0586	1.9	0.209	0.2673
4000.0	5.76	8.91	24.00	2.84	0.12	36.00	100	0.0018	0.0661	1.9	0.237	0.3035
4250.0	6.12	9.47	24.00	3.01	0.14	36.00	100	0.0021	0.0739	1.9	0.268	0.3420
4500.0	6.48	10.03	24.00	3.19	0.16	36.00	100	0.0023	0.0822	1.9	0.301	0.3827
4750.0	6.84	10.58	24.00	3.37	0.18	36.00	100	0.0025	0.0909	1.9	0.335	0.4257
5000.0	7.20	11.14	24.00	3.55	0.20	36.00	100	0.0028	0.0999	1.9	0.371	0.4709
5250.0	7.56	11.70	24.00	3.72	0.22	36.00	100	0.0030	0.1094	1.9	0.409	0.5184
5500.0	7.92	12.25	24.00	3.90	0.24	36.00	100	0.0033	0.1192	1.9	0.449	0.5681
5750.0	8.28	12.81	24.00	4.08	0.26	36.00	100	0.0036	0.1294	1.9	0.491	0.6201
6000.0	8.64	13.37	24.00	4.26	0.28	36.00	100	0.0039	0.1400	1.9	0.534	0.6743
6250.0	9.00	13.93	24.00	4.43	0.31	36.00	100	0.0042	0.1510	1.9	0.580	0.7308
6500.0	9.36	14.48	24.00	4.61	0.33	36.00	100	0.0045	0.1624	1.9	0.627	0.7895
6750.0	9.72	15.04	24.00	4.79	0.36	36.00	100	0.0048	0.1742	1.9	0.676	0.8504
7000.0	10.08	15.60	24.00	4.96	0.38	36.00	100	0.0052	0.1863	1.9	0.727	0.9135
7250.0	10.44	16.15	24.00	5.14	0.41	36.00	100	0.0055	0.1988	1.9	0.780	0.9789
7500.0	10.80	16.71	24.00	5.32	0.44	36.00	100	0.0059	0.2117	1.9	0.835	1.0465
7750.0	11.16	17.27	24.00	5.50	0.47	36.00	100	0.0062	0.2250	1.9	0.891	1.1163
8000.0	11.52	17.83	24.00	5.67	0.50	36.00	100	0.0066	0.2386	1.9	0.950	1.1884
8250.0	11.88	18.38	24.00	5.85	0.53	36.00	100	0.0070	0.2526	1.9	1.010	1.2627
8500.0	12.24	18.94	24.00	6.03	0.56	36.00	100	0.0074	0.2669	1.9	1.072	1.3392
8750.0	12.60	19.50	24.00	6.21	0.60	36.00	100	0.0078	0.2817	1.9	1.136	1.4179
9000.0	12.96	20.05	24.00	6.38	0.63	36.00	100	0.0082	0.2967	1.9	1.202	1.4989
9250.0	13.32	20.61	24.00	6.56	0.67	36.00	100	0.0087	0.3122	1.9	1.270	1.5820
9500.0	13.68	21.17	24.00	6.74	0.70	36.00	100	0.0091	0.3280	1.9	1.339	1.6674

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – A Modified High Point

9750.0	14.04	21.72	24.00	6.92	0.74	36.00	100	0.0096	0.3442	1.9	1.411	1.7550
10000.0	14.40	22.28	24.00	7.09	0.78	36.00	100	0.0100	0.3607	1.9	1.484	1.8448
10250.0	14.76	22.84	24.00	7.27	0.82	36.00	100	0.0105	0.3776	1.9	1.559	1.9368
10500.0	15.12	23.40	24.00	7.45	0.86	36.00	100	0.0110	0.3948	1.9	1.636	2.0310
10750.0	15.48	23.95	24.00	7.62	0.90	36.00	100	0.0115	0.4124	1.9	1.715	2.1274
11000.0	15.84	24.51	24.00	7.80	0.95	36.00	100	0.0120	0.4303	1.9	1.796	2.2261
11250.0	16.20	25.07	24.00	7.98	0.99	36.00	100	0.0125	0.4486	1.9	1.878	2.3269
11500.0	16.56	25.62	24.00	8.16	1.03	36.00	100	0.0130	0.4672	1.9	1.963	2.4300
11750.0	16.92	26.18	24.00	8.33	1.08	36.00	100	0.0135	0.4862	1.9	2.049	2.5352
12000.0	17.28	26.74	24.00	8.51	1.12	36.00	100	0.0140	0.5056	1.9	2.137	2.6427
12250.0	17.64	27.30	24.00	8.69	1.17	36.00	100	0.0146	0.5252	1.9	2.227	2.7523
12500.0	18.00	27.85	24.00	8.87	1.22	36.00	100	0.0151	0.5453	1.9	2.319	2.8642
12750.0	18.36	28.41	24.00	9.04	1.27	36.00	100	0.0157	0.5656	1.9	2.413	2.9782
13000.0	18.72	28.97	24.00	9.22	1.32	36.00	100	0.0163	0.5863	1.9	2.508	3.0945
13250.0	19.08	29.52	24.00	9.40	1.37	36.00	100	0.0169	0.6074	1.9	2.606	3.2129
13500.0	19.44	30.08	24.00	9.57	1.42	36.00	100	0.0175	0.6288	1.9	2.705	3.3336
13750.0	19.80	30.64	24.00	9.75	1.48	36.00	100	0.0181	0.6505	1.9	2.806	3.4564
14000.0	20.16	31.19	24.00	9.93	1.53	36.00	100	0.0187	0.6726	1.9	2.909	3.5814
14250.0	20.52	31.75	24.00	10.11	1.59	36.00	100	0.0193	0.6950	1.9	3.014	3.7087
14500.0	20.88	32.31	24.00	10.28	1.64	36.00	100	0.0199	0.7178	1.9	3.120	3.8381
14750.0	21.24	32.87	24.00	10.46	1.70	36.00	100	0.0206	0.7408	1.9	3.229	3.9697
15000.0	21.60	33.42	24.00	10.64	1.76	36.00	100	0.0212	0.7643	1.9	3.339	4.1035
15250.0	21.96	33.98	24.00	10.82	1.82	36.00	100	0.0219	0.7880	1.9	3.451	4.2395
15500.0	22.32	34.54	24.00	10.99	1.88	36.00	100	0.0226	0.8121	1.9	3.566	4.3777
15750.0	22.68	35.09	24.00	11.17	1.94	36.00	100	0.0232	0.8365	1.9	3.681	4.5180
16000.0	23.04	35.65	24.00	11.35	2.00	36.00	100	0.0239	0.8613	1.9	3.799	4.6606

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area for = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	10260	120	0.0000	0.0000	4.5	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	10260	120	0.0000	0.0816	4.5	0.002	0.0838
500.0	0.72	1.11	23.85	0.36	0.00	10260	120	0.0000	0.2945	4.5	0.009	0.3035
750.0	1.08	1.67	23.85	0.54	0.00	10260	120	0.0001	0.6240	4.5	0.020	0.6443
1000.0	1.44	2.23	23.85	0.72	0.01	10260	120	0.0001	1.0631	4.5	0.036	1.0992
1250.0	1.80	2.79	23.85	0.90	0.01	10260	120	0.0002	1.6072	4.5	0.056	1.6635
1500.0	2.16	3.34	23.85	1.08	0.02	10260	120	0.0002	2.2527	4.5	0.081	2.3338
1750.0	2.52	3.90	23.85	1.26	0.02	10260	120	0.0003	2.9971	4.5	0.110	3.1074
2000.0	2.88	4.46	23.85	1.44	0.03	10260	120	0.0004	3.8379	4.5	0.144	3.9821
2250.0	3.24	5.01	23.85	1.62	0.04	10260	120	0.0005	4.7734	4.5	0.182	4.9559
2500.0	3.60	5.57	23.85	1.80	0.05	10260	120	0.0006	5.8019	4.5	0.225	6.0272
2750.0	3.96	6.13	23.85	1.98	0.06	10260	120	0.0007	6.9220	4.5	0.273	7.1946
3000.0	4.32	6.68	23.85	2.15	0.07	10260	120	0.0008	8.1324	4.5	0.324	8.4568
3250.0	4.68	7.24	23.85	2.33	0.08	10260	120	0.0009	9.4319	4.5	0.381	9.8126
3500.0	5.04	7.80	23.85	2.51	0.10	10260	120	0.0011	10.8194	4.5	0.442	11.2609
3750.0	5.40	8.36	23.85	2.69	0.11	10260	120	0.0012	12.2940	4.5	0.507	12.8009
4000.0	5.76	8.91	23.85	2.87	0.13	10260	120	0.0014	13.8549	4.5	0.577	14.4316
4250.0	6.12	9.47	23.85	3.05	0.14	10260	120	0.0015	15.5012	4.5	0.651	16.1522
4500.0	6.48	10.03	23.85	3.23	0.16	10260	120	0.0017	17.2321	4.5	0.730	17.9620
4750.0	6.84	10.58	23.85	3.41	0.18	10260	120	0.0019	19.0470	4.5	0.813	19.8602
5000.0	7.20	11.14	23.85	3.59	0.20	10260	120	0.0020	20.9451	4.5	0.901	21.8461
5250.0	7.56	11.70	23.85	3.77	0.22	10260	120	0.0022	22.9258	4.5	0.993	23.9192
5500.0	7.92	12.25	23.85	3.95	0.24	10260	120	0.0024	24.9885	4.5	1.090	26.0788
5750.0	8.28	12.81	23.85	4.13	0.26	10260	120	0.0026	27.1328	4.5	1.192	28.3244
6000.0	8.64	13.37	23.85	4.31	0.29	10260	120	0.0029	29.3579	4.5	1.298	30.6554
6250.0	9.00	13.93	23.85	4.49	0.31	10260	120	0.0031	31.6635	4.5	1.408	33.0714

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – A Modified High Point

6500.0	9.36	14.48	23.85	4.67	0.34	10260	120	0.0033	34.0490	4.5	1.523	35.5718
6750.0	9.72	15.04	23.85	4.85	0.36	10260	120	0.0036	36.5140	4.5	1.642	38.1562
7000.0	10.08	15.60	23.85	5.03	0.39	10260	120	0.0038	39.0581	4.5	1.766	40.8241
7250.0	10.44	16.15	23.85	5.21	0.42	10260	120	0.0041	41.6807	4.5	1.894	43.5752
7500.0	10.80	16.71	23.85	5.39	0.45	10260	120	0.0043	44.3816	4.5	2.027	46.4089
7750.0	11.16	17.27	23.85	5.57	0.48	10260	120	0.0046	47.1602	4.5	2.165	49.3250
8000.0	11.52	17.83	23.85	5.75	0.51	10260	120	0.0049	50.0163	4.5	2.307	52.3230
8250.0	11.88	18.38	23.85	5.93	0.55	10260	120	0.0052	52.9495	4.5	2.453	55.4026
8500.0	12.24	18.94	23.85	6.10	0.58	10260	120	0.0055	55.9594	4.5	2.604	58.5634
8750.0	12.60	19.50	23.85	6.28	0.61	10260	120	0.0058	59.0457	4.5	2.759	61.8051
9000.0	12.96	20.05	23.85	6.46	0.65	10260	120	0.0061	62.2080	4.5	2.919	65.1274
9250.0	13.32	20.61	23.85	6.64	0.69	10260	120	0.0064	65.4461	4.5	3.084	68.5299
9500.0	13.68	21.17	23.85	6.82	0.72	10260	120	0.0067	68.7596	4.5	3.253	72.0124
9750.0	14.04	21.72	23.85	7.00	0.76	10260	120	0.0070	72.1482	4.5	3.426	75.5745
10000.0	14.40	22.28	23.85	7.18	0.80	10260	120	0.0074	75.6117	4.5	3.604	79.2159
10250.0	14.76	22.84	23.85	7.36	0.84	10260	120	0.0077	79.1498	4.5	3.787	82.9365
10500.0	15.12	23.40	23.85	7.54	0.88	10260	120	0.0081	82.7621	4.5	3.974	86.7358
10750.0	15.48	23.95	23.85	7.72	0.93	10260	120	0.0084	86.4485	4.5	4.165	90.6137
11000.0	15.84	24.51	23.85	7.90	0.97	10260	120	0.0088	90.2087	4.5	4.361	94.5698
11250.0	16.20	25.07	23.85	8.08	1.01	10260	120	0.0092	94.0424	4.5	4.562	98.6040
11500.0	16.56	25.62	23.85	8.26	1.06	10260	120	0.0095	97.9493	4.5	4.767	102.7159
11750.0	16.92	26.18	23.85	8.44	1.11	10260	120	0.0099	101.9293	4.5	4.976	106.9054
12000.0	17.28	26.74	23.85	8.62	1.15	10260	120	0.0103	105.9822	4.5	5.190	111.1722
12250.0	17.64	27.30	23.85	8.80	1.20	10260	120	0.0107	110.1075	4.5	5.409	115.5161
12500.0	18.00	27.85	23.85	8.98	1.25	10260	120	0.0111	114.3053	4.5	5.632	119.9369
12750.0	18.36	28.41	23.85	9.16	1.30	10260	120	0.0116	118.5752	4.5	5.859	124.4343
13000.0	18.72	28.97	23.85	9.34	1.35	10260	120	0.0120	122.9171	4.5	6.091	129.0082
13250.0	19.08	29.52	23.85	9.52	1.41	10260	120	0.0124	127.3306	4.5	6.328	133.6583
13500.0	19.44	30.08	23.85	9.70	1.46	10260	120	0.0128	131.8157	4.5	6.569	138.3844
13750.0	19.80	30.64	23.85	9.88	1.51	10260	120	0.0133	136.3721	4.5	6.814	143.1864
14000.0	20.16	31.19	23.85	10.05	1.57	10260	120	0.0137	140.9997	4.5	7.064	148.0640
14250.0	20.52	31.75	23.85	10.23	1.63	10260	120	0.0142	145.6982	4.5	7.319	153.0170
14500.0	20.88	32.31	23.85	10.41	1.68	10260	120	0.0147	150.4675	4.5	7.578	158.0454
14750.0	21.24	32.87	23.85	10.59	1.74	10260	120	0.0151	155.3073	4.5	7.841	163.1488
15000.0	21.60	33.42	23.85	10.77	1.80	10260	120	0.0156	160.2175	4.5	8.110	168.3271
15250.0	21.96	33.98	23.85	10.95	1.86	10260	120	0.0161	165.1980	4.5	8.382	173.5801
15500.0	22.32	34.54	23.85	11.13	1.92	10260	120	0.0166	170.2485	4.5	8.659	178.9077
15750.0	22.68	35.09	23.85	11.31	1.99	10260	120	0.0171	175.3689	4.5	8.941	184.3097
16000.0	23.04	35.65	23.85	11.49	2.05	10260	120	0.0176	180.5591	4.5	9.227	189.7859

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area for = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	619.99	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	619.99	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	619.99	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	619.99	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	619.99	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	619.99	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	619.99	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	619.99	120	0.0003	0.1811	2.7	0.066	0.2473
2000.0	2.88	4.46	23.85	1.44	0.03	619.99	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	619.99	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	619.99	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	619.99	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	619.99	120	0.0008	0.4914	2.7	0.195	0.6861

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – A Modified High Point

3250.0	4.68	7.24	23.85	2.33	0.08	619.99	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	619.99	120	0.0011	0.6538	2.7	0.265	0.9187
3750.0	5.40	8.36	23.85	2.69	0.11	619.99	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	619.99	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	619.99	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	619.99	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	619.99	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	619.99	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	619.99	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	619.99	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	619.99	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	619.99	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	619.99	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	619.99	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	619.99	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	619.99	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	619.99	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	619.99	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	619.99	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	619.99	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	619.99	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	619.99	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	619.99	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	619.99	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	619.99	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	619.99	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	619.99	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	619.99	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	619.99	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	619.99	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	619.99	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	619.99	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	619.99	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	619.99	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	619.99	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	619.99	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	619.99	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	619.99	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	619.99	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	619.99	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	619.99	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	619.99	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	619.99	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	619.99	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	619.99	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	619.99	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	619.99	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	619.99	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	619.99	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	619.99	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	619.99	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	619.99	120	0.0176	10.9108	2.7	5.536	16.4469

FM System Curve – 25.14" (24" DIP)

Diameter =	25.14	in
Area for =	3.4471	ft^2
RH=	0.5238	
C=	100	

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – A Modified High Point

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	**L**	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	**(ft)**			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.14	0.00	0.00	**625.00**	100	0.0000	0.0000	0.6	0.000	0.0000
250.0	0.36	0.56	25.14	0.16	0.00	**625.00**	100	0.0000	0.0054	0.6	0.000	0.0056
500.0	0.72	1.11	25.14	0.32	0.00	**625.00**	100	0.0000	0.0195	0.6	0.001	0.0204
750.0	1.08	1.67	25.14	0.48	0.00	**625.00**	100	0.0001	0.0412	0.6	0.002	0.0434
1000.0	1.44	2.23	25.14	0.65	0.01	**625.00**	100	0.0001	0.0702	0.6	0.004	0.0741
1250.0	1.80	2.79	25.14	0.81	0.01	**625.00**	100	0.0002	0.1062	0.6	0.006	0.1123
1500.0	2.16	3.34	25.14	0.97	0.01	**625.00**	100	0.0002	0.1488	0.6	0.009	0.1576
1750.0	2.52	3.90	25.14	1.13	0.02	**625.00**	100	0.0003	0.1980	0.6	0.012	0.2099
2000.0	2.88	4.46	25.14	1.29	0.03	**625.00**	100	0.0004	0.2535	0.6	0.016	0.2691
2250.0	3.24	5.01	25.14	1.45	0.03	**625.00**	100	0.0005	0.3153	0.6	0.020	0.3350
2500.0	3.60	5.57	25.14	1.62	0.04	**625.00**	100	0.0006	0.3833	0.6	0.024	0.4076
2750.0	3.96	6.13	25.14	1.78	0.05	**625.00**	100	0.0007	0.4573	0.6	0.029	0.4867
3000.0	4.32	6.68	25.14	1.94	0.06	**625.00**	100	0.0009	0.5372	0.6	0.035	0.5723
3250.0	4.68	7.24	25.14	2.10	0.07	**625.00**	100	0.0010	0.6231	0.6	0.041	0.6642
3500.0	5.04	7.80	25.14	2.26	0.08	**625.00**	100	0.0011	0.7147	0.6	0.048	0.7624
3750.0	5.40	8.36	25.14	2.42	0.09	**625.00**	100	0.0013	0.8122	0.6	0.055	0.8669
4000.0	5.76	8.91	25.14	2.59	0.10	**625.00**	100	0.0015	0.9153	0.6	0.062	0.9776
4250.0	6.12	9.47	25.14	2.75	0.12	**625.00**	100	0.0016	1.0240	0.6	0.070	1.0943
4500.0	6.48	10.03	25.14	2.91	0.13	**625.00**	100	0.0018	1.1384	0.6	0.079	1.2172
4750.0	6.84	10.58	25.14	3.07	0.15	**625.00**	100	0.0020	1.2583	0.6	0.088	1.3461
5000.0	7.20	11.14	25.14	3.23	0.16	**625.00**	100	0.0022	1.3837	0.6	0.097	1.4810
5250.0	7.56	11.70	25.14	3.39	0.18	**625.00**	100	0.0024	1.5145	0.6	0.107	1.6218
5500.0	7.92	12.25	25.14	3.56	0.20	**625.00**	100	0.0026	1.6508	0.6	0.118	1.7685
5750.0	8.28	12.81	25.14	3.72	0.21	**625.00**	100	0.0029	1.7924	0.6	0.129	1.9211
6000.0	8.64	13.37	25.14	3.88	0.23	**625.00**	100	0.0031	1.9394	0.6	0.140	2.0796
6250.0	9.00	13.93	25.14	4.04	0.25	**625.00**	100	0.0033	2.0917	0.6	0.152	2.2438
6500.0	9.36	14.48	25.14	4.20	0.27	**625.00**	100	0.0036	2.2493	0.6	0.164	2.4138
6750.0	9.72	15.04	25.14	4.36	0.30	**625.00**	100	0.0039	2.4122	0.6	0.177	2.5895
7000.0	10.08	15.60	25.14	4.52	0.32	**625.00**	100	0.0041	2.5802	0.6	0.191	2.7710
7250.0	10.44	16.15	25.14	4.69	0.34	**625.00**	100	0.0044	2.7535	0.6	0.205	2.9581
7500.0	10.80	16.71	25.14	4.85	0.36	**625.00**	100	0.0047	2.9319	0.6	0.219	3.1509
7750.0	11.16	17.27	25.14	5.01	0.39	**625.00**	100	0.0050	3.1155	0.6	0.234	3.3493
8000.0	11.52	17.83	25.14	5.17	0.42	**625.00**	100	0.0053	3.3042	0.6	0.249	3.5533
8250.0	11.88	18.38	25.14	5.33	0.44	**625.00**	100	0.0056	3.4979	0.6	0.265	3.7629
8500.0	12.24	18.94	25.14	5.49	0.47	**625.00**	100	0.0059	3.6968	0.6	0.281	3.9780
8750.0	12.60	19.50	25.14	5.66	0.50	**625.00**	100	0.0062	3.9006	0.6	0.298	4.1987
9000.0	12.96	20.05	25.14	5.82	0.53	**625.00**	100	0.0066	4.1096	0.6	0.315	4.4249
9250.0	13.32	20.61	25.14	5.98	0.56	**625.00**	100	0.0069	4.3235	0.6	0.333	4.6565
9500.0	13.68	21.17	25.14	6.14	0.59	**625.00**	100	0.0073	4.5424	0.6	0.351	4.8937
9750.0	14.04	21.72	25.14	6.30	0.62	**625.00**	100	0.0076	4.7662	0.6	0.370	5.1363
10000.0	14.40	22.28	25.14	6.46	0.65	**625.00**	100	0.0080	4.9950	0.6	0.389	5.3843
10250.0	14.76	22.84	25.14	6.63	0.68	**625.00**	100	0.0084	5.2288	0.6	0.409	5.6377
10500.0	15.12	23.40	25.14	6.79	0.72	**625.00**	100	0.0087	5.4674	0.6	0.429	5.8966
10750.0	15.48	23.95	25.14	6.95	0.75	**625.00**	100	0.0091	5.7109	0.6	0.450	6.1608
11000.0	15.84	24.51	25.14	7.11	0.79	**625.00**	100	0.0095	5.9593	0.6	0.471	6.4303
11250.0	16.20	25.07	25.14	7.27	0.82	**625.00**	100	0.0099	6.2126	0.6	0.493	6.7052
11500.0	16.56	25.62	25.14	7.43	0.86	**625.00**	100	0.0104	6.4707	0.6	0.515	6.9855
11750.0	16.92	26.18	25.14	7.59	0.90	**625.00**	100	0.0108	6.7336	0.6	0.537	7.2710
12000.0	17.28	26.74	25.14	7.76	0.93	**625.00**	100	0.0112	7.0013	0.6	0.561	7.5619
12250.0	17.64	27.30	25.14	7.92	0.97	**625.00**	100	0.0116	7.2739	0.6	0.584	7.8580
12500.0	18.00	27.85	25.14	8.08	1.01	**625.00**	100	0.0121	7.5512	0.6	0.608	8.1594
12750.0	18.36	28.41	25.14	8.24	1.05	**625.00**	100	0.0125	7.8333	0.6	0.633	8.4661
13000.0	18.72	28.97	25.14	8.40	1.10	**625.00**	100	0.0130	8.1201	0.6	0.658	8.7779
13250.0	19.08	29.52	25.14	8.56	1.14	**625.00**	100	0.0135	8.4117	0.6	0.683	9.0951
13500.0	19.44	30.08	25.14	8.73	1.18	**625.00**	100	0.0139	8.7079	0.6	0.709	9.4174
13750.0	19.80	30.64	25.14	8.89	1.23	**625.00**	100	0.0144	9.0089	0.6	0.736	9.7449
14000.0	20.16	31.19	25.14	9.05	1.27	**625.00**	100	0.0149	9.3147	0.6	0.763	10.0776
14250.0	20.52	31.75	25.14	9.21	1.32	**625.00**	100	0.0154	9.6250	0.6	0.790	10.4155
14500.0	20.88	32.31	25.14	9.37	1.36	**625.00**	100	0.0159	9.9401	0.6	0.818	10.7585
14750.0	21.24	32.87	25.14	9.53	1.41	**625.00**	100	0.0164	10.2598	0.6	0.847	11.1067
15000.0	21.60	33.42	25.14	9.70	1.46	**625.00**	100	0.0169	10.5842	0.6	0.876	11.4601
15250.0	21.96	33.98	25.14	9.86	1.51	**625.00**	100	0.0175	10.9132	0.6	0.905	11.8185

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – A Modified High Point

15500.0	22.32	34.54	25.14	10.02	1.56	**625.00**	100	0.0180	11.2469	0.6	0.935	12.1821
15750.0	22.68	35.09	25.14	10.18	1.61	**625.00**	100	0.0185	11.5851	0.6	0.966	12.5508
16000.0	23.04	35.65	25.14	10.34	1.66	**625.00**	100	0.0191	11.9280	0.6	0.997	12.9245

FM System Curve – 25.3" (30" DIP)

Diameter = 25.3 in
Area for = 3.4911 ft^2
RH= 0.5271
C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.30	0.00	0.00	3481	120	0.0000	0.0000	4.125	0.000	0.0000
250.0	0.36	0.56	25.30	0.16	0.00	3481	120	0.0000	0.0208	4.125	0.002	0.0224
500.0	0.72	1.11	25.30	0.32	0.00	3481	120	0.0000	0.0750	4.125	0.007	0.0815
750.0	1.08	1.67	25.30	0.48	0.00	3481	120	0.0000	0.1588	4.125	0.015	0.1735
1000.0	1.44	2.23	25.30	0.64	0.01	3481	120	0.0001	0.2706	4.125	0.026	0.2967
1250.0	1.80	2.79	25.30	0.80	0.01	3481	120	0.0001	0.4090	4.125	0.041	0.4498
1500.0	2.16	3.34	25.30	0.96	0.01	3481	120	0.0002	0.5733	4.125	0.059	0.6321
1750.0	2.52	3.90	25.30	1.12	0.02	3481	120	0.0002	0.7628	4.125	0.080	0.8427
2000.0	2.88	4.46	25.30	1.28	0.03	3481	120	0.0003	0.9768	4.125	0.104	1.0812
2250.0	3.24	5.01	25.30	1.44	0.03	3481	120	0.0003	1.2149	4.125	0.132	1.3470
2500.0	3.60	5.57	25.30	1.60	0.04	3481	120	0.0004	1.4767	4.125	0.163	1.6397
2750.0	3.96	6.13	25.30	1.76	0.05	3481	120	0.0005	1.7617	4.125	0.197	1.9591
3000.0	4.32	6.68	25.30	1.91	0.06	3481	120	0.0006	2.0698	4.125	0.235	2.3046
3250.0	4.68	7.24	25.30	2.07	0.07	3481	120	0.0007	2.4005	4.125	0.276	2.6761
3500.0	5.04	7.80	25.30	2.23	0.08	3481	120	0.0008	2.7537	4.125	0.320	3.0733
3750.0	5.40	8.36	25.30	2.39	0.09	3481	120	0.0009	3.1290	4.125	0.367	3.4959
4000.0	5.76	8.91	25.30	2.55	0.10	3481	120	0.0010	3.5262	4.125	0.417	3.9437
4250.0	6.12	9.47	25.30	2.71	0.11	3481	120	0.0011	3.9452	4.125	0.471	4.4165
4500.0	6.48	10.03	25.30	2.87	0.13	3481	120	0.0013	4.3858	4.125	0.528	4.9141
4750.0	6.84	10.58	25.30	3.03	0.14	3481	120	0.0014	4.8477	4.125	0.589	5.4364
5000.0	7.20	11.14	25.30	3.19	0.16	3481	120	0.0015	5.3308	4.125	0.652	5.9831
5250.0	7.56	11.70	25.30	3.35	0.17	3481	120	0.0017	5.8349	4.125	0.719	6.5540
5500.0	7.92	12.25	25.30	3.51	0.19	3481	120	0.0018	6.3599	4.125	0.789	7.1491
5750.0	8.28	12.81	25.30	3.67	0.21	3481	120	0.0020	6.9056	4.125	0.863	7.7683
6000.0	8.64	13.37	25.30	3.83	0.23	3481	120	0.0021	7.4719	4.125	0.939	8.4112
6250.0	9.00	13.93	25.30	3.99	0.25	3481	120	0.0023	8.0587	4.125	1.019	9.0779
6500.0	9.36	14.48	25.30	4.15	0.27	3481	120	0.0025	8.6659	4.125	1.102	9.7682
6750.0	9.72	15.04	25.30	4.31	0.29	3481	120	0.0027	9.2933	4.125	1.189	10.4820
7000.0	10.08	15.60	25.30	4.47	0.31	3481	120	0.0029	9.9408	4.125	1.278	11.2192
7250.0	10.44	16.15	25.30	4.63	0.33	3481	120	0.0030	10.6082	4.125	1.371	11.9797
7500.0	10.80	16.71	25.30	4.79	0.36	3481	120	0.0032	11.2956	4.125	1.468	12.7633
7750.0	11.16	17.27	25.30	4.95	0.38	3481	120	0.0034	12.0029	4.125	1.567	13.5700
8000.0	11.52	17.83	25.30	5.11	0.40	3481	120	0.0037	12.7298	4.125	1.670	14.3996
8250.0	11.88	18.38	25.30	5.27	0.43	3481	120	0.0039	13.4763	4.125	1.776	15.2521
8500.0	12.24	18.94	25.30	5.42	0.46	3481	120	0.0041	14.2423	4.125	1.885	16.1274
8750.0	12.60	19.50	25.30	5.58	0.48	3481	120	0.0043	15.0278	4.125	1.998	17.0255
9000.0	12.96	20.05	25.30	5.74	0.51	3481	120	0.0045	15.8327	4.125	2.113	17.9461
9250.0	13.32	20.61	25.30	5.90	0.54	3481	120	0.0048	16.6568	4.125	2.232	18.8893
9500.0	13.68	21.17	25.30	6.06	0.57	3481	120	0.0050	17.5002	4.125	2.355	19.8549
9750.0	14.04	21.72	25.30	6.22	0.60	3481	120	0.0053	18.3626	4.125	2.480	20.8429
10000.0	14.40	22.28	25.30	6.38	0.63	3481	120	0.0055	19.2441	4.125	2.609	21.8532
10250.0	14.76	22.84	25.30	6.54	0.66	3481	120	0.0058	20.1446	4.125	2.741	22.8858
10500.0	15.12	23.40	25.30	6.70	0.70	3481	120	0.0061	21.0640	4.125	2.877	23.9405
10750.0	15.48	23.95	25.30	6.86	0.73	3481	120	0.0063	22.0022	4.125	3.015	25.0174
11000.0	15.84	24.51	25.30	7.02	0.77	3481	120	0.0066	22.9592	4.125	3.157	26.1163
11250.0	16.20	25.07	25.30	7.18	0.80	3481	120	0.0069	23.9349	4.125	3.302	27.2371
11500.0	16.56	25.62	25.30	7.34	0.84	3481	120	0.0072	24.9293	4.125	3.451	28.3799
11750.0	16.92	26.18	25.30	7.50	0.87	3481	120	0.0075	25.9423	4.125	3.602	29.5445

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – A Modified High Point

12000.0	17.28	26.74	25.30	7.66	0.91	3481	120	0.0077	26.9738	4.125	3.757	30.7309
12250.0	17.64	27.30	25.30	7.82	0.95	3481	120	0.0081	28.0237	4.125	3.915	31.9390
12500.0	18.00	27.85	25.30	7.98	0.99	3481	120	0.0084	29.0921	4.125	4.077	33.1689
12750.0	18.36	28.41	25.30	8.14	1.03	3481	120	0.0087	30.1788	4.125	4.241	34.4203
13000.0	18.72	28.97	25.30	8.30	1.07	3481	120	0.0090	31.2839	4.125	4.409	35.6933
13250.0	19.08	29.52	25.30	8.46	1.11	3481	120	0.0093	32.4072	4.125	4.581	36.9879
13500.0	19.44	30.08	25.30	8.62	1.15	3481	120	0.0096	33.5487	4.125	4.755	38.3039
13750.0	19.80	30.64	25.30	8.78	1.20	3481	120	0.0100	34.7084	4.125	4.933	39.6413
14000.0	20.16	31.19	25.30	8.94	1.24	3481	120	0.0103	35.8861	4.125	5.114	41.0000
14250.0	20.52	31.75	25.30	9.09	1.28	3481	120	0.0107	37.0820	4.125	5.298	42.3801
14500.0	20.88	32.31	25.30	9.25	1.33	3481	120	0.0110	38.2958	4.125	5.486	43.7815
14750.0	21.24	32.87	25.30	9.41	1.38	3481	120	0.0114	39.5276	4.125	5.676	45.2041
15000.0	21.60	33.42	25.30	9.57	1.42	3481	120	0.0117	40.7773	4.125	5.871	46.6479
15250.0	21.96	33.98	25.30	9.73	1.47	3481	120	0.0121	42.0449	4.125	6.068	48.1128
15500.0	22.32	34.54	25.30	9.89	1.52	3481	120	0.0124	43.3303	4.125	6.268	49.5988
15750.0	22.68	35.09	25.30	10.05	1.57	3481	120	0.0128	44.6335	4.125	6.472	51.1058
16000.0	23.04	35.65	25.30	10.21	1.62	3481	120	0.0132	45.9545	4.125	6.679	52.6339

FM System Curve – 24"

Diameter = 24 in
Area for = 3.1416 ft^2
RH= 0.5
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	3580.4	100	0.0000	0.0000	1.00	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	3580.4	100	0.0000	0.0387	1.00	0.000	0.0392
500.0	0.72	1.11	24.00	0.35	0.00	3580.4	100	0.0000	0.1397	1.00	0.002	0.1417
750.0	1.08	1.67	24.00	0.53	0.00	3580.4	100	0.0001	0.2961	1.00	0.004	0.3004
1000.0	1.44	2.23	24.00	0.71	0.01	3580.4	100	0.0001	0.5044	1.00	0.008	0.5122
1250.0	1.80	2.79	24.00	0.89	0.01	3580.4	100	0.0002	0.7625	1.00	0.012	0.7747
1500.0	2.16	3.34	24.00	1.06	0.02	3580.4	100	0.0003	1.0688	1.00	0.018	1.0863
1750.0	2.52	3.90	24.00	1.24	0.02	3580.4	100	0.0004	1.4219	1.00	0.024	1.4458
2000.0	2.88	4.46	24.00	1.42	0.03	3580.4	100	0.0005	1.8208	1.00	0.031	1.8520
2250.0	3.24	5.01	24.00	1.60	0.04	3580.4	100	0.0006	2.2646	1.00	0.040	2.3042
2500.0	3.60	5.57	24.00	1.77	0.05	3580.4	100	0.0008	2.7526	1.00	0.049	2.8014
2750.0	3.96	6.13	24.00	1.95	0.06	3580.4	100	0.0009	3.2840	1.00	0.059	3.3430
3000.0	4.32	6.68	24.00	2.13	0.07	3580.4	100	0.0011	3.8582	1.00	0.070	3.9285
3250.0	4.68	7.24	24.00	2.31	0.08	3580.4	100	0.0012	4.4747	1.00	0.083	4.5572
3500.0	5.04	7.80	24.00	2.48	0.10	3580.4	100	0.0014	5.1330	1.00	0.096	5.2287
3750.0	5.40	8.36	24.00	2.66	0.11	3580.4	100	0.0016	5.8326	1.00	0.110	5.9424
4000.0	5.76	8.91	24.00	2.84	0.12	3580.4	100	0.0018	6.5731	1.00	0.125	6.6981
4250.0	6.12	9.47	24.00	3.01	0.14	3580.4	100	0.0021	7.3541	1.00	0.141	7.4952
4500.0	6.48	10.03	24.00	3.19	0.16	3580.4	100	0.0023	8.1753	1.00	0.158	8.3335
4750.0	6.84	10.58	24.00	3.37	0.18	3580.4	100	0.0025	9.0363	1.00	0.176	9.2126
5000.0	7.20	11.14	24.00	3.55	0.20	3580.4	100	0.0028	9.9368	1.00	0.195	10.1321
5250.0	7.56	11.70	24.00	3.72	0.22	3580.4	100	0.0030	10.8765	1.00	0.215	11.0918
5500.0	7.92	12.25	24.00	3.90	0.24	3580.4	100	0.0033	11.8552	1.00	0.236	12.0914
5750.0	8.28	12.81	24.00	4.08	0.26	3580.4	100	0.0036	12.8724	1.00	0.258	13.1307
6000.0	8.64	13.37	24.00	4.26	0.28	3580.4	100	0.0039	13.9281	1.00	0.281	14.2093
6250.0	9.00	13.93	24.00	4.43	0.31	3580.4	100	0.0042	15.0219	1.00	0.305	15.3270
6500.0	9.36	14.48	24.00	4.61	0.33	3580.4	100	0.0045	16.1537	1.00	0.330	16.4837
6750.0	9.72	15.04	24.00	4.79	0.36	3580.4	100	0.0048	17.3231	1.00	0.356	17.6790
7000.0	10.08	15.60	24.00	4.96	0.38	3580.4	100	0.0052	18.5301	1.00	0.383	18.9128
7250.0	10.44	16.15	24.00	5.14	0.41	3580.4	100	0.0055	19.7743	1.00	0.411	20.1849
7500.0	10.80	16.71	24.00	5.32	0.44	3580.4	100	0.0059	21.0557	1.00	0.439	21.4950
7750.0	11.16	17.27	24.00	5.50	0.47	3580.4	100	0.0062	22.3739	1.00	0.469	22.8431
8000.0	11.52	17.83	24.00	5.67	0.50	3580.4	100	0.0066	23.7289	1.00	0.500	24.2288
8250.0	11.88	18.38	24.00	5.85	0.53	3580.4	100	0.0070	25.1205	1.00	0.532	25.6521
8500.0	12.24	18.94	24.00	6.03	0.56	3580.4	100	0.0074	26.5485	1.00	0.564	27.1128

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – A Modified High Point

8750.0	12.60	19.50	24.00	6.21	0.60	3580.4	100	0.0078	28.0127	1.00	0.598	28.6107
9000.0	12.96	20.05	24.00	6.38	0.63	3580.4	100	0.0082	29.5130	1.00	0.633	30.1457
9250.0	13.32	20.61	24.00	6.56	0.67	3580.4	100	0.0087	31.0492	1.00	0.668	31.7175
9500.0	13.68	21.17	24.00	6.74	0.70	3580.4	100	0.0091	32.6212	1.00	0.705	33.3261
9750.0	14.04	21.72	24.00	6.92	0.74	3580.4	100	0.0096	34.2288	1.00	0.743	34.9714
10000.0	14.40	22.28	24.00	7.09	0.78	3580.4	100	0.0100	35.8720	1.00	0.781	36.6531
10250.0	14.76	22.84	24.00	7.27	0.82	3580.4	100	0.0105	37.5506	1.00	0.821	38.3712
10500.0	15.12	23.40	24.00	7.45	0.86	3580.4	100	0.0110	39.2643	1.00	0.861	40.1255
10750.0	15.48	23.95	24.00	7.62	0.90	3580.4	100	0.0115	41.0133	1.00	0.903	41.9159
11000.0	15.84	24.51	24.00	7.80	0.95	3580.4	100	0.0120	42.7972	1.00	0.945	43.7423
11250.0	16.20	25.07	24.00	7.98	0.99	3580.4	100	0.0125	44.6160	1.00	0.989	45.6045
11500.0	16.56	25.62	24.00	8.16	1.03	3580.4	100	0.0130	46.4695	1.00	1.033	47.5025
11750.0	16.92	26.18	24.00	8.33	1.08	3580.4	100	0.0135	48.3577	1.00	1.078	49.4361
12000.0	17.28	26.74	24.00	8.51	1.12	3580.4	100	0.0140	50.2805	1.00	1.125	51.4053
12250.0	17.64	27.30	24.00	8.69	1.17	3580.4	100	0.0146	52.2377	1.00	1.172	53.4098
12500.0	18.00	27.85	24.00	8.87	1.22	3580.4	100	0.0151	54.2292	1.00	1.220	55.4497
12750.0	18.36	28.41	24.00	9.04	1.27	3580.4	100	0.0157	56.2549	1.00	1.270	57.5247
13000.0	18.72	28.97	24.00	9.22	1.32	3580.4	100	0.0163	58.3148	1.00	1.320	59.6349
13250.0	19.08	29.52	24.00	9.40	1.37	3580.4	100	0.0169	60.4087	1.00	1.371	61.7800
13500.0	19.44	30.08	24.00	9.57	1.42	3580.4	100	0.0175	62.5365	1.00	1.424	63.9601
13750.0	19.80	30.64	24.00	9.75	1.48	3580.4	100	0.0181	64.6982	1.00	1.477	66.1750
14000.0	20.16	31.19	24.00	9.93	1.53	3580.4	100	0.0187	66.8936	1.00	1.531	68.4246
14250.0	20.52	31.75	24.00	10.11	1.59	3580.4	100	0.0193	69.1227	1.00	1.586	70.7089
14500.0	20.88	32.31	24.00	10.28	1.64	3580.4	100	0.0199	71.3854	1.00	1.642	73.0277
14750.0	21.24	32.87	24.00	10.46	1.70	3580.4	100	0.0206	73.6815	1.00	1.699	75.3809
15000.0	21.60	33.42	24.00	10.64	1.76	3580.4	100	0.0212	76.0111	1.00	1.757	77.7685
15250.0	21.96	33.98	24.00	10.82	1.82	3580.4	100	0.0219	78.3739	1.00	1.817	80.1905
15500.0	22.32	34.54	24.00	10.99	1.88	3580.4	100	0.0226	80.7700	1.00	1.877	82.6466
15750.0	22.68	35.09	24.00	11.17	1.94	3580.4	100	0.0232	83.1992	1.00	1.938	85.1369
16000.0	23.04	35.65	24.00	11.35	2.00	3580.4	100	0.0239	85.6616	1.00	2.000	87.6612

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – A Modified High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	0.16
500.0	0.72	0.58
750.0	1.08	1.24
1000.0	1.44	2.11
1250.0	1.80	3.20
1500.0	2.16	4.49
1750.0	2.52	5.98
2000.0	2.88	7.67
2250.0	3.24	9.55
2500.0	3.60	11.62
2750.0	3.96	13.87
3000.0	4.32	16.31
3250.0	4.68	18.93
3500.0	5.04	21.74
3750.0	5.40	24.72
4000.0	5.76	27.87
4250.0	6.12	31.21
4500.0	6.48	34.71
4750.0	6.84	38.39
5000.0	7.20	42.24
5250.0	7.56	46.26
5500.0	7.92	50.45
5750.0	8.28	54.80
6000.0	8.64	59.33
6250.0	9.00	64.01
6500.0	9.36	68.87
6750.0	9.72	73.89
7000.0	10.08	79.07
7250.0	10.44	84.41
7500.0	10.80	89.91
7750.0	11.16	95.58
8000.0	11.52	101.41
8250.0	11.88	107.39
8500.0	12.24	113.54
8750.0	12.60	119.84
9000.0	12.96	126.30
9250.0	13.32	132.92
9500.0	13.68	139.69
9750.0	14.04	146.62
10000.0	14.40	153.70
10250.0	14.76	160.94
10500.0	15.12	168.34
10750.0	15.48	175.89
11000.0	15.84	183.59
11250.0	16.20	191.44
11500.0	16.56	199.45
11750.0	16.92	207.61
12000.0	17.28	215.92
12250.0	17.64	224.38
12500.0	18.00	232.99
12750.0	18.36	241.76
13000.0	18.72	250.67
13250.0	19.08	259.73
13500.0	19.44	268.94
13750.0	19.80	278.30
14000.0	20.16	287.81
14250.0	20.52	297.47
14500.0	20.88	307.27
14750.0	21.24	317.23
15000.0	21.60	327.33
15250.0	21.96	337.57
15500.0	22.32	347.96
15750.0	22.68	358.50
16000.0	23.04	369.19

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	27.85	32.35
250.0	0.36	28.01	32.51
500.0	0.72	28.43	32.93
750.0	1.08	29.09	33.59
1000.0	1.44	29.96	34.46
1250.0	1.80	31.05	35.55
1500.0	2.16	32.34	36.84
1750.0	2.52	33.83	38.33
2000.0	2.88	35.52	40.02
2250.0	3.24	37.40	41.90
2500.0	3.60	39.47	43.97
2750.0	3.96	41.72	46.22
3000.0	4.32	44.16	48.66
3250.0	4.68	46.78	51.28
3500.0	5.04	49.59	54.09
3750.0	5.40	52.57	57.07
4000.0	5.76	55.72	60.22
4250.0	6.12	59.06	63.56
4500.0	6.48	62.56	67.06
4750.0	6.84	66.24	70.74
5000.0	7.20	70.09	74.59
5250.0	7.56	74.11	78.61
5500.0	7.92	78.30	82.80
5750.0	8.28	82.65	87.15
6000.0	8.64	87.18	91.68
6250.0	9.00	91.86	96.36
6500.0	9.36	96.72	101.22
6750.0	9.72	101.74	106.24
7000.0	10.08	106.92	111.42
7250.0	10.44	112.26	116.76
7500.0	10.80	117.76	122.26
7750.0	11.16	123.43	127.93
8000.0	11.52	129.26	133.76
8250.0	11.88	135.24	139.74
8500.0	12.24	141.39	145.89
8750.0	12.60	147.69	152.19
9000.0	12.96	154.15	158.65
9250.0	13.32	160.77	165.27
9500.0	13.68	167.54	172.04
9750.0	14.04	174.47	178.97
10000.0	14.40	181.55	186.05
10250.0	14.76	188.79	193.29
10500.0	15.12	196.19	200.69
10750.0	15.48	203.74	208.24
11000.0	15.84	211.44	215.94
11250.0	16.20	219.29	223.79
11500.0	16.56	227.30	231.80
11750.0	16.92	235.46	239.96
12000.0	17.28	243.77	248.27
12250.0	17.64	252.23	256.73
12500.0	18.00	260.84	265.34
12750.0	18.36	269.61	274.11
13000.0	18.72	278.52	283.02
13250.0	19.08	287.58	292.08
13500.0	19.44	296.79	301.29
13750.0	19.80	306.15	310.65
14000.0	20.16	315.66	320.16
14250.0	20.52	325.32	329.82
14500.0	20.88	335.12	339.62
14750.0	21.24	345.08	349.58
15000.0	21.60	355.18	359.68
15250.0	21.96	365.42	369.92
15500.0	22.32	375.81	380.31
15750.0	22.68	386.35	390.85
16000.0	23.04	397.04	401.54

MIN Static Head = 27.85
MAX Static Head = 32.35

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – B Modified High Point

FM System Curve - 24"

Diameter = 24 in
Area for = 3.141593 ft^2
RH= 0.5
C= 100

Q (gpm)	Q (mgd)	Q (cfs)	Pipe Dia. (in)	V (fps)	$V^2/2g$ (ft)	L (ft)	C	S	Friction Losses S x L (ft)	K	Minor Losses K x ($v^2/2g$) (ft)	Total Losses (ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – B Modified High Point

13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071
13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve - 24" (24" Parallel FM Portion)

Diameter = 24 in

Area for = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	36.00	100	0.0000	0.0000	1.9	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	36.00	100	0.0000	0.0004	1.9	0.001	0.0013
500.0	0.72	1.11	24.00	0.35	0.00	36.00	100	0.0000	0.0014	1.9	0.004	0.0051
750.0	1.08	1.67	24.00	0.53	0.00	36.00	100	0.0001	0.0030	1.9	0.008	0.0113
1000.0	1.44	2.23	24.00	0.71	0.01	36.00	100	0.0001	0.0051	1.9	0.015	0.0199
1250.0	1.80	2.79	24.00	0.89	0.01	36.00	100	0.0002	0.0077	1.9	0.023	0.0309
1500.0	2.16	3.34	24.00	1.06	0.02	36.00	100	0.0003	0.0107	1.9	0.033	0.0441
1750.0	2.52	3.90	24.00	1.24	0.02	36.00	100	0.0004	0.0143	1.9	0.045	0.0597
2000.0	2.88	4.46	24.00	1.42	0.03	36.00	100	0.0005	0.0183	1.9	0.059	0.0777
2250.0	3.24	5.01	24.00	1.60	0.04	36.00	100	0.0006	0.0228	1.9	0.075	0.0979
2500.0	3.60	5.57	24.00	1.77	0.05	36.00	100	0.0008	0.0277	1.9	0.093	0.1204
2750.0	3.96	6.13	24.00	1.95	0.06	36.00	100	0.0009	0.0330	1.9	0.112	0.1453
3000.0	4.32	6.68	24.00	2.13	0.07	36.00	100	0.0011	0.0388	1.9	0.134	0.1724
3250.0	4.68	7.24	24.00	2.31	0.08	36.00	100	0.0012	0.0450	1.9	0.157	0.2017
3500.0	5.04	7.80	24.00	2.48	0.10	36.00	100	0.0014	0.0516	1.9	0.182	0.2334
3750.0	5.40	8.36	24.00	2.66	0.11	36.00	100	0.0016	0.0586	1.9	0.209	0.2673
4000.0	5.76	8.91	24.00	2.84	0.12	36.00	100	0.0018	0.0661	1.9	0.237	0.3035
4250.0	6.12	9.47	24.00	3.01	0.14	36.00	100	0.0021	0.0739	1.9	0.268	0.3420
4500.0	6.48	10.03	24.00	3.19	0.16	36.00	100	0.0023	0.0822	1.9	0.301	0.3827
4750.0	6.84	10.58	24.00	3.37	0.18	36.00	100	0.0025	0.0909	1.9	0.335	0.4257
5000.0	7.20	11.14	24.00	3.55	0.20	36.00	100	0.0028	0.0999	1.9	0.371	0.4709
5250.0	7.56	11.70	24.00	3.72	0.22	36.00	100	0.0030	0.1094	1.9	0.409	0.5184
5500.0	7.92	12.25	24.00	3.90	0.24	36.00	100	0.0033	0.1192	1.9	0.449	0.5681
5750.0	8.28	12.81	24.00	4.08	0.26	36.00	100	0.0036	0.1294	1.9	0.491	0.6201
6000.0	8.64	13.37	24.00	4.26	0.28	36.00	100	0.0039	0.1400	1.9	0.534	0.6743
6250.0	9.00	13.93	24.00	4.43	0.31	36.00	100	0.0042	0.1510	1.9	0.580	0.7308
6500.0	9.36	14.48	24.00	4.61	0.33	36.00	100	0.0045	0.1624	1.9	0.627	0.7895
6750.0	9.72	15.04	24.00	4.79	0.36	36.00	100	0.0048	0.1742	1.9	0.676	0.8504
7000.0	10.08	15.60	24.00	4.96	0.38	36.00	100	0.0052	0.1863	1.9	0.727	0.9135
7250.0	10.44	16.15	24.00	5.14	0.41	36.00	100	0.0055	0.1988	1.9	0.780	0.9789
7500.0	10.80	16.71	24.00	5.32	0.44	36.00	100	0.0059	0.2117	1.9	0.835	1.0465
7750.0	11.16	17.27	24.00	5.50	0.47	36.00	100	0.0062	0.2250	1.9	0.891	1.1163
8000.0	11.52	17.83	24.00	5.67	0.50	36.00	100	0.0066	0.2386	1.9	0.950	1.1884
8250.0	11.88	18.38	24.00	5.85	0.53	36.00	100	0.0070	0.2526	1.9	1.010	1.2627
8500.0	12.24	18.94	24.00	6.03	0.56	36.00	100	0.0074	0.2669	1.9	1.072	1.3392
8750.0	12.60	19.50	24.00	6.21	0.60	36.00	100	0.0078	0.2817	1.9	1.136	1.4179
9000.0	12.96	20.05	24.00	6.38	0.63	36.00	100	0.0082	0.2967	1.9	1.202	1.4989
9250.0	13.32	20.61	24.00	6.56	0.67	36.00	100	0.0087	0.3122	1.9	1.270	1.5820
9500.0	13.68	21.17	24.00	6.74	0.70	36.00	100	0.0091	0.3280	1.9	1.339	1.6674
9750.0	14.04	21.72	24.00	6.92	0.74	36.00	100	0.0096	0.3442	1.9	1.411	1.7550

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – B Modified High Point

10000.0	14.40	22.28	24.00	7.09	0.78	36.00	100	0.0100	0.3607	1.9	1.484	1.8448
10250.0	14.76	22.84	24.00	7.27	0.82	36.00	100	0.0105	0.3776	1.9	1.559	1.9368
10500.0	15.12	23.40	24.00	7.45	0.86	36.00	100	0.0110	0.3948	1.9	1.636	2.0310
10750.0	15.48	23.95	24.00	7.62	0.90	36.00	100	0.0115	0.4124	1.9	1.715	2.1274
11000.0	15.84	24.51	24.00	7.80	0.95	36.00	100	0.0120	0.4303	1.9	1.796	2.2261
11250.0	16.20	25.07	24.00	7.98	0.99	36.00	100	0.0125	0.4486	1.9	1.878	2.3269
11500.0	16.56	25.62	24.00	8.16	1.03	36.00	100	0.0130	0.4672	1.9	1.963	2.4300
11750.0	16.92	26.18	24.00	8.33	1.08	36.00	100	0.0135	0.4862	1.9	2.049	2.5352
12000.0	17.28	26.74	24.00	8.51	1.12	36.00	100	0.0140	0.5056	1.9	2.137	2.6427
12250.0	17.64	27.30	24.00	8.69	1.17	36.00	100	0.0146	0.5252	1.9	2.227	2.7523
12500.0	18.00	27.85	24.00	8.87	1.22	36.00	100	0.0151	0.5453	1.9	2.319	2.8642
12750.0	18.36	28.41	24.00	9.04	1.27	36.00	100	0.0157	0.5656	1.9	2.413	2.9782
13000.0	18.72	28.97	24.00	9.22	1.32	36.00	100	0.0163	0.5863	1.9	2.508	3.0945
13250.0	19.08	29.52	24.00	9.40	1.37	36.00	100	0.0169	0.6074	1.9	2.606	3.2129
13500.0	19.44	30.08	24.00	9.57	1.42	36.00	100	0.0175	0.6288	1.9	2.705	3.3336
13750.0	19.80	30.64	24.00	9.75	1.48	36.00	100	0.0181	0.6505	1.9	2.806	3.4564
14000.0	20.16	31.19	24.00	9.93	1.53	36.00	100	0.0187	0.6726	1.9	2.909	3.5814
14250.0	20.52	31.75	24.00	10.11	1.59	36.00	100	0.0193	0.6950	1.9	3.014	3.7087
14500.0	20.88	32.31	24.00	10.28	1.64	36.00	100	0.0199	0.7178	1.9	3.120	3.8381
14750.0	21.24	32.87	24.00	10.46	1.70	36.00	100	0.0206	0.7408	1.9	3.229	3.9697
15000.0	21.60	33.42	24.00	10.64	1.76	36.00	100	0.0212	0.7643	1.9	3.339	4.1035
15250.0	21.96	33.98	24.00	10.82	1.82	36.00	100	0.0219	0.7880	1.9	3.451	4.2395
15500.0	22.32	34.54	24.00	10.99	1.88	36.00	100	0.0226	0.8121	1.9	3.566	4.3777
15750.0	22.68	35.09	24.00	11.17	1.94	36.00	100	0.0232	0.8365	1.9	3.681	4.5180
16000.0	23.04	35.65	24.00	11.35	2.00	36.00	100	0.0239	0.8613	1.9	3.799	4.6606

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area for = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	10260	120	0.0000	0.0000	4.5	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	10260	120	0.0000	0.0816	4.5	0.002	0.0838
500.0	0.72	1.11	23.85	0.36	0.00	10260	120	0.0000	0.2945	4.5	0.009	0.3035
750.0	1.08	1.67	23.85	0.54	0.00	10260	120	0.0001	0.6240	4.5	0.020	0.6443
1000.0	1.44	2.23	23.85	0.72	0.01	10260	120	0.0001	1.0631	4.5	0.036	1.0992
1250.0	1.80	2.79	23.85	0.90	0.01	10260	120	0.0002	1.6072	4.5	0.056	1.6635
1500.0	2.16	3.34	23.85	1.08	0.02	10260	120	0.0002	2.2527	4.5	0.081	2.3338
1750.0	2.52	3.90	23.85	1.26	0.02	10260	120	0.0003	2.9971	4.5	0.110	3.1074
2000.0	2.88	4.46	23.85	1.44	0.03	10260	120	0.0004	3.8379	4.5	0.144	3.9821
2250.0	3.24	5.01	23.85	1.62	0.04	10260	120	0.0005	4.7734	4.5	0.182	4.9559
2500.0	3.60	5.57	23.85	1.80	0.05	10260	120	0.0006	5.8019	4.5	0.225	6.0272
2750.0	3.96	6.13	23.85	1.98	0.06	10260	120	0.0007	6.9220	4.5	0.273	7.1946
3000.0	4.32	6.68	23.85	2.15	0.07	10260	120	0.0008	8.1324	4.5	0.324	8.4568
3250.0	4.68	7.24	23.85	2.33	0.08	10260	120	0.0009	9.4319	4.5	0.381	9.8126
3500.0	5.04	7.80	23.85	2.51	0.10	10260	120	0.0011	10.8194	4.5	0.442	11.2609
3750.0	5.40	8.36	23.85	2.69	0.11	10260	120	0.0012	12.2940	4.5	0.507	12.8009
4000.0	5.76	8.91	23.85	2.87	0.13	10260	120	0.0014	13.8549	4.5	0.577	14.4316
4250.0	6.12	9.47	23.85	3.05	0.14	10260	120	0.0015	15.5012	4.5	0.651	16.1522
4500.0	6.48	10.03	23.85	3.23	0.16	10260	120	0.0017	17.2321	4.5	0.730	17.9620
4750.0	6.84	10.58	23.85	3.41	0.18	10260	120	0.0019	19.0470	4.5	0.813	19.8602
5000.0	7.20	11.14	23.85	3.59	0.20	10260	120	0.0020	20.9451	4.5	0.901	21.8461
5250.0	7.56	11.70	23.85	3.77	0.22	10260	120	0.0022	22.9258	4.5	0.993	23.9192
5500.0	7.92	12.25	23.85	3.95	0.24	10260	120	0.0024	24.9885	4.5	1.090	26.0788
5750.0	8.28	12.81	23.85	4.13	0.26	10260	120	0.0026	27.1328	4.5	1.192	28.3244
6000.0	8.64	13.37	23.85	4.31	0.29	10260	120	0.0029	29.3579	4.5	1.298	30.6554
6250.0	9.00	13.93	23.85	4.49	0.31	10260	120	0.0031	31.6635	4.5	1.408	33.0714
6500.0	9.36	14.48	23.85	4.67	0.34	10260	120	0.0033	34.0490	4.5	1.523	35.5718

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – B Modified High Point

6750.0	9.72	15.04	23.85	4.85	0.36	10260	120	0.0036	36.5140	4.5	1.642	38.1562
7000.0	10.08	15.60	23.85	5.03	0.39	10260	120	0.0038	39.0581	4.5	1.766	40.8241
7250.0	10.44	16.15	23.85	5.21	0.42	10260	120	0.0041	41.6807	4.5	1.894	43.5752
7500.0	10.80	16.71	23.85	5.39	0.45	10260	120	0.0043	44.3816	4.5	2.027	46.4089
7750.0	11.16	17.27	23.85	5.57	0.48	10260	120	0.0046	47.1602	4.5	2.165	49.3250
8000.0	11.52	17.83	23.85	5.75	0.51	10260	120	0.0049	50.0163	4.5	2.307	52.3230
8250.0	11.88	18.38	23.85	5.93	0.55	10260	120	0.0052	52.9495	4.5	2.453	55.4026
8500.0	12.24	18.94	23.85	6.10	0.58	10260	120	0.0055	55.9594	4.5	2.604	58.5634
8750.0	12.60	19.50	23.85	6.28	0.61	10260	120	0.0058	59.0457	4.5	2.759	61.8051
9000.0	12.96	20.05	23.85	6.46	0.65	10260	120	0.0061	62.2080	4.5	2.919	65.1274
9250.0	13.32	20.61	23.85	6.64	0.69	10260	120	0.0064	65.4461	4.5	3.084	68.5299
9500.0	13.68	21.17	23.85	6.82	0.72	10260	120	0.0067	68.7596	4.5	3.253	72.0124
9750.0	14.04	21.72	23.85	7.00	0.76	10260	120	0.0070	72.1482	4.5	3.426	75.5745
10000.0	14.40	22.28	23.85	7.18	0.80	10260	120	0.0074	75.6117	4.5	3.604	79.2159
10250.0	14.76	22.84	23.85	7.36	0.84	10260	120	0.0077	79.1498	4.5	3.787	82.9365
10500.0	15.12	23.40	23.85	7.54	0.88	10260	120	0.0081	82.7621	4.5	3.974	86.7358
10750.0	15.48	23.95	23.85	7.72	0.93	10260	120	0.0084	86.4485	4.5	4.165	90.6137
11000.0	15.84	24.51	23.85	7.90	0.97	10260	120	0.0088	90.2087	4.5	4.361	94.5698
11250.0	16.20	25.07	23.85	8.08	1.01	10260	120	0.0092	94.0424	4.5	4.562	98.6040
11500.0	16.56	25.62	23.85	8.26	1.06	10260	120	0.0095	97.9493	4.5	4.767	102.7159
11750.0	16.92	26.18	23.85	8.44	1.11	10260	120	0.0099	101.9293	4.5	4.976	106.9054
12000.0	17.28	26.74	23.85	8.62	1.15	10260	120	0.0103	105.9822	4.5	5.190	111.1722
12250.0	17.64	27.30	23.85	8.80	1.20	10260	120	0.0107	110.1075	4.5	5.409	115.5161
12500.0	18.00	27.85	23.85	8.98	1.25	10260	120	0.0111	114.3053	4.5	5.632	119.9369
12750.0	18.36	28.41	23.85	9.16	1.30	10260	120	0.0116	118.5752	4.5	5.859	124.4343
13000.0	18.72	28.97	23.85	9.34	1.35	10260	120	0.0120	122.9171	4.5	6.091	129.0082
13250.0	19.08	29.52	23.85	9.52	1.41	10260	120	0.0124	127.3306	4.5	6.328	133.6583
13500.0	19.44	30.08	23.85	9.70	1.46	10260	120	0.0128	131.8157	4.5	6.569	138.3844
13750.0	19.80	30.64	23.85	9.88	1.51	10260	120	0.0133	136.3721	4.5	6.814	143.1864
14000.0	20.16	31.19	23.85	10.05	1.57	10260	120	0.0137	140.9997	4.5	7.064	148.0640
14250.0	20.52	31.75	23.85	10.23	1.63	10260	120	0.0142	145.6982	4.5	7.319	153.0170
14500.0	20.88	32.31	23.85	10.41	1.68	10260	120	0.0147	150.4675	4.5	7.578	158.0454
14750.0	21.24	32.87	23.85	10.59	1.74	10260	120	0.0151	155.3073	4.5	7.841	163.1488
15000.0	21.60	33.42	23.85	10.77	1.80	10260	120	0.0156	160.2175	4.5	8.110	168.3271
15250.0	21.96	33.98	23.85	10.95	1.86	10260	120	0.0161	165.1980	4.5	8.382	173.5801
15500.0	22.32	34.54	23.85	11.13	1.92	10260	120	0.0166	170.2485	4.5	8.659	178.9077
15750.0	22.68	35.09	23.85	11.31	1.99	10260	120	0.0171	175.3689	4.5	8.941	184.3097
16000.0	23.04	35.65	23.85	11.49	2.05	10260	120	0.0176	180.5591	4.5	9.227	189.7859

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area for = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	619.99	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	619.99	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	619.99	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	619.99	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	619.99	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	619.99	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	619.99	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	619.99	120	0.0003	0.1811	2.7	0.066	0.2473
2000.0	2.88	4.46	23.85	1.44	0.03	619.99	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	619.99	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	619.99	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	619.99	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	619.99	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	619.99	120	0.0009	0.5699	2.7	0.228	0.7984

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – B Modified High Point

3500.0	5.04	7.80	23.85	2.51	0.10	619.99	120	0.0011	0.6538	2.7	0.265	0.9187
3750.0	5.40	8.36	23.85	2.69	0.11	619.99	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	619.99	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	619.99	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	619.99	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	619.99	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	619.99	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	619.99	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	619.99	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	619.99	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	619.99	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	619.99	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	619.99	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	619.99	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	619.99	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	619.99	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	619.99	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	619.99	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	619.99	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	619.99	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	619.99	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	619.99	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	619.99	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	619.99	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	619.99	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	619.99	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	619.99	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	619.99	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	619.99	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	619.99	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	619.99	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	619.99	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	619.99	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	619.99	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	619.99	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	619.99	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	619.99	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	619.99	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	619.99	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	619.99	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	619.99	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	619.99	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	619.99	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	619.99	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	619.99	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	619.99	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	619.99	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	619.99	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	619.99	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	619.99	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	619.99	120	0.0176	10.9108	2.7	5.536	16.4469

FM System Curve – 25.14" (24" DIP)

Diameter = 25.14 in

Area for = 3.4471 ft^2

RH=D/4= 0.5238

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.14	0.00	0.00	625.00	100	0.0000	0.0000	0.6	0.000	0.0000
250.0	0.36	0.56	25.14	0.16	0.00	625.00	100	0.0000	0.0054	0.6	0.000	0.0056
500.0	0.72	1.11	25.14	0.32	0.00	625.00	100	0.0000	0.0195	0.6	0.001	0.0204

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – B Modified High Point

750.0	1.08	1.67	25.14	0.48	0.00	625.00	100	0.0001	0.0412	0.6	0.002	0.0434
1000.0	1.44	2.23	25.14	0.65	0.01	625.00	100	0.0001	0.0702	0.6	0.004	0.0741
1250.0	1.80	2.79	25.14	0.81	0.01	625.00	100	0.0002	0.1062	0.6	0.006	0.1123
1500.0	2.16	3.34	25.14	0.97	0.01	625.00	100	0.0002	0.1488	0.6	0.009	0.1576
1750.0	2.52	3.90	25.14	1.13	0.02	625.00	100	0.0003	0.1980	0.6	0.012	0.2099
2000.0	2.88	4.46	25.14	1.29	0.03	625.00	100	0.0004	0.2535	0.6	0.016	0.2691
2250.0	3.24	5.01	25.14	1.45	0.03	625.00	100	0.0005	0.3153	0.6	0.020	0.3350
2500.0	3.60	5.57	25.14	1.62	0.04	625.00	100	0.0006	0.3833	0.6	0.024	0.4076
2750.0	3.96	6.13	25.14	1.78	0.05	625.00	100	0.0007	0.4573	0.6	0.029	0.4867
3000.0	4.32	6.68	25.14	1.94	0.06	625.00	100	0.0009	0.5372	0.6	0.035	0.5723
3250.0	4.68	7.24	25.14	2.10	0.07	625.00	100	0.0010	0.6231	0.6	0.041	0.6642
3500.0	5.04	7.80	25.14	2.26	0.08	625.00	100	0.0011	0.7147	0.6	0.048	0.7624
3750.0	5.40	8.36	25.14	2.42	0.09	625.00	100	0.0013	0.8122	0.6	0.055	0.8669
4000.0	5.76	8.91	25.14	2.59	0.10	625.00	100	0.0015	0.9153	0.6	0.062	0.9776
4250.0	6.12	9.47	25.14	2.75	0.12	625.00	100	0.0016	1.0240	0.6	0.070	1.0943
4500.0	6.48	10.03	25.14	2.91	0.13	625.00	100	0.0018	1.1384	0.6	0.079	1.2172
4750.0	6.84	10.58	25.14	3.07	0.15	625.00	100	0.0020	1.2583	0.6	0.088	1.3461
5000.0	7.20	11.14	25.14	3.23	0.16	625.00	100	0.0022	1.3837	0.6	0.097	1.4810
5250.0	7.56	11.70	25.14	3.39	0.18	625.00	100	0.0024	1.5145	0.6	0.107	1.6218
5500.0	7.92	12.25	25.14	3.56	0.20	625.00	100	0.0026	1.6508	0.6	0.118	1.7685
5750.0	8.28	12.81	25.14	3.72	0.21	625.00	100	0.0029	1.7924	0.6	0.129	1.9211
6000.0	8.64	13.37	25.14	3.88	0.23	625.00	100	0.0031	1.9394	0.6	0.140	2.0796
6250.0	9.00	13.93	25.14	4.04	0.25	625.00	100	0.0033	2.0917	0.6	0.152	2.2438
6500.0	9.36	14.48	25.14	4.20	0.27	625.00	100	0.0036	2.2493	0.6	0.164	2.4138
6750.0	9.72	15.04	25.14	4.36	0.30	625.00	100	0.0039	2.4122	0.6	0.177	2.5895
7000.0	10.08	15.60	25.14	4.52	0.32	625.00	100	0.0041	2.5802	0.6	0.191	2.7710
7250.0	10.44	16.15	25.14	4.69	0.34	625.00	100	0.0044	2.7535	0.6	0.205	2.9581
7500.0	10.80	16.71	25.14	4.85	0.36	625.00	100	0.0047	2.9319	0.6	0.219	3.1509
7750.0	11.16	17.27	25.14	5.01	0.39	625.00	100	0.0050	3.1155	0.6	0.234	3.3493
8000.0	11.52	17.83	25.14	5.17	0.42	625.00	100	0.0053	3.3042	0.6	0.249	3.5533
8250.0	11.88	18.38	25.14	5.33	0.44	625.00	100	0.0056	3.4979	0.6	0.265	3.7629
8500.0	12.24	18.94	25.14	5.49	0.47	625.00	100	0.0059	3.6968	0.6	0.281	3.9780
8750.0	12.60	19.50	25.14	5.66	0.50	625.00	100	0.0062	3.9006	0.6	0.298	4.1987
9000.0	12.96	20.05	25.14	5.82	0.53	625.00	100	0.0066	4.1096	0.6	0.315	4.4249
9250.0	13.32	20.61	25.14	5.98	0.56	625.00	100	0.0069	4.3235	0.6	0.333	4.6565
9500.0	13.68	21.17	25.14	6.14	0.59	625.00	100	0.0073	4.5424	0.6	0.351	4.8937
9750.0	14.04	21.72	25.14	6.30	0.62	625.00	100	0.0076	4.7662	0.6	0.370	5.1363
10000.0	14.40	22.28	25.14	6.46	0.65	625.00	100	0.0080	4.9950	0.6	0.389	5.3843
10250.0	14.76	22.84	25.14	6.63	0.68	625.00	100	0.0084	5.2288	0.6	0.409	5.6377
10500.0	15.12	23.40	25.14	6.79	0.72	625.00	100	0.0087	5.4674	0.6	0.429	5.8966
10750.0	15.48	23.95	25.14	6.95	0.75	625.00	100	0.0091	5.7109	0.6	0.450	6.1608
11000.0	15.84	24.51	25.14	7.11	0.79	625.00	100	0.0095	5.9593	0.6	0.471	6.4303
11250.0	16.20	25.07	25.14	7.27	0.82	625.00	100	0.0099	6.2126	0.6	0.493	6.7052
11500.0	16.56	25.62	25.14	7.43	0.86	625.00	100	0.0104	6.4707	0.6	0.515	6.9855
11750.0	16.92	26.18	25.14	7.59	0.90	625.00	100	0.0108	6.7336	0.6	0.537	7.2710
12000.0	17.28	26.74	25.14	7.76	0.93	625.00	100	0.0112	7.0013	0.6	0.561	7.5619
12250.0	17.64	27.30	25.14	7.92	0.97	625.00	100	0.0116	7.2739	0.6	0.584	7.8580
12500.0	18.00	27.85	25.14	8.08	1.01	625.00	100	0.0121	7.5512	0.6	0.608	8.1594
12750.0	18.36	28.41	25.14	8.24	1.05	625.00	100	0.0125	7.8333	0.6	0.633	8.4661
13000.0	18.72	28.97	25.14	8.40	1.10	625.00	100	0.0130	8.1201	0.6	0.658	8.7779
13250.0	19.08	29.52	25.14	8.56	1.14	625.00	100	0.0135	8.4117	0.6	0.683	9.0951
13500.0	19.44	30.08	25.14	8.73	1.18	625.00	100	0.0139	8.7079	0.6	0.709	9.4174
13750.0	19.80	30.64	25.14	8.89	1.23	625.00	100	0.0144	9.0089	0.6	0.736	9.7449
14000.0	20.16	31.19	25.14	9.05	1.27	625.00	100	0.0149	9.3147	0.6	0.763	10.0776
14250.0	20.52	31.75	25.14	9.21	1.32	625.00	100	0.0154	9.6250	0.6	0.790	10.4155
14500.0	20.88	32.31	25.14	9.37	1.36	625.00	100	0.0159	9.9401	0.6	0.818	10.7585
14750.0	21.24	32.87	25.14	9.53	1.41	625.00	100	0.0164	10.2598	0.6	0.847	11.1067
15000.0	21.60	33.42	25.14	9.70	1.46	625.00	100	0.0169	10.5842	0.6	0.876	11.4601
15250.0	21.96	33.98	25.14	9.86	1.51	625.00	100	0.0175	10.9132	0.6	0.905	11.8185
15500.0	22.32	34.54	25.14	10.02	1.56	625.00	100	0.0180	11.2469	0.6	0.935	12.1821
15750.0	22.68	35.09	25.14	10.18	1.61	625.00	100	0.0185	11.5851	0.6	0.966	12.5508
16000.0	23.04	35.65	25.14	10.34	1.66	625.00	100	0.0191	11.9280	0.6	0.997	12.9245

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – B Modified High Point

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FM System Curve – 25.3" (30" HDPE)

Diameter = 25.3 in
Area for = 3.4911 ft^2
RH= 0.5271
C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.30	0.00	0.00	3481	120	0.0000	0.0000	4.125	0.000	0.0000
250.0	0.36	0.56	25.30	0.16	0.00	3481	120	0.0000	0.0208	4.125	0.002	0.0224
500.0	0.72	1.11	25.30	0.32	0.00	3481	120	0.0000	0.0750	4.125	0.007	0.0815
750.0	1.08	1.67	25.30	0.48	0.00	3481	120	0.0000	0.1588	4.125	0.015	0.1735
1000.0	1.44	2.23	25.30	0.64	0.01	3481	120	0.0001	0.2706	4.125	0.026	0.2967
1250.0	1.80	2.79	25.30	0.80	0.01	3481	120	0.0001	0.4090	4.125	0.041	0.4498
1500.0	2.16	3.34	25.30	0.96	0.01	3481	120	0.0002	0.5733	4.125	0.059	0.6321
1750.0	2.52	3.90	25.30	1.12	0.02	3481	120	0.0002	0.7628	4.125	0.080	0.8427
2000.0	2.88	4.46	25.30	1.28	0.03	3481	120	0.0003	0.9768	4.125	0.104	1.0812
2250.0	3.24	5.01	25.30	1.44	0.03	3481	120	0.0003	1.2149	4.125	0.132	1.3470
2500.0	3.60	5.57	25.30	1.60	0.04	3481	120	0.0004	1.4767	4.125	0.163	1.6397
2750.0	3.96	6.13	25.30	1.76	0.05	3481	120	0.0005	1.7617	4.125	0.197	1.9591
3000.0	4.32	6.68	25.30	1.91	0.06	3481	120	0.0006	2.0698	4.125	0.235	2.3046
3250.0	4.68	7.24	25.30	2.07	0.07	3481	120	0.0007	2.4005	4.125	0.276	2.6761
3500.0	5.04	7.80	25.30	2.23	0.08	3481	120	0.0008	2.7537	4.125	0.320	3.0733
3750.0	5.40	8.36	25.30	2.39	0.09	3481	120	0.0009	3.1290	4.125	0.367	3.4959
4000.0	5.76	8.91	25.30	2.55	0.10	3481	120	0.0010	3.5262	4.125	0.417	3.9437
4250.0	6.12	9.47	25.30	2.71	0.11	3481	120	0.0011	3.9452	4.125	0.471	4.4165
4500.0	6.48	10.03	25.30	2.87	0.13	3481	120	0.0013	4.3858	4.125	0.528	4.9141
4750.0	6.84	10.58	25.30	3.03	0.14	3481	120	0.0014	4.8477	4.125	0.589	5.4364
5000.0	7.20	11.14	25.30	3.19	0.16	3481	120	0.0015	5.3308	4.125	0.652	5.9831
5250.0	7.56	11.70	25.30	3.35	0.17	3481	120	0.0017	5.8349	4.125	0.719	6.5540
5500.0	7.92	12.25	25.30	3.51	0.19	3481	120	0.0018	6.3599	4.125	0.789	7.1491
5750.0	8.28	12.81	25.30	3.67	0.21	3481	120	0.0020	6.9056	4.125	0.863	7.7683
6000.0	8.64	13.37	25.30	3.83	0.23	3481	120	0.0021	7.4719	4.125	0.939	8.4112
6250.0	9.00	13.93	25.30	3.99	0.25	3481	120	0.0023	8.0587	4.125	1.019	9.0779
6500.0	9.36	14.48	25.30	4.15	0.27	3481	120	0.0025	8.6659	4.125	1.102	9.7682
6750.0	9.72	15.04	25.30	4.31	0.29	3481	120	0.0027	9.2933	4.125	1.189	10.4820
7000.0	10.08	15.60	25.30	4.47	0.31	3481	120	0.0029	9.9408	4.125	1.278	11.2192
7250.0	10.44	16.15	25.30	4.63	0.33	3481	120	0.0030	10.6082	4.125	1.371	11.9797
7500.0	10.80	16.71	25.30	4.79	0.36	3481	120	0.0032	11.2956	4.125	1.468	12.7633
7750.0	11.16	17.27	25.30	4.95	0.38	3481	120	0.0034	12.0029	4.125	1.567	13.5700
8000.0	11.52	17.83	25.30	5.11	0.40	3481	120	0.0037	12.7298	4.125	1.670	14.3996
8250.0	11.88	18.38	25.30	5.27	0.43	3481	120	0.0039	13.4763	4.125	1.776	15.2521
8500.0	12.24	18.94	25.30	5.42	0.46	3481	120	0.0041	14.2423	4.125	1.885	16.1274
8750.0	12.60	19.50	25.30	5.58	0.48	3481	120	0.0043	15.0278	4.125	1.998	17.0255
9000.0	12.96	20.05	25.30	5.74	0.51	3481	120	0.0045	15.8327	4.125	2.113	17.9461
9250.0	13.32	20.61	25.30	5.90	0.54	3481	120	0.0048	16.6568	4.125	2.232	18.8893
9500.0	13.68	21.17	25.30	6.06	0.57	3481	120	0.0050	17.5002	4.125	2.355	19.8549
9750.0	14.04	21.72	25.30	6.22	0.60	3481	120	0.0053	18.3626	4.125	2.480	20.8429
10000.0	14.40	22.28	25.30	6.38	0.63	3481	120	0.0055	19.2441	4.125	2.609	21.8532
10250.0	14.76	22.84	25.30	6.54	0.66	3481	120	0.0058	20.1446	4.125	2.741	22.8858
10500.0	15.12	23.40	25.30	6.70	0.70	3481	120	0.0061	21.0640	4.125	2.877	23.9405
10750.0	15.48	23.95	25.30	6.86	0.73	3481	120	0.0063	22.0022	4.125	3.015	25.0174
11000.0	15.84	24.51	25.30	7.02	0.77	3481	120	0.0066	22.9592	4.125	3.157	26.1163
11250.0	16.20	25.07	25.30	7.18	0.80	3481	120	0.0069	23.9349	4.125	3.302	27.2371
11500.0	16.56	25.62	25.30	7.34	0.84	3481	120	0.0072	24.9293	4.125	3.451	28.3799
11750.0	16.92	26.18	25.30	7.50	0.87	3481	120	0.0075	25.9423	4.125	3.602	29.5445
12000.0	17.28	26.74	25.30	7.66	0.91	3481	120	0.0077	26.9738	4.125	3.757	30.7309
12250.0	17.64	27.30	25.30	7.82	0.95	3481	120	0.0081	28.0237	4.125	3.915	31.9390
12500.0	18.00	27.85	25.30	7.98	0.99	3481	120	0.0084	29.0921	4.125	4.077	33.1689
12750.0	18.36	28.41	25.30	8.14	1.03	3481	120	0.0087	30.1788	4.125	4.241	34.4203
13000.0	18.72	28.97	25.30	8.30	1.07	3481	120	0.0090	31.2839	4.125	4.409	35.6933

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – B Modified High Point

13250.0	19.08	29.52	25.30	8.46	1.11	3481	120	0.0093	32.4072	4.125	4.581	36.9879
13500.0	19.44	30.08	25.30	8.62	1.15	3481	120	0.0096	33.5487	4.125	4.755	38.3039
13750.0	19.80	30.64	25.30	8.78	1.20	3481	120	0.0100	34.7084	4.125	4.933	39.6413
14000.0	20.16	31.19	25.30	8.94	1.24	3481	120	0.0103	35.8861	4.125	5.114	41.0000
14250.0	20.52	31.75	25.30	9.09	1.28	3481	120	0.0107	37.0820	4.125	5.298	42.3801
14500.0	20.88	32.31	25.30	9.25	1.33	3481	120	0.0110	38.2958	4.125	5.486	43.7815
14750.0	21.24	32.87	25.30	9.41	1.38	3481	120	0.0114	39.5276	4.125	5.676	45.2041
15000.0	21.60	33.42	25.30	9.57	1.42	3481	120	0.0117	40.7773	4.125	5.871	46.6479
15250.0	21.96	33.98	25.30	9.73	1.47	3481	120	0.0121	42.0449	4.125	6.068	48.1128
15500.0	22.32	34.54	25.30	9.89	1.52	3481	120	0.0124	43.3303	4.125	6.268	49.5988
15750.0	22.68	35.09	25.30	10.05	1.57	3481	120	0.0128	44.6335	4.125	6.472	51.1058
16000.0	23.04	35.65	25.30	10.21	1.62	3481	120	0.0132	45.9545	4.125	6.679	52.6339

FM System Curve – 24”

Diameter =	24	in
Area for =	3.1416	ft^2
RH=	0.5	
C=	100	

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	13542.3	100	0.0000	0.0000	3.03	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	13542.3	100	0.0000	0.1464	3.03	0.001	0.1479
500.0	0.72	1.11	24.00	0.35	0.00	13542.3	100	0.0000	0.5285	3.03	0.006	0.5344
750.0	1.08	1.67	24.00	0.53	0.00	13542.3	100	0.0001	1.1198	3.03	0.013	1.1331
1000.0	1.44	2.23	24.00	0.71	0.01	13542.3	100	0.0001	1.9077	3.03	0.024	1.9314
1250.0	1.80	2.79	24.00	0.89	0.01	13542.3	100	0.0002	2.8840	3.03	0.037	2.9210
1500.0	2.16	3.34	24.00	1.06	0.02	13542.3	100	0.0003	4.0424	3.03	0.053	4.0956
1750.0	2.52	3.90	24.00	1.24	0.02	13542.3	100	0.0004	5.3780	3.03	0.072	5.4505
2000.0	2.88	4.46	24.00	1.42	0.03	13542.3	100	0.0005	6.8869	3.03	0.095	6.9816
2250.0	3.24	5.01	24.00	1.60	0.04	13542.3	100	0.0006	8.5656	3.03	0.120	8.6854
2500.0	3.60	5.57	24.00	1.77	0.05	13542.3	100	0.0008	10.4112	3.03	0.148	10.5591
2750.0	3.96	6.13	24.00	1.95	0.06	13542.3	100	0.0009	12.4211	3.03	0.179	12.6001
3000.0	4.32	6.68	24.00	2.13	0.07	13542.3	100	0.0011	14.5930	3.03	0.213	14.8060
3250.0	4.68	7.24	24.00	2.31	0.08	13542.3	100	0.0012	16.9248	3.03	0.250	17.1748
3500.0	5.04	7.80	24.00	2.48	0.10	13542.3	100	0.0014	19.4146	3.03	0.290	19.7046
3750.0	5.40	8.36	24.00	2.66	0.11	13542.3	100	0.0016	22.0608	3.03	0.333	22.3936
4000.0	5.76	8.91	24.00	2.84	0.12	13542.3	100	0.0018	24.8617	3.03	0.379	25.2404
4250.0	6.12	9.47	24.00	3.01	0.14	13542.3	100	0.0021	27.8158	3.03	0.427	28.2433
4500.0	6.48	10.03	24.00	3.19	0.16	13542.3	100	0.0023	30.9218	3.03	0.479	31.4011
4750.0	6.84	10.58	24.00	3.37	0.18	13542.3	100	0.0025	34.1784	3.03	0.534	34.7124
5000.0	7.20	11.14	24.00	3.55	0.20	13542.3	100	0.0028	37.5844	3.03	0.592	38.1761
5250.0	7.56	11.70	24.00	3.72	0.22	13542.3	100	0.0030	41.1387	3.03	0.652	41.7910
5500.0	7.92	12.25	24.00	3.90	0.24	13542.3	100	0.0033	44.8402	3.03	0.716	45.5561
5750.0	8.28	12.81	24.00	4.08	0.26	13542.3	100	0.0036	48.6878	3.03	0.783	49.4703
6000.0	8.64	13.37	24.00	4.26	0.28	13542.3	100	0.0039	52.6807	3.03	0.852	53.5327
6250.0	9.00	13.93	24.00	4.43	0.31	13542.3	100	0.0042	56.8179	3.03	0.925	57.7424
6500.0	9.36	14.48	24.00	4.61	0.33	13542.3	100	0.0045	61.0986	3.03	1.000	62.0985
6750.0	9.72	15.04	24.00	4.79	0.36	13542.3	100	0.0048	65.5218	3.03	1.078	66.6002
7000.0	10.08	15.60	24.00	4.96	0.38	13542.3	100	0.0052	70.0869	3.03	1.160	71.2466
7250.0	10.44	16.15	24.00	5.14	0.41	13542.3	100	0.0055	74.7931	3.03	1.244	76.0371
7500.0	10.80	16.71	24.00	5.32	0.44	13542.3	100	0.0059	79.6396	3.03	1.331	80.9709
7750.0	11.16	17.27	24.00	5.50	0.47	13542.3	100	0.0062	84.6257	3.03	1.422	86.0472
8000.0	11.52	17.83	24.00	5.67	0.50	13542.3	100	0.0066	89.7507	3.03	1.515	91.2655
8250.0	11.88	18.38	24.00	5.85	0.53	13542.3	100	0.0070	95.0141	3.03	1.611	96.6250
8500.0	12.24	18.94	24.00	6.03	0.56	13542.3	100	0.0074	100.4152	3.03	1.710	102.1251
8750.0	12.60	19.50	24.00	6.21	0.60	13542.3	100	0.0078	105.9533	3.03	1.812	107.7653
9000.0	12.96	20.05	24.00	6.38	0.63	13542.3	100	0.0082	111.6278	3.03	1.917	113.5449
9250.0	13.32	20.61	24.00	6.56	0.67	13542.3	100	0.0087	117.4383	3.03	2.025	119.4634
9500.0	13.68	21.17	24.00	6.74	0.70	13542.3	100	0.0091	123.3842	3.03	2.136	125.5202
9750.0	14.04	21.72	24.00	6.92	0.74	13542.3	100	0.0096	129.4649	3.03	2.250	131.7148

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – B Modified High Point

10000.0	14.40	22.28	24.00	7.09	0.78	13542.3	100	0.0100	135.6799	3.03	2.367	138.0466
10250.0	14.76	22.84	24.00	7.27	0.82	13542.3	100	0.0105	142.0287	3.03	2.487	144.5152
10500.0	15.12	23.40	24.00	7.45	0.86	13542.3	100	0.0110	148.5108	3.03	2.609	151.1201
10750.0	15.48	23.95	24.00	7.62	0.90	13542.3	100	0.0115	155.1257	3.03	2.735	157.8608
11000.0	15.84	24.51	24.00	7.80	0.95	13542.3	100	0.0120	161.8731	3.03	2.864	164.7369
11250.0	16.20	25.07	24.00	7.98	0.99	13542.3	100	0.0125	168.7524	3.03	2.995	171.7478
11500.0	16.56	25.62	24.00	8.16	1.03	13542.3	100	0.0130	175.7631	3.03	3.130	178.8932
11750.0	16.92	26.18	24.00	8.33	1.08	13542.3	100	0.0135	182.9050	3.03	3.268	186.1726
12000.0	17.28	26.74	24.00	8.51	1.12	13542.3	100	0.0140	190.1775	3.03	3.408	193.5856
12250.0	17.64	27.30	24.00	8.69	1.17	13542.3	100	0.0146	197.5802	3.03	3.552	201.1318
12500.0	18.00	27.85	24.00	8.87	1.22	13542.3	100	0.0151	205.1128	3.03	3.698	208.8108
12750.0	18.36	28.41	24.00	9.04	1.27	13542.3	100	0.0157	212.7748	3.03	3.847	216.6223
13000.0	18.72	28.97	24.00	9.22	1.32	13542.3	100	0.0163	220.5660	3.03	4.000	224.5658
13250.0	19.08	29.52	24.00	9.40	1.37	13542.3	100	0.0169	228.4858	3.03	4.155	232.6409
13500.0	19.44	30.08	24.00	9.57	1.42	13542.3	100	0.0175	236.5340	3.03	4.313	240.8474
13750.0	19.80	30.64	24.00	9.75	1.48	13542.3	100	0.0181	244.7102	3.03	4.475	249.1848
14000.0	20.16	31.19	24.00	9.93	1.53	13542.3	100	0.0187	253.0140	3.03	4.639	257.6528
14250.0	20.52	31.75	24.00	10.11	1.59	13542.3	100	0.0193	261.4451	3.03	4.806	266.2511
14500.0	20.88	32.31	24.00	10.28	1.64	13542.3	100	0.0199	270.0032	3.03	4.976	274.9793
14750.0	21.24	32.87	24.00	10.46	1.70	13542.3	100	0.0206	278.6880	3.03	5.149	283.8371
15000.0	21.60	33.42	24.00	10.64	1.76	13542.3	100	0.0212	287.4991	3.03	5.325	292.8242
15250.0	21.96	33.98	24.00	10.82	1.82	13542.3	100	0.0219	296.4361	3.03	5.504	301.9403
15500.0	22.32	34.54	24.00	10.99	1.88	13542.3	100	0.0226	305.4989	3.03	5.686	311.1850
15750.0	22.68	35.09	24.00	11.17	1.94	13542.3	100	0.0232	314.6871	3.03	5.871	320.5582
16000.0	23.04	35.65	24.00	11.35	2.00	13542.3	100	0.0239	324.0005	3.03	6.059	330.0593

Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – B Modified High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	0.27
500.0	0.72	0.97
750.0	1.08	2.07
1000.0	1.44	3.53
1250.0	1.80	5.34
1500.0	2.16	7.50
1750.0	2.52	9.98
2000.0	2.88	12.80
2250.0	3.24	15.93
2500.0	3.60	19.37
2750.0	3.96	23.13
3000.0	4.32	27.19
3250.0	4.68	31.55
3500.0	5.04	36.21
3750.0	5.40	41.17
4000.0	5.76	46.42
4250.0	6.12	51.95
4500.0	6.48	57.78
4750.0	6.84	63.89
5000.0	7.20	70.28
5250.0	7.56	76.96
5500.0	7.92	83.91
5750.0	8.28	91.14
6000.0	8.64	98.65
6250.0	9.00	106.43
6500.0	9.36	114.48
6750.0	9.72	122.81
7000.0	10.08	131.40
7250.0	10.44	140.26
7500.0	10.80	149.39
7750.0	11.16	158.78
8000.0	11.52	168.44
8250.0	11.88	178.36
8500.0	12.24	188.55
8750.0	12.60	198.99
9000.0	12.96	209.70
9250.0	13.32	220.66
9500.0	13.68	231.88
9750.0	14.04	243.36
10000.0	14.40	255.10
10250.0	14.76	267.09
10500.0	15.12	279.33
10750.0	15.48	291.83
11000.0	15.84	304.58
11250.0	16.20	317.59
11500.0	16.56	330.84
11750.0	16.92	344.35
12000.0	17.28	358.10
12250.0	17.64	372.10
12500.0	18.00	386.36
12750.0	18.36	400.85
13000.0	18.72	415.60
13250.0	19.08	430.59
13500.0	19.44	445.83
13750.0	19.80	461.31
14000.0	20.16	477.04
14250.0	20.52	493.01
14500.0	20.88	509.23
14750.0	21.24	525.68
15000.0	21.60	542.38
15250.0	21.96	559.32
15500.0	22.32	576.50
15750.0	22.68	593.92
16000.0	23.04	611.59

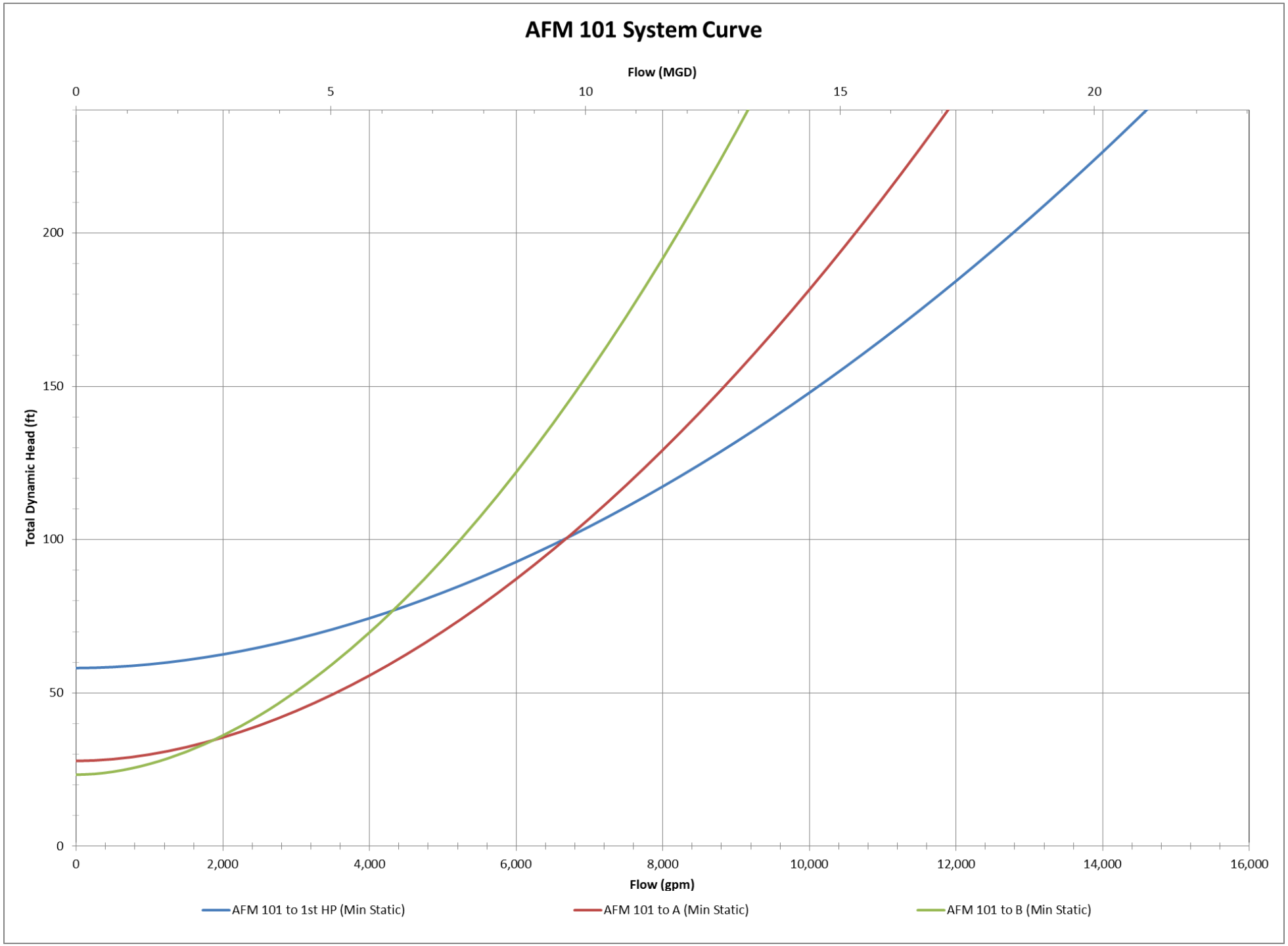
Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	23.35	27.85
250.0	0.36	23.62	28.12
500.0	0.72	24.32	28.82
750.0	1.08	25.42	29.92
1000.0	1.44	26.88	31.38
1250.0	1.80	28.69	33.19
1500.0	2.16	30.85	35.35
1750.0	2.52	33.33	37.83
2000.0	2.88	36.15	40.65
2250.0	3.24	39.28	43.78
2500.0	3.60	42.72	47.22
2750.0	3.96	46.48	50.98
3000.0	4.32	50.54	55.04
3250.0	4.68	54.90	59.40
3500.0	5.04	59.56	64.06
3750.0	5.40	64.52	69.02
4000.0	5.76	69.77	74.27
4250.0	6.12	75.30	79.80
4500.0	6.48	81.13	85.63
4750.0	6.84	87.24	91.74
5000.0	7.20	93.63	98.13
5250.0	7.56	100.31	104.81
5500.0	7.92	107.26	111.76
5750.0	8.28	114.49	118.99
6000.0	8.64	122.00	126.50
6250.0	9.00	129.78	134.28
6500.0	9.36	137.83	142.33
6750.0	9.72	146.16	150.66
7000.0	10.08	154.75	159.25
7250.0	10.44	163.61	168.11
7500.0	10.80	172.74	177.24
7750.0	11.16	182.13	186.63
8000.0	11.52	191.79	196.29
8250.0	11.88	201.71	206.21
8500.0	12.24	211.90	216.40
8750.0	12.60	222.34	226.84
9000.0	12.96	233.05	237.55
9250.0	13.32	244.01	248.51
9500.0	13.68	255.23	259.73
9750.0	14.04	266.71	271.21
10000.0	14.40	278.45	282.95
10250.0	14.76	290.44	294.94
10500.0	15.12	302.68	307.18
10750.0	15.48	315.18	319.68
11000.0	15.84	327.93	332.43
11250.0	16.20	340.94	345.44
11500.0	16.56	354.19	358.69
11750.0	16.92	367.70	372.20
12000.0	17.28	381.45	385.95
12250.0	17.64	395.45	399.95
12500.0	18.00	409.71	414.21
12750.0	18.36	424.20	428.70
13000.0	18.72	438.95	443.45
13250.0	19.08	453.94	458.44
13500.0	19.44	469.18	473.68
13750.0	19.80	484.66	489.16
14000.0	20.16	500.39	504.89
14250.0	20.52	516.36	520.86
14500.0	20.88	532.58	537.08
14750.0	21.24	549.03	553.53
15000.0	21.60	565.73	570.23
15250.0	21.96	582.67	587.17
15500.0	22.32	599.85	604.35
15750.0	22.68	617.27	621.77
16000.0	23.04	634.94	639.44

MIN Static Head = 23.35
MAX Static Head = 27.85

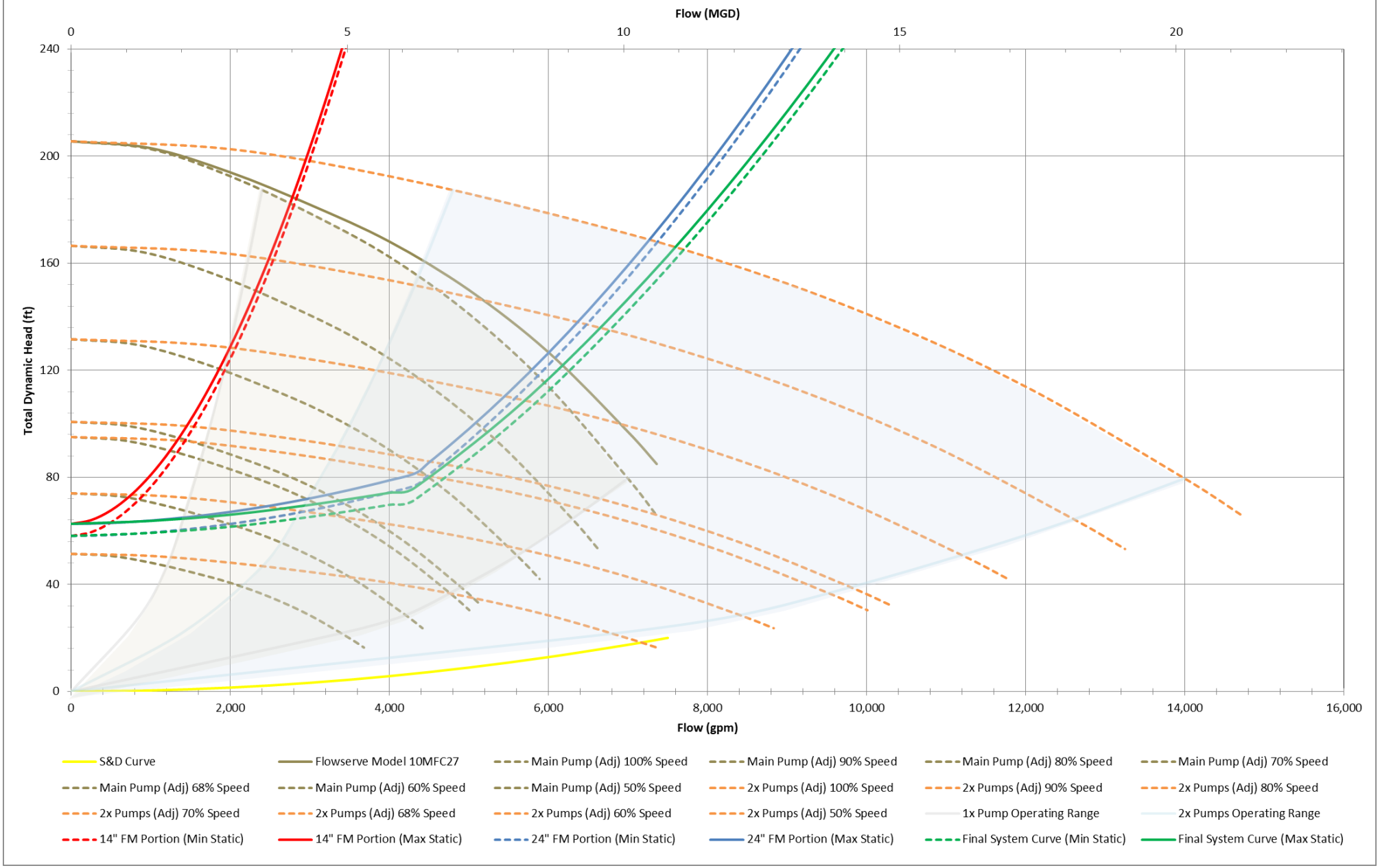
Bridgehead Pump Station with AFM101

24-inch Parallel Forcemain Portion Only – Final Curve

Q (gpm)	Q (mgd)	Min Static	Max Static
0	0	58.13	62.63
250	0.36	58.22	62.72
500	0.72	58.47	62.97
750	1.08	58.85	63.35
1000	1.44	59.36	63.86
1250	1.8	59.99	64.49
1500	2.16	60.74	65.24
1750	2.52	61.61	66.11
2000	2.88	62.60	67.10
2250	3.24	63.69	68.19
2500	3.6	64.90	69.40
2750	3.96	66.21	70.71
3000	4.32	67.64	72.14
3250	4.68	69.17	73.67
3500	5.04	70.80	75.30
3750	5.4	72.54	77.04
4000	5.76	74.39	78.89
4325	6.228	77.02	81.52
4500	6.48	81.13	85.63
4750	6.84	87.24	91.74
5000	7.2	93.63	98.13
5250	7.56	100.31	104.81
5500	7.92	107.26	111.76
5750	8.28	114.49	118.99
6000	8.64	122.00	126.50
6250	9	129.78	134.28
6500	9.36	137.83	142.33
6750	9.72	146.16	150.66
7000	10.08	154.75	159.25
7250	10.44	163.61	168.11
7500	10.8	172.74	177.24
7750	11.16	182.13	186.63
8000	11.52	191.79	196.29
8250	11.88	201.71	206.21
8500	12.24	211.90	216.40
8750	12.6	222.34	226.84
9000	12.96	233.05	237.55
9250	13.32	244.01	248.51
9500	13.68	255.23	259.73
9750	14.04	266.71	271.21
10000	14.4	278.45	282.95
10250	14.76	290.44	294.94
10500	15.12	302.68	307.18
10750	15.48	315.18	319.68
11000	15.84	327.93	332.43
11250	16.2	340.94	345.44
11500	16.56	354.19	358.69
11750	16.92	367.70	372.20
12000	17.28	381.45	385.95
12250	17.64	395.45	399.95
12500	18	409.71	414.21
12750	18.36	424.20	428.70
13000	18.72	438.95	443.45
13250	19.08	453.94	458.44
13500	19.44	469.18	473.68
13750	19.8	484.66	489.16
14000	20.16	500.39	504.89
14250	20.52	516.36	520.86
14500	20.88	532.58	537.08
14750	21.24	549.03	553.53
15000	21.6	565.73	570.23
15250	21.96	582.67	587.17
15500	22.32	599.85	604.35
15750	22.68	617.27	621.77
16000	23.04	634.94	639.44


AFM 101 System Curve
Flow (MGD)
0
5
10
15
20
Total Dynamic Head (ft)
0
50
100
150
200
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
Flow (gpm)
AFM 101 to 1st HP (Min Static)
AFM 101 to A (Min Static)
AFM 101 to B (Min Static)

Bridgehead Main PS Pump and System Curves w/ AFM 101 to WWTP



V.W. HOUSEN
& ASSOCIATES

Appendix C. APS w/ AFM102: New Pump and Hydraulic Information

V.W. HOUSEN
& ASSOCIATES

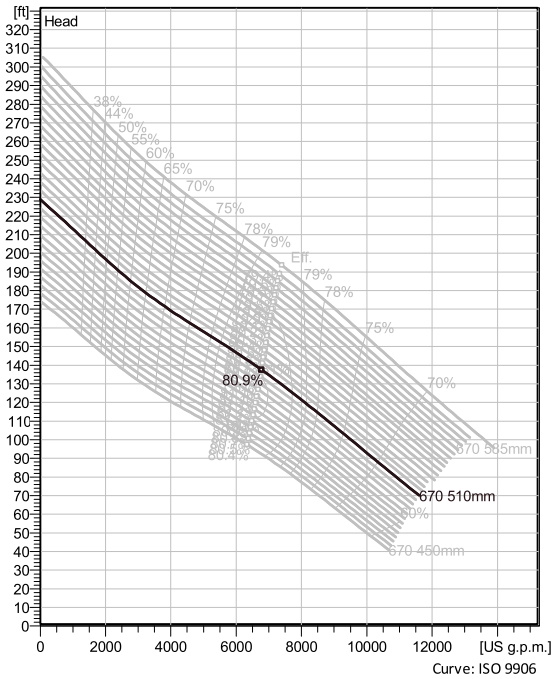
APS w/ AFM102: New Equal Sized Flygt Pump Information

NT 3312/836 3~ 670

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Possible to be upgraded with Guide-pin® for even better clogging resistance. Modular based design with high adaptation grade.

Technical specification

Curves according to: Water, pure ,39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



Curve: ISO 9906

Configuration

Motor number
N0836.000 54-52-6ID-D IE3 385hp

Installation type
T - Vertical Permanent, Dry

Impeller diameter
510 mm

Discharge diameter
300 inch

Pump information

Impeller diameter
510 mm

Discharge diameter
300 inch

Inlet diameter
350 mm

Maximum operating speed
1195 rpm

Number of blades
3

Max. fluid temperature
40 °C

Materials

Impeller
Hard-Iron ™

Project		**Created by**	David Troyer
Block		**Created on**	3/31/2021 **Last update** 3/31/2021

NT 3312/836 3~ 670

Technical specification

Motor - General

Motor number N0836.000 54-52-6ID-D IE3 385hp	**Phases** 3~	**Rated speed** 1195 rpm	**Rated power** 385 hp
ATEX approved No	**Number of poles** 6	**Rated current** 445 A	**Stator variant** 1
Frequency 60 Hz	**Rated voltage** 460 V	**Insulation class** H	**Type of Duty**
Version code 000			

Motor - Technical

Power factor - 1/1 Load 0.84	**Motor efficiency - 1/1 Load** 96.2 %	**Total moment of inertia** 211 lb ft²	**Starts per hour max.** 0
Power factor - 3/4 Load 0.80	**Motor efficiency - 3/4 Load** 96.6 %	**Starting current, direct starting** 3290 A	
Power factor - 1/2 Load 0.69	**Motor efficiency - 1/2 Load** 96.5 %	**Starting current, star-delta** 1100 A	

Project	**Created by**	David Troyer	
Block	**Created on**	3/31/2021	**Last update** 3/31/2021

PERFORMANCE CURVE

DATE	PROJECT:	ISSUE	PROD
2021-05-10		73	N3312/836

NO. OF BLADES.....	3	TOT.MOM.OF INERTIA.....	8.78	KGM ^{2}	POLES 6	FREQ. 60	HZ
		RATED SPEED.....	1195	RPM	VOLTAGE.....	460	V
					MOTOR SHAFT POWER.....	385hp / 287	kW
					STARTING TORQUE.....	2820	NM
					MAX TORQUE.....	6965	NM
					RATED CURRENT.....	445	A
					STARTING CURRENT.....	3295	A

	1/1-LOAD	3/4-LOAD	1/2-LOAD
MOTOR COS PHI	0.84	0.80	0.69
MOTOR EFFICIENCY	96.2%	96.6%	96.5%
GEAR EFFICIENCY			

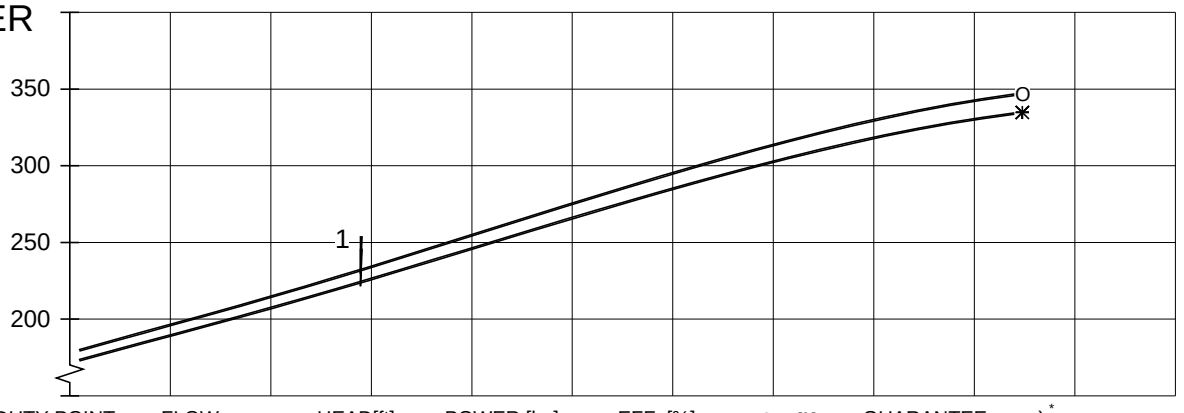
CURVE NO 63- 670

IMPELLER DIAMETER 515 mm

MOTOR TYPE 54-52-6ID /01 (11)

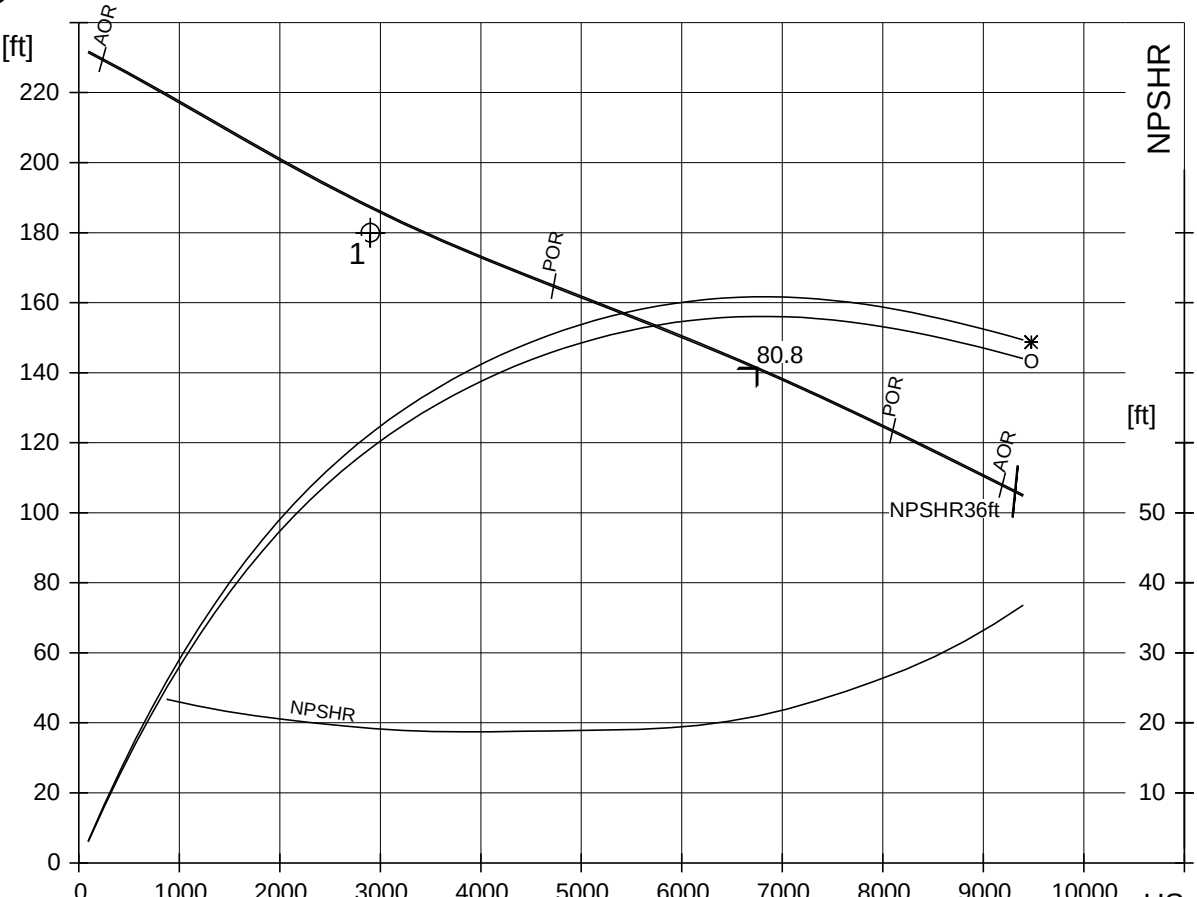
GEAR TYPE RATIO

POWER [hp]



DUTY POINTs :	FLOW[USgpm]	HEAD[ft]	POWER [hp]	EFF. [%]	NPSHR[ft]	GUARANTEE	) * -> No guarantee
	2900	180.0	(< 242) (<234) *	60.1 (62.2) *	19.6	HI grade 2U eff.	(ANSI/HI 11.6:2012)

HEAD (H) [ft]



NOTE:

CURVES SHOW PERFORMANCE WITH CLEAR COLD WATER.

* : PUMP EFFICIENCY / SHAFT POWER

O : OVERALL EFFICIENCY / INPUT POWER

NPSHR = NPSH3 + min. operational margin

unix AUTHOR: fus116 PECU rev:21.14 /CUPC

USA

PERFORMANCE CURVE

FLYGT

PERFORMANCE FIELD
FREQUENCY VARIATION

PROD
N 3312/836

CURVE NO
63- 670

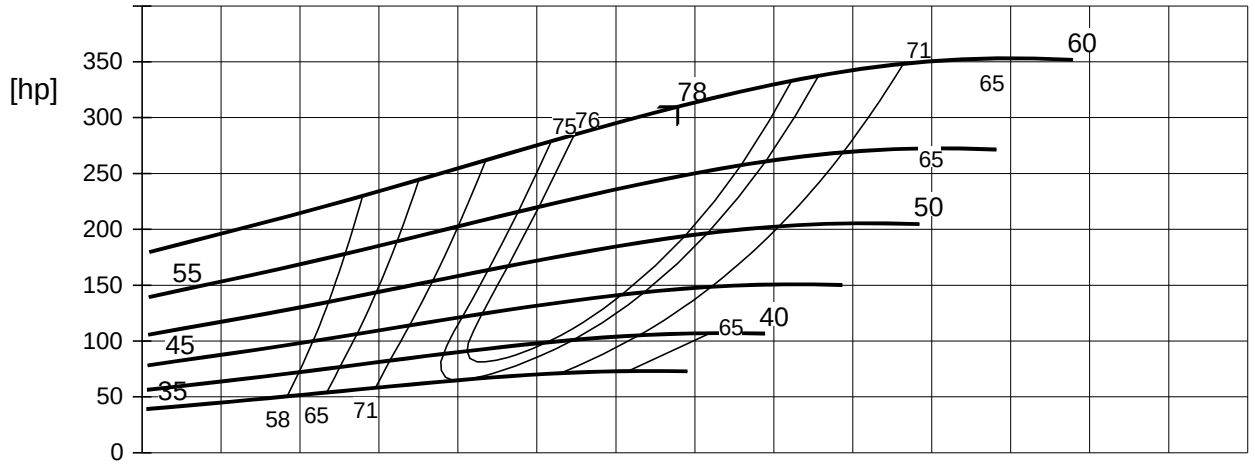
DATE	ISSUE	FREQ.	NOMINAL HYDRAULIC-END SPEED
2021-05-10	73	60 HZ	-

IMPELLER PART	PUMPHOUSING PART	INLET/OUTLET		NO. OF BLADES	IMPELLER DIAMETER
701 52 00		350/300		3	515 mm

DRIVE UNIT	MOTOR	POLES	RATED POWER	RATED SPEED RPM
836	54-52-6ID /01	6	385 HP /287 kW	1195

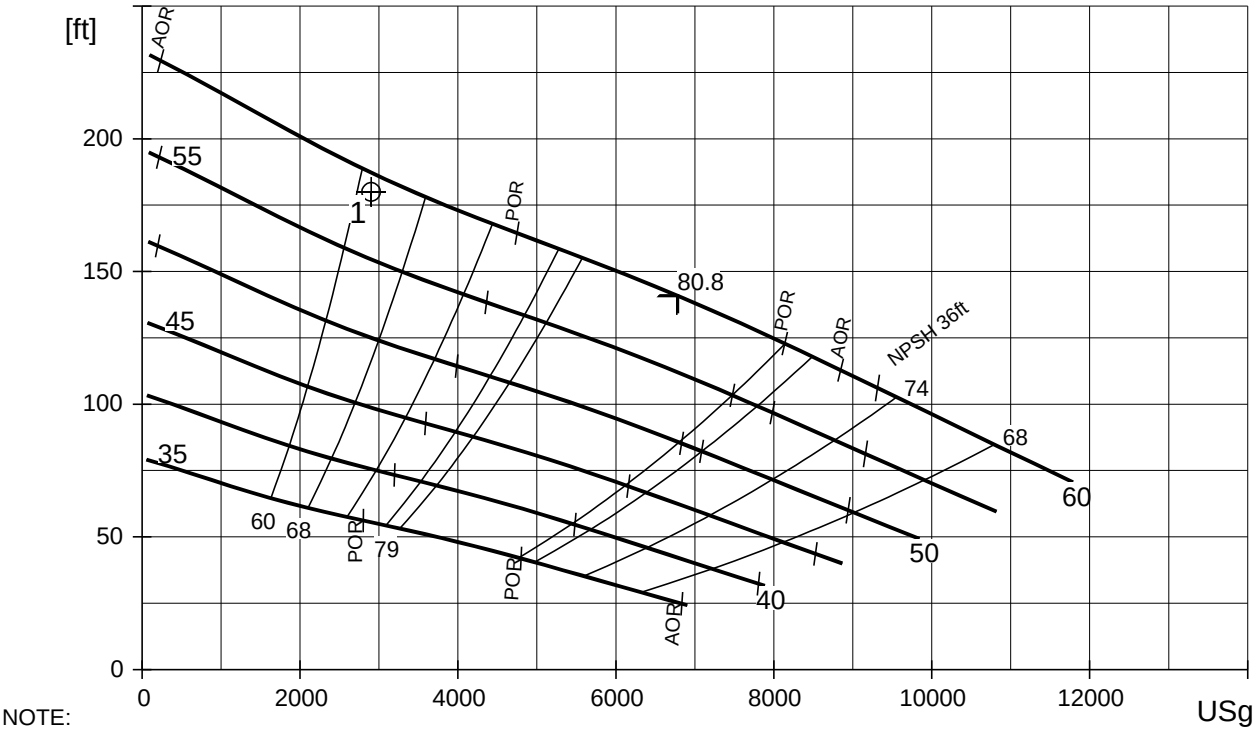
POWER (ELECTRIC)

ISO-CURVES : OVERALL EFFICIENCY [%]



HEAD

ISO-CURVES : (———) PUMP EFFICIENCY [%]

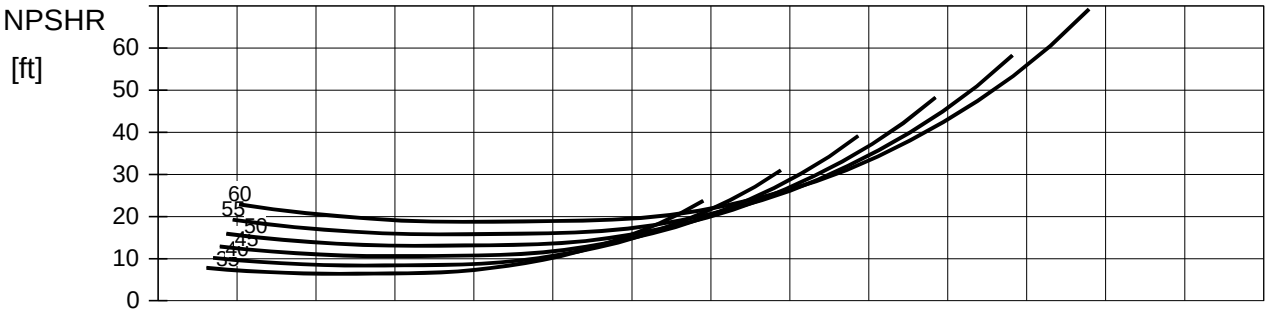


NOTE:
CURVES SHOW PERFORMANCE WITH CLEAR COLD WATER.

FLOW

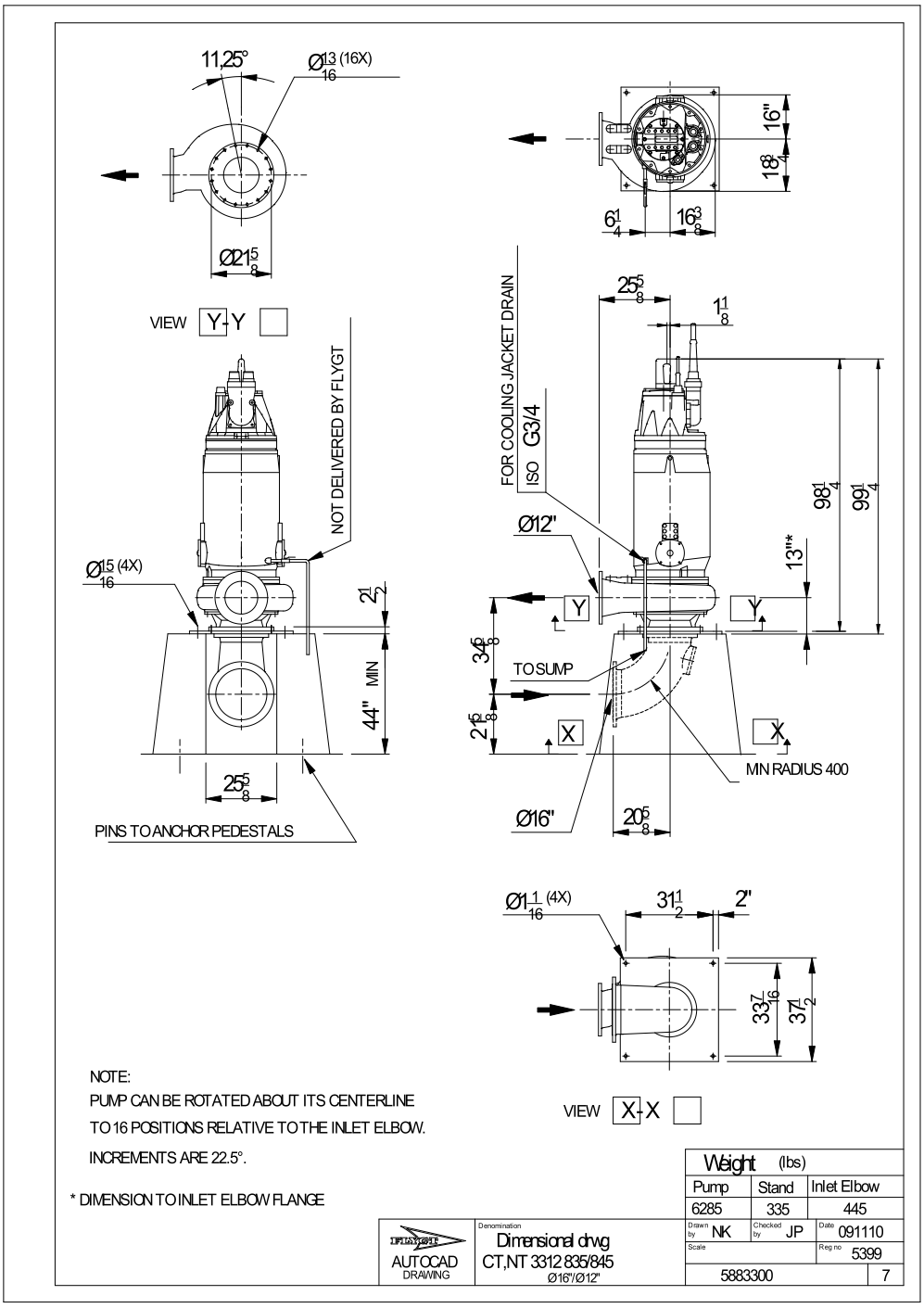
NPSHR = NPSH3 + min. operational margin

NPSHR
[ft]



NT 3312/836 3~ 670

Dimensional drawing



Project		**Created by**	David Troyer
Block		**Created on**	3/31/2021 **Last update** 3/31/2021

V.W. HOUSEN
& ASSOCIATES

APS w/ AFM102: Hydraulic Calculations

Antioch Pump Station with AFM102

Pump and Suction and Discharge Loss Curves – APS Equal Sized Pumps with AFM102

Suction @ 16”

Diameter = 16 in
Area for = 1.396263 ft^2
RH= 0.333333
C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x $(v^2/2g)$	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	16.00	0.00	0.00	1.00	120	0.0000	0.0000	0.04	0.000	0.0000
241.4	0.35	0.54	16.00	0.39	0.00	1.00	120	0.0001	0.0001	0.04	0.000	0.0001
1000.0	1.44	2.23	16.00	1.60	0.04	1.00	120	0.0007	0.0007	0.04	0.002	0.0023
2000.0	2.88	4.46	16.00	3.19	0.16	1.00	120	0.0026	0.0026	0.04	0.006	0.0089
3000.0	4.32	6.68	16.00	4.79	0.36	1.00	120	0.0055	0.0055	0.04	0.014	0.0198
4000.0	5.76	8.91	16.00	6.38	0.63	1.00	120	0.0094	0.0094	0.04	0.025	0.0347
5000.0	7.20	11.14	16.00	7.98	0.99	1.00	120	0.0143	0.0143	0.04	0.040	0.0538
6000.0	8.64	13.37	16.00	9.57	1.42	1.00	120	0.0200	0.0200	0.04	0.057	0.0769
7000.0	10.08	15.60	16.00	11.17	1.94	1.00	120	0.0266	0.0266	0.04	0.078	0.1041
8000.0	11.52	17.83	16.00	12.77	2.53	1.00	120	0.0341	0.0341	0.04	0.101	0.1353
9206.9	13.26	20.51	16.00	14.69	3.35	1.00	120	0.0442	0.0442	0.04	0.134	0.1783

Suction @ 18"

Diameter = 18 in
Area = 1.767146 ft^2
RH= 0.375
C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x $(v^2/2g)$	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	18.00	0.00	0.00	6.50	120	0.0000	0.0000	1.09	0.000	0.0000
241.4	0.35	0.54	18.00	0.39	0.00	6.50	120	0.0001	0.0003	1.09	0.003	0.0028
1000.0	1.44	2.23	18.00	1.60	0.04	6.50	120	0.0007	0.0047	1.09	0.043	0.0478
2000.0	2.88	4.46	18.00	3.19	0.16	6.50	120	0.0026	0.0170	1.09	0.172	0.1894
3000.0	4.32	6.68	18.00	4.79	0.36	6.50	120	0.0055	0.0360	1.09	0.388	0.4239
4000.0	5.76	8.91	18.00	6.38	0.63	6.50	120	0.0094	0.0613	1.09	0.690	0.7510
5000.0	7.20	11.14	18.00	7.98	0.99	6.50	120	0.0143	0.0927	1.09	1.078	1.1703
6000.0	8.64	13.37	18.00	9.57	1.42	6.50	120	0.0200	0.1300	1.09	1.552	1.6817
7000.0	10.08	15.60	18.00	11.17	1.94	6.50	120	0.0266	0.1729	1.09	2.112	2.2850
8000.0	11.52	17.83	18.00	12.77	2.53	6.50	120	0.0341	0.2215	1.09	2.759	2.9800
9206.9	13.26	20.51	18.00	14.69	3.35	6.50	120	0.0442	0.2873	1.09	3.654	3.9409

Suction @ 16"

Diameter = 16 in
Area = 1.396263 ft^2
RH= 0.333333
C= 120

Antioch Pump Station with AFM102

Pump and Suction and Discharge Loss Curves – APS Equal Sized Pumps with AFM102

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x $(v^2/2g)$	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	16.00	0.00	0.00	18.00	120	0.0000	0.0000	4.42	0.000	0.0000
241.4	0.35	0.54	16.00	0.39	0.00	18.00	120	0.0001	0.0009	4.42	0.010	0.0111
1000.0	1.44	2.23	16.00	1.60	0.04	18.00	120	0.0007	0.0130	4.42	0.175	0.1878
2000.0	2.88	4.46	16.00	3.19	0.16	18.00	120	0.0026	0.0471	4.42	0.699	0.7462
3000.0	4.32	6.68	16.00	4.79	0.36	18.00	120	0.0055	0.0997	4.42	1.573	1.6728
4000.0	5.76	8.91	16.00	6.38	0.63	18.00	120	0.0094	0.1699	4.42	2.797	2.9664
5000.0	7.20	11.14	16.00	7.98	0.99	18.00	120	0.0143	0.2568	4.42	4.370	4.6264
6000.0	8.64	13.37	16.00	9.57	1.42	18.00	120	0.0200	0.3600	4.42	6.292	6.6521
7000.0	10.08	15.60	16.00	11.17	1.94	18.00	120	0.0266	0.4789	4.42	8.564	9.0432
8000.0	11.52	17.83	16.00	12.77	2.53	18.00	120	0.0341	0.6133	4.42	11.186	11.7993
9206.9	13.26	20.51	16.00	14.69	3.35	18.00	120	0.0442	0.7956	4.42	14.816	15.6113

Pump Suction and Discharge Losses

Q (gpm)	Q (mgd)	Total Losses S&D (ft)
0.0	0.00	0.0000
241.4	0.35	0.0141
1000.0	1.44	0.2379
2000.0	2.88	0.9445
3000.0	4.32	2.1165
4000.0	5.76	3.7521
5000.0	7.20	5.8505
6000.0	8.64	8.4107
7000.0	10.08	11.4323
8000.0	11.52	14.9146
9206.9	13.26	19.7305

Antioch Pump Station with AFM102

Pump and Suction and Discharge Loss Curves – APS Equal Sized Pumps with AFM102

Pumps – Flygt NT3312/836 (515 mm) 385 Hp

Mfr Pump Curve

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
0	0.00	232.94
241	0.35	229.41
1000	1.44	216.47
2000	2.88	201.18
3000	4.32	185.88
4000	5.76	172.94
5000	7.20	161.76
6000	8.64	150.00
7000	10.08	137.65
8000	11.52	124.71
9207	13.26	108.24

S&D Losses S&D
(ft)
0.0000
0.0141
0.2379
0.9445
2.1165
3.7521
5.8505
8.4107
11.4323
14.9146
19.7305

Adjusted Pump Curves

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	232.9
241	0.35	229.4
1000	1.44	216.2
2000	2.88	200.2
3000	4.32	183.8
4000	5.76	169.2
5000	7.20	155.9
6000	8.64	141.6
7000	10.08	126.2
8000	11.52	109.8
9207	13.26	88.5

1 Equal Pump

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	232.9
483	0.70	229.4
2000	2.88	216.2
4000	5.76	200.2
6000	8.64	183.8
8000	11.52	169.2
10000	14.40	155.9
12000	17.28	141.6
14000	20.16	126.2
16000	23.04	109.8
18414	26.52	88.5

2 Equal Pumps

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	232.9
724	1.04	229.4
3000	4.32	216.2
6000	8.64	200.2
9000	12.96	183.8
12000	17.28	169.2
15000	21.60	155.9
18000	25.92	141.6
21000	30.24	126.2
24000	34.56	109.8
27621	39.77	88.5

3 Equal Pumps

Reduced Speed Curves @ 90%

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
0	0.00	188.6814
217.242	0.31	185.8221
900	1.30	175.3407
1800	2.59	162.9558
2700	3.89	150.5628
3600	5.18	140.0814
4500	6.48	131.0256
5400	7.78	121.5
6300	9.07	111.4965
7200	10.37	101.0151
8286.21	11.93	87.6744

S&D Losses S&D
(ft)
0.0000
0.0123
0.1930
0.7659
1.7161
3.0423
4.7435
6.8192
9.2688
12.0919
15.6283

Adjusted Pump Curves

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	188.7
217	0.31	185.8
900	1.30	175.1
1800	2.59	162.2
2700	3.89	148.8
3600	5.18	137.0
4500	6.48	126.3
5400	7.78	114.7
6300	9.07	102.2
7200	10.37	88.9
8286	11.93	72.0

1 Equal Pump

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	188.7
434	0.63	185.8
1800	2.59	175.1
3600	5.18	162.2
5400	7.78	148.8
7200	10.37	137.0
9000	12.96	126.3
10800	15.55	114.7
12600	18.14	102.2
14400	20.74	88.9
16572	23.86	72.0

2 Equal Pumps

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	188.7
652	0.94	185.8
2700	3.89	175.1
5400	7.78	162.2
8100	11.66	148.8
10800	15.55	137.0
13500	19.44	126.3
16200	23.33	114.7
18900	27.22	102.2
21600	31.10	88.9
24859	35.80	72.0

3 Equal Pumps

Reduced Speed Curves @ 80%

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
0	0.00	149.0816
193	0.28	146.8224
800	1.15	138.5408
1600	2.30	128.7552
2400	3.46	118.9632
3200	4.61	110.6816
4000	5.76	103.5264
4800	6.91	96
5600	8.06	88.096
6400	9.22	79.8144
7366	10.61	69.2736

S&D Losses S&D
(ft)
0.0000
0.0097
0.1527
0.6059
1.3576
2.4065
3.7521
5.3938
7.3313
9.5640
12.3609

Adjusted Pump Curves

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	149.1
193	0.28	146.8
800	1.15	138.4
1600	2.30	128.1
2400	3.46	117.6
3200	4.61	108.3
4000	5.76	99.8
4800	6.91	90.6
5600	8.06	80.8
6400	9.22	70.3
7366	10.61	56.9

1 Equal Pump

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	149.1
386	0.56	146.8
1600	2.30	138.4
3200	4.61	128.1
4800	6.91	117.6
6400	9.22	108.3
8000	11.52	99.8
9600	13.82	90.6
11200	16.13	80.8
12800	18.43	70.3
14731	21.21	56.9

2 Equal Pumps

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	149.1
579	0.83	146.8
2400	3.46	138.4
4800	6.91	128.1
7200	10.37	117.6
9600	13.82	108.3
12000	17.28	99.8
14400	20.74	90.6
16800	24.19	80.8
19200	27.65	70.3
22097	31.82	56.9

3 Equal Pumps

Reduced Speed Curves @ 70%

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
0	0.00	114.1406
169	0.24	112.4109

S&D Losses S&D
(ft)
0.0000
0.0075

Adjusted Pump Curves

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	114.1
169	0.24	112.4

1 Equal Pump

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	114.1
338	0.49	112.4

2 Equal Pumps

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	114.1
507	0.73	112.4

3 Equal Pumps

Antioch Pump Station with AFM102

Pump and Suction and Discharge Loss Curves – APS Equal Sized Pumps with AFM102

700	1.01	106.0703	0.1171	700	1.01	106.0	1400	2.02	106.0	2100	3.02	106.0
1400	2.02	98.5782	0.4646	1400	2.02	98.1	2800	4.03	98.1	4200	6.05	98.1
2100	3.02	91.0812	1.0408	2100	3.02	90.0	4200	6.05	90.0	6300	9.07	90.0
2800	4.03	84.7406	1.8449	2800	4.03	82.9	5600	8.06	82.9	8400	12.10	82.9
3500	5.04	79.2624	2.8764	3500	5.04	76.4	7000	10.08	76.4	10500	15.12	76.4
4200	6.05	73.5	4.1348	4200	6.05	69.4	8400	12.10	69.4	12600	18.14	69.4
4900	7.06	67.4485	5.6199	4900	7.06	61.8	9800	14.11	61.8	14700	21.17	61.8
5600	8.06	61.1079	7.3313	5600	8.06	53.8	11200	16.13	53.8	16800	24.19	53.8
6445	9.28	53.0376	9.4750	6445	9.28	43.6	12890	18.56	43.6	19334	27.84	43.6

Reduced Speed Curves @ 60%

				Adjusted Pump Curves		1 Equal Pump			2 Equal Pumps			3 Equal Pumps
Q	Q	Mfr Curve Head	S&D Losses S&D	Q	Q	ADJ Curve Head	Q	Q	ADJ Curve Head	Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)	(ft)	(gpm)	(mgd)	(ft)	(gpm)	(mgd)	(ft)	(gpm)	(mgd)	(ft)
0	0.00	83.8584	0.0000	0	0.00	83.9	0	0.00	83.9	0	0.00	83.9
145	0.21	82.5876	0.0055	145	0.21	82.6	290	0.42	82.6	434	0.63	82.6
600	0.86	77.9292	0.0862	600	0.86	77.8	1200	1.73	77.8	1800	2.59	77.8
1200	1.73	72.4248	0.3419	1200	1.73	72.1	2400	3.46	72.1	3600	5.18	72.1
1800	2.59	66.9168	0.7659	1800	2.59	66.2	3600	5.18	66.2	5400	7.78	66.2
2400	3.46	62.2584	1.3576	2400	3.46	60.9	4800	6.91	60.9	7200	10.37	60.9
3000	4.32	58.2336	2.1165	3000	4.32	56.1	6000	8.64	56.1	9000	12.96	56.1
3600	5.18	54	3.0423	3600	5.18	51.0	7200	10.37	51.0	10800	15.55	51.0
4200	6.05	49.554	4.1348	4200	6.05	45.4	8400	12.10	45.4	12600	18.14	45.4
4800	6.91	44.8956	5.3938	4800	6.91	39.5	9600	13.82	39.5	14400	20.74	39.5
5524	7.95	38.9664	6.9709	5524	7.95	32.0	11048	15.91	32.0	16572	23.86	32.0

Reduced Speed Curves @ 50%

				Adjusted Pump Curves		1 Equal Pump			2 Equal Pumps			3 Equal Pumps
Q	Q	Mfr Curve Head	S&D Losses S&D	Q	Q	ADJ Curve Head	Q	Q	ADJ Curve Head	Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)	(ft)	(gpm)	(mgd)	(ft)	(gpm)	(mgd)	(ft)	(gpm)	(mgd)	(ft)
0	0.00	58.235	0.0000	0	0.00	58.2	0	0.00	58.2	0	0.00	58.2
121	0.17	57.3525	0.0038	121	0.17	57.3	241	0.35	57.3	362	0.52	57.3
500	0.72	54.1175	0.0600	500	0.72	54.1	1000	1.44	54.1	1500	2.16	54.1
1000	1.44	50.295	0.2379	1000	1.44	50.1	2000	2.88	50.1	3000	4.32	50.1
1500	2.16	46.47	0.5329	1500	2.16	45.9	3000	4.32	45.9	4500	6.48	45.9
2000	2.88	43.235	0.9445	2000	2.88	42.3	4000	5.76	42.3	6000	8.64	42.3
2500	3.60	40.44	1.4724	2500	3.60	39.0	5000	7.20	39.0	7500	10.80	39.0
3000	4.32	37.5	2.1165	3000	4.32	35.4	6000	8.64	35.4	9000	12.96	35.4
3500	5.04	34.4125	2.8764	3500	5.04	31.5	7000	10.08	31.5	10500	15.12	31.5
4000	5.76	31.1775	3.7521	4000	5.76	27.4	8000	11.52	27.4	12000	17.28	27.4
4603	6.63	27.06	4.8490	4603	6.63	22.2	9207	13.26	22.2	13810	19.89	22.2

Reduced Speed Curves @ 40%

				Adjusted Pump Curves		1 Equal Pump			2 Equal Pumps			3 Equal Pumps
Q	Q	Mfr Curve Head	S&D Losses S&D	Q	Q	ADJ Curve Head	Q	Q	ADJ Curve Head	Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)	(ft)	(gpm)	(mgd)	(ft)	(gpm)	(mgd)	(ft)	(gpm)	(mgd)	(ft)
0	0.00	37.2704	0.0000	0	0.00	37.3	0	0.00	37.3	0	0.00	37.3
97	0.14	36.7056	0.0025	97	0.14	36.7	193	0.28	36.7	290	0.42	36.7
400	0.58	34.6352	0.0385	400	0.58	34.6	800	1.15	34.6	1200	1.73	34.6
800	1.15	32.1888	0.1527	800	1.15	32.0	1600	2.30	32.0	2400	3.46	32.0
1200	1.73	29.7408	0.3419	1200	1.73	29.4	2400	3.46	29.4	3600	5.18	29.4
1600	2.30	27.6704	0.6059	1600	2.30	27.1	3200	4.61	27.1	4800	6.91	27.1
2000	2.88	25.8816	0.9445	2000	2.88	24.9	4000	5.76	24.9	6000	8.64	24.9
2400	3.46	24	1.3576	2400	3.46	22.6	4800	6.91	22.6	7200	10.37	22.6
2800	4.03	22.024	1.8449	2800	4.03	20.2	5600	8.06	20.2	8400	12.10	20.2
3200	4.61	19.9536	2.4065	3200	4.61	17.5	6400	9.22	17.5	9600	13.82	17.5
3683	5.30	17.3184	3.1099	3683	5.30	14.2	7366	10.61	14.2	11048	15.91	14.2

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point A

FM System - 16" (Inside the PS)

Diameter = 16 in
Area = 1.396263 ft^2
RH=D/4= 0.333333
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	16.00	0.00	0.00	16.75	100	0.0000	0.0000	2.05	0.000	0.0000
250.0	0.36	0.56	16.00	0.40	0.00	16.75	100	0.0001	0.0013	2.05	0.005	0.0064
500.0	0.72	1.11	16.00	0.80	0.01	16.75	100	0.0003	0.0047	2.05	0.020	0.0250
750.0	1.08	1.67	16.00	1.20	0.02	16.75	100	0.0006	0.0100	2.05	0.046	0.0556
1000.0	1.44	2.23	16.00	1.60	0.04	16.75	100	0.0010	0.0170	2.05	0.081	0.0981
1250.0	1.80	2.79	16.00	1.99	0.06	16.75	100	0.0015	0.0257	2.05	0.127	0.1524
1500.0	2.16	3.34	16.00	2.39	0.09	16.75	100	0.0022	0.0360	2.05	0.182	0.2184
1750.0	2.52	3.90	16.00	2.79	0.12	16.75	100	0.0029	0.0479	2.05	0.248	0.2962
2000.0	2.88	4.46	16.00	3.19	0.16	16.75	100	0.0037	0.0614	2.05	0.324	0.3856
2250.0	3.24	5.01	16.00	3.59	0.20	16.75	100	0.0046	0.0763	2.05	0.410	0.4867
2500.0	3.60	5.57	16.00	3.99	0.25	16.75	100	0.0055	0.0928	2.05	0.507	0.5994
2750.0	3.96	6.13	16.00	4.39	0.30	16.75	100	0.0066	0.1107	2.05	0.613	0.7238
3000.0	4.32	6.68	16.00	4.79	0.36	16.75	100	0.0078	0.1301	2.05	0.730	0.8596
3250.0	4.68	7.24	16.00	5.19	0.42	16.75	100	0.0090	0.1508	2.05	0.856	1.0071
3500.0	5.04	7.80	16.00	5.59	0.48	16.75	100	0.0103	0.1730	2.05	0.993	1.1661
3750.0	5.40	8.36	16.00	5.98	0.56	16.75	100	0.0117	0.1966	2.05	1.140	1.3366
4000.0	5.76	8.91	16.00	6.38	0.63	16.75	100	0.0132	0.2216	2.05	1.297	1.5186
4250.0	6.12	9.47	16.00	6.78	0.71	16.75	100	0.0148	0.2479	2.05	1.464	1.7121
4500.0	6.48	10.03	16.00	7.18	0.80	16.75	100	0.0165	0.2756	2.05	1.642	1.9171
4750.0	6.84	10.58	16.00	7.58	0.89	16.75	100	0.0182	0.3046	2.05	1.829	2.1336
5000.0	7.20	11.14	16.00	7.98	0.99	16.75	100	0.0200	0.3350	2.05	2.027	2.3616
5250.0	7.56	11.70	16.00	8.38	1.09	16.75	100	0.0219	0.3667	2.05	2.234	2.6010
5500.0	7.92	12.25	16.00	8.78	1.20	16.75	100	0.0239	0.3997	2.05	2.452	2.8518
5750.0	8.28	12.81	16.00	9.18	1.31	16.75	100	0.0259	0.4340	2.05	2.680	3.1141
6000.0	8.64	13.37	16.00	9.57	1.42	16.75	100	0.0280	0.4695	2.05	2.918	3.3878
6250.0	9.00	13.93	16.00	9.97	1.54	16.75	100	0.0302	0.5064	2.05	3.167	3.6730
6500.0	9.36	14.48	16.00	10.37	1.67	16.75	100	0.0325	0.5446	2.05	3.425	3.9695
6750.0	9.72	15.04	16.00	10.77	1.80	16.75	100	0.0349	0.5840	2.05	3.693	4.2775
7000.0	10.08	15.60	16.00	11.17	1.94	16.75	100	0.0373	0.6247	2.05	3.972	4.5968
7250.0	10.44	16.15	16.00	11.57	2.08	16.75	100	0.0398	0.6666	2.05	4.261	4.9275
7500.0	10.80	16.71	16.00	11.97	2.22	16.75	100	0.0424	0.7098	2.05	4.560	5.2697
7750.0	11.16	17.27	16.00	12.37	2.38	16.75	100	0.0450	0.7543	2.05	4.869	5.6232
8000.0	11.52	17.83	16.00	12.77	2.53	16.75	100	0.0478	0.7999	2.05	5.188	5.9880
8250.0	11.88	18.38	16.00	13.17	2.69	16.75	100	0.0506	0.8469	2.05	5.517	6.3643
8500.0	12.24	18.94	16.00	13.56	2.86	16.75	100	0.0534	0.8950	2.05	5.857	6.7519
8750.0	12.60	19.50	16.00	13.96	3.03	16.75	100	0.0564	0.9444	2.05	6.206	7.1508
9000.0	12.96	20.05	16.00	14.36	3.20	16.75	100	0.0594	0.9949	2.05	6.566	7.5611
9250.0	13.32	20.61	16.00	14.76	3.38	16.75	100	0.0625	1.0467	2.05	6.936	7.9828
9500.0	13.68	21.17	16.00	15.16	3.57	16.75	100	0.0657	1.0997	2.05	7.316	8.4157
9750.0	14.04	21.72	16.00	15.56	3.76	16.75	100	0.0689	1.1539	2.05	7.706	8.8601
10000.0	14.40	22.28	16.00	15.96	3.95	16.75	100	0.0722	1.2093	2.05	8.106	9.3157
11000.0	15.84	24.51	16.00	17.55	4.78	16.75	100	0.0861	1.4428	2.05	9.809	11.2515
12000.0	17.28	26.74	16.00	19.15	5.69	16.75	100	0.1012	1.6950	2.05	11.673	13.3682
13000.0	18.72	28.97	16.00	20.75	6.68	16.75	100	0.1174	1.9659	2.05	13.700	15.6657
14000.0	20.16	31.19	16.00	22.34	7.75	16.75	100	0.1346	2.2551	2.05	15.889	18.1436
15000.0	21.60	33.42	16.00	23.94	8.90	16.75	100	0.1530	2.5625	2.05	18.239	20.8018
16000.0	23.04	35.65	16.00	25.53	10.12	16.75	100	0.1724	2.8878	2.05	20.752	23.6402
17000.0	24.48	37.88	16.00	27.13	11.43	16.75	100	0.1929	3.2309	2.05	23.427	26.6584
18000.0	25.92	40.11	16.00	28.72	12.81	16.75	100	0.2144	3.5917	2.05	26.265	29.8564
19000.0	27.36	42.34	16.00	30.32	14.28	16.75	100	0.2370	3.9700	2.05	29.264	33.2340
20000.0	28.80	44.56	16.00	31.92	15.82	16.75	100	0.2606	4.3656	2.05	32.426	36.7912
21000.0	30.24	46.79	16.00	33.51	17.44	16.75	100	0.2853	4.7784	2.05	35.749	40.5276
22000.0	31.68	49.02	16.00	35.11	19.14	16.75	100	0.3109	5.2084	2.05	39.235	44.4433
23000.0	33.12	51.25	16.00	36.70	20.92	16.75	100	0.3376	5.6553	2.05	42.883	48.5381

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point A

24000.0	34.56	53.48	16.00	38.30	22.78	16.75	100	0.3653	6.1191	2.05	46.693	52.8119
25000.0	36.00	55.70	16.00	39.90	24.71	16.75	100	0.3940	6.5997	2.05	50.665	57.2646

FM System Curve - 16" (Outside the PS)

Diameter = 16 in
Area = 1.396263 ft^2
RH=D/4= 0.333333
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	16.00	0.00	0.00	98.00	100	0.0000	0.0000	2.90	0.000	0.0000
250.0	0.36	0.56	16.00	0.40	0.00	98.00	100	0.0001	0.0076	2.90	0.007	0.0148
500.0	0.72	1.11	16.00	0.80	0.01	98.00	100	0.0003	0.0276	2.90	0.029	0.0562
750.0	1.08	1.67	16.00	1.20	0.02	98.00	100	0.0006	0.0584	2.90	0.065	0.1229
1000.0	1.44	2.23	16.00	1.60	0.04	98.00	100	0.0010	0.0995	2.90	0.115	0.2142
1250.0	1.80	2.79	16.00	1.99	0.06	98.00	100	0.0015	0.1504	2.90	0.179	0.3296
1500.0	2.16	3.34	16.00	2.39	0.09	98.00	100	0.0022	0.2108	2.90	0.258	0.4688
1750.0	2.52	3.90	16.00	2.79	0.12	98.00	100	0.0029	0.2804	2.90	0.351	0.6316
2000.0	2.88	4.46	16.00	3.19	0.16	98.00	100	0.0037	0.3591	2.90	0.459	0.8178
2250.0	3.24	5.01	16.00	3.59	0.20	98.00	100	0.0046	0.4467	2.90	0.581	1.0272
2500.0	3.60	5.57	16.00	3.99	0.25	98.00	100	0.0055	0.5429	2.90	0.717	1.2596
2750.0	3.96	6.13	16.00	4.39	0.30	98.00	100	0.0066	0.6477	2.90	0.867	1.5150
3000.0	4.32	6.68	16.00	4.79	0.36	98.00	100	0.0078	0.7610	2.90	1.032	1.7931
3250.0	4.68	7.24	16.00	5.19	0.42	98.00	100	0.0090	0.8826	2.90	1.211	2.0938
3500.0	5.04	7.80	16.00	5.59	0.48	98.00	100	0.0103	1.0124	2.90	1.405	2.4172
3750.0	5.40	8.36	16.00	5.98	0.56	98.00	100	0.0117	1.1504	2.90	1.613	2.7630
4000.0	5.76	8.91	16.00	6.38	0.63	98.00	100	0.0132	1.2965	2.90	1.835	3.1313
4250.0	6.12	9.47	16.00	6.78	0.71	98.00	100	0.0148	1.4505	2.90	2.071	3.5219
4500.0	6.48	10.03	16.00	7.18	0.80	98.00	100	0.0165	1.6125	2.90	2.322	3.9347
4750.0	6.84	10.58	16.00	7.58	0.89	98.00	100	0.0182	1.7823	2.90	2.587	4.3697
5000.0	7.20	11.14	16.00	7.98	0.99	98.00	100	0.0200	1.9599	2.90	2.867	4.8268
5250.0	7.56	11.70	16.00	8.38	1.09	98.00	100	0.0219	2.1453	2.90	3.161	5.3060
5500.0	7.92	12.25	16.00	8.78	1.20	98.00	100	0.0239	2.3383	2.90	3.469	5.8072
5750.0	8.28	12.81	16.00	9.18	1.31	98.00	100	0.0259	2.5389	2.90	3.791	6.3304
6000.0	8.64	13.37	16.00	9.57	1.42	98.00	100	0.0280	2.7472	2.90	4.128	6.8755
6250.0	9.00	13.93	16.00	9.97	1.54	98.00	100	0.0302	2.9629	2.90	4.480	7.4424
6500.0	9.36	14.48	16.00	10.37	1.67	98.00	100	0.0325	3.1861	2.90	4.845	8.0312
6750.0	9.72	15.04	16.00	10.77	1.80	98.00	100	0.0349	3.4168	2.90	5.225	8.6417
7000.0	10.08	15.60	16.00	11.17	1.94	98.00	100	0.0373	3.6548	2.90	5.619	9.2740
7250.0	10.44	16.15	16.00	11.57	2.08	98.00	100	0.0398	3.9003	2.90	6.028	9.9279
7500.0	10.80	16.71	16.00	11.97	2.22	98.00	100	0.0424	4.1530	2.90	6.451	10.6035
7750.0	11.16	17.27	16.00	12.37	2.38	98.00	100	0.0450	4.4130	2.90	6.888	11.3007
8000.0	11.52	17.83	16.00	12.77	2.53	98.00	100	0.0478	4.6803	2.90	7.339	12.0195
8250.0	11.88	18.38	16.00	13.17	2.69	98.00	100	0.0506	4.9547	2.90	7.805	12.7599
8500.0	12.24	18.94	16.00	13.56	2.86	98.00	100	0.0534	5.2364	2.90	8.285	13.5217
8750.0	12.60	19.50	16.00	13.96	3.03	98.00	100	0.0564	5.5252	2.90	8.780	14.3050
9000.0	12.96	20.05	16.00	14.36	3.20	98.00	100	0.0594	5.8211	2.90	9.289	15.1098
9250.0	13.32	20.61	16.00	14.76	3.38	98.00	100	0.0625	6.1241	2.90	9.812	15.9360
9500.0	13.68	21.17	16.00	15.16	3.57	98.00	100	0.0657	6.4342	2.90	10.349	16.7836
9750.0	14.04	21.72	16.00	15.56	3.76	98.00	100	0.0689	6.7512	2.90	10.901	17.6526
10000.0	14.40	22.28	16.00	15.96	3.95	98.00	100	0.0722	7.0753	2.90	11.468	18.5429
11000.0	15.84	24.51	16.00	17.55	4.78	98.00	100	0.0861	8.4412	2.90	13.876	22.3170
12000.0	17.28	26.74	16.00	19.15	5.69	98.00	100	0.1012	9.9172	2.90	16.513	26.4306
13000.0	18.72	28.97	16.00	20.75	6.68	98.00	100	0.1174	11.5019	2.90	19.380	30.8821
14000.0	20.16	31.19	16.00	22.34	7.75	98.00	100	0.1346	13.1940	2.90	22.476	35.6705
15000.0	21.60	33.42	16.00	23.94	8.90	98.00	100	0.1530	14.9923	2.90	25.802	40.7944
16000.0	23.04	35.65	16.00	25.53	10.12	98.00	100	0.1724	16.8958	2.90	29.357	46.2528
17000.0	24.48	37.88	16.00	27.13	11.43	98.00	100	0.1929	18.9033	2.90	33.141	52.0446
18000.0	25.92	40.11	16.00	28.72	12.81	98.00	100	0.2144	21.0142	2.90	37.155	58.1691
19000.0	27.36	42.34	16.00	30.32	14.28	98.00	100	0.2370	23.2273	2.90	41.398	64.6253

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point A

20000.0	28.80	44.56	16.00	31.92	15.82	98.00	100	0.2606	25.5420	2.90	45.870	71.4123
21000.0	30.24	46.79	16.00	33.51	17.44	98.00	100	0.2853	27.9574	2.90	50.572	78.5295
22000.0	31.68	49.02	16.00	35.11	19.14	98.00	100	0.3109	30.4729	2.90	55.503	85.9760
23000.0	33.12	51.25	16.00	36.70	20.92	98.00	100	0.3376	33.0878	2.90	60.663	93.7512
24000.0	34.56	53.48	16.00	38.30	22.78	98.00	100	0.3653	35.8013	2.90	66.053	101.8545
25000.0	36.00	55.70	16.00	39.90	24.71	98.00	100	0.3940	38.6129	2.90	71.672	110.2852

FM System Curve - 24" PVC (Outside the PS)

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	2645	100	0.0000	0.0000	3.18	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	2645	100	0.0000	0.0286	3.18	0.002	0.0301
500.0	0.72	1.11	24.00	0.35	0.00	2645	100	0.0000	0.1032	3.18	0.006	0.1094
750.0	1.08	1.67	24.00	0.53	0.00	2645	100	0.0001	0.2187	3.18	0.014	0.2327
1000.0	1.44	2.23	24.00	0.71	0.01	2645	100	0.0001	0.3726	3.18	0.025	0.3974
1250.0	1.80	2.79	24.00	0.89	0.01	2645	100	0.0002	0.5633	3.18	0.039	0.6021
1500.0	2.16	3.34	24.00	1.06	0.02	2645	100	0.0003	0.7895	3.18	0.056	0.8454
1750.0	2.52	3.90	24.00	1.24	0.02	2645	100	0.0004	1.0504	3.18	0.076	1.1265
2000.0	2.88	4.46	24.00	1.42	0.03	2645	100	0.0005	1.3451	3.18	0.099	1.4445
2250.0	3.24	5.01	24.00	1.60	0.04	2645	100	0.0006	1.6730	3.18	0.126	1.7987
2500.0	3.60	5.57	24.00	1.77	0.05	2645	100	0.0008	2.0335	3.18	0.155	2.1887
2750.0	3.96	6.13	24.00	1.95	0.06	2645	100	0.0009	2.4260	3.18	0.188	2.6139
3000.0	4.32	6.68	24.00	2.13	0.07	2645	100	0.0011	2.8502	3.18	0.224	3.0738
3250.0	4.68	7.24	24.00	2.31	0.08	2645	100	0.0012	3.3056	3.18	0.262	3.5680
3500.0	5.04	7.80	24.00	2.48	0.10	2645	100	0.0014	3.7920	3.18	0.304	4.0962
3750.0	5.40	8.36	24.00	2.66	0.11	2645	100	0.0016	4.3088	3.18	0.349	4.6581
4000.0	5.76	8.91	24.00	2.84	0.12	2645	100	0.0018	4.8558	3.18	0.397	5.2533
4250.0	6.12	9.47	24.00	3.01	0.14	2645	100	0.0021	5.4328	3.18	0.449	5.8815
4500.0	6.48	10.03	24.00	3.19	0.16	2645	100	0.0023	6.0395	3.18	0.503	6.5425
4750.0	6.84	10.58	24.00	3.37	0.18	2645	100	0.0025	6.6755	3.18	0.560	7.2360
5000.0	7.20	11.14	24.00	3.55	0.20	2645	100	0.0028	7.3408	3.18	0.621	7.9617
5250.0	7.56	11.70	24.00	3.72	0.22	2645	100	0.0030	8.0350	3.18	0.685	8.7196
5500.0	7.92	12.25	24.00	3.90	0.24	2645	100	0.0033	8.7579	3.18	0.751	9.5093
5750.0	8.28	12.81	24.00	4.08	0.26	2645	100	0.0036	9.5094	3.18	0.821	10.3307
6000.0	8.64	13.37	24.00	4.26	0.28	2645	100	0.0039	10.2893	3.18	0.894	11.1835
6250.0	9.00	13.93	24.00	4.43	0.31	2645	100	0.0042	11.0973	3.18	0.970	12.0676
6500.0	9.36	14.48	24.00	4.61	0.33	2645	100	0.0045	11.9334	3.18	1.049	12.9829
6750.0	9.72	15.04	24.00	4.79	0.36	2645	100	0.0048	12.7973	3.18	1.132	13.9291
7000.0	10.08	15.60	24.00	4.96	0.38	2645	100	0.0052	13.6890	3.18	1.217	14.9061
7250.0	10.44	16.15	24.00	5.14	0.41	2645	100	0.0055	14.6081	3.18	1.306	15.9137
7500.0	10.80	16.71	24.00	5.32	0.44	2645	100	0.0059	15.5547	3.18	1.397	16.9519
7750.0	11.16	17.27	24.00	5.50	0.47	2645	100	0.0062	16.5286	3.18	1.492	18.0205
8000.0	11.52	17.83	24.00	5.67	0.50	2645	100	0.0066	17.5296	3.18	1.590	19.1193
8250.0	11.88	18.38	24.00	5.85	0.53	2645	100	0.0070	18.5576	3.18	1.691	20.2482
8500.0	12.24	18.94	24.00	6.03	0.56	2645	100	0.0074	19.6125	3.18	1.795	21.4071
8750.0	12.60	19.50	24.00	6.21	0.60	2645	100	0.0078	20.6941	3.18	1.902	22.5959
9000.0	12.96	20.05	24.00	6.38	0.63	2645	100	0.0082	21.8025	3.18	2.012	23.8144
9250.0	13.32	20.61	24.00	6.56	0.67	2645	100	0.0087	22.9373	3.18	2.125	25.0626
9500.0	13.68	21.17	24.00	6.74	0.70	2645	100	0.0091	24.0987	3.18	2.242	26.3404
9750.0	14.04	21.72	24.00	6.92	0.74	2645	100	0.0096	25.2863	3.18	2.361	27.6476
10000.0	14.40	22.28	24.00	7.09	0.78	2645	100	0.0100	26.5002	3.18	2.484	28.9841
11000.0	15.84	24.51	24.00	7.80	0.95	2645	100	0.0120	31.6161	3.18	3.006	34.6216
12000.0	17.28	26.74	24.00	8.51	1.12	2645	100	0.0140	37.1443	3.18	3.577	40.7211
13000.0	18.72	28.97	24.00	9.22	1.32	2645	100	0.0163	43.0796	3.18	4.198	47.2774
14000.0	20.16	31.19	24.00	9.93	1.53	2645	100	0.0187	49.4172	3.18	4.868	54.2856
15000.0	21.60	33.42	24.00	10.64	1.76	2645	100	0.0212	56.1526	3.18	5.589	61.7414

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point A

16000.0	23.04	35.65	24.00	11.35	2.00	2645	100	0.0239	63.2818	3.18	6.359	69.6406
17000.0	24.48	37.88	24.00	12.06	2.26	2645	100	0.0268	70.8011	3.18	7.178	77.9796
18000.0	25.92	40.11	24.00	12.77	2.53	2645	100	0.0298	78.7070	3.18	8.048	86.7549
19000.0	27.36	42.34	24.00	13.48	2.82	2645	100	0.0329	86.9962	3.18	8.967	95.9631
20000.0	28.80	44.56	24.00	14.18	3.12	2645	100	0.0362	95.6657	3.18	9.936	105.6013
21000.0	30.24	46.79	24.00	14.89	3.44	2645	100	0.0396	104.7126	3.18	10.954	115.6666
22000.0	31.68	49.02	24.00	15.60	3.78	2645	100	0.0432	114.1341	3.18	12.022	126.1562
23000.0	33.12	51.25	24.00	16.31	4.13	2645	100	0.0469	123.9278	3.18	13.140	137.0676
24000.0	34.56	53.48	24.00	17.02	4.50	2645	100	0.0507	134.0911	3.18	14.307	148.3984
25000.0	36.00	55.70	24.00	17.73	4.88	2645	100	0.0547	144.6217	3.18	15.524	160.1462

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point A

Q (gpm)	Q (mgd)	Losses
0	0.00	0.00
250	0.36	0.05
500	0.72	0.19
750	1.08	0.41
1000	1.44	0.71
1250	1.80	1.08
1500	2.16	1.53
1750	2.52	2.05
2000	2.88	2.65
2250	3.24	3.31
2500	3.60	4.05
2750	3.96	4.85
3000	4.32	5.73
3250	4.68	6.67
3500	5.04	7.68
3750	5.40	8.76
4000	5.76	9.90
4250	6.12	11.12
4500	6.48	12.39
4750	6.84	13.74
5000	7.20	15.15
5250	7.56	16.63
5500	7.92	18.17
5750	8.28	19.78
6000	8.64	21.45
6250	9.00	23.18
6500	9.36	24.98
6750	9.72	26.85
7000	10.08	28.78
7250	10.44	30.77
7500	10.80	32.83
7750	11.16	34.94
8000	11.52	37.13
8250	11.88	39.37
8500	12.24	41.68
8750	12.60	44.05
9000	12.96	46.49
9250	13.32	48.98
9500	13.68	51.54
9750	14.04	54.16
10000	14.40	56.84
11000	15.84	68.19
12000	17.28	80.52
13000	18.72	93.83
14000	20.16	108.10
15000	21.60	123.34
16000	23.04	139.53
17000	24.48	156.68
18000	25.92	174.78
19000	27.36	193.82
20000	28.80	213.80
21000	30.24	234.72
22000	31.68	256.58
23000	33.12	279.36
24000	34.56	303.06
25000	36.00	327.70

Q (gpm)	Q (mgd)	Min Static	Max Static
0	0.00	36.93	39.43
250	0.36	36.98	39.48
500	0.72	37.12	39.62
750	1.08	37.34	39.84
1000	1.44	37.64	40.14
1250	1.80	38.01	40.51
1500	2.16	38.46	40.96
1750	2.52	38.98	41.48
2000	2.88	39.58	42.08
2250	3.24	40.24	42.74
2500	3.60	40.98	43.48
2750	3.96	41.78	44.28
3000	4.32	42.66	45.16
3250	4.68	43.60	46.10
3500	5.04	44.61	47.11
3750	5.40	45.69	48.19
4000	5.76	46.83	49.33
4250	6.12	48.05	50.55
4500	6.48	49.32	51.82
4750	6.84	50.67	53.17
5000	7.20	52.08	54.58
5250	7.56	53.56	56.06
5500	7.92	55.10	57.60
5750	8.28	56.71	59.21
6000	8.64	58.38	60.88
6250	9.00	60.11	62.61
6500	9.36	61.91	64.41
6750	9.72	63.78	66.28
7000	10.08	65.71	68.21
7250	10.44	67.70	70.20
7500	10.80	69.76	72.26
7750	11.16	71.87	74.37
8000	11.52	74.06	76.56
8250	11.88	76.30	78.80
8500	12.24	78.61	81.11
8750	12.60	80.98	83.48
9000	12.96	83.42	85.92
9250	13.32	85.91	88.41
9500	13.68	88.47	90.97
9750	14.04	91.09	93.59
10000	14.40	93.77	96.27
11000	15.84	105.12	107.62
12000	17.28	117.45	119.95
13000	18.72	130.76	133.26
14000	20.16	145.03	147.53
15000	21.60	160.27	162.77
16000	23.04	176.46	178.96
17000	24.48	193.61	196.11
18000	25.92	211.71	214.21
19000	27.36	230.75	233.25
20000	28.80	250.73	253.23
21000	30.24	271.65	274.15
22000	31.68	293.51	296.01
23000	33.12	316.29	318.79
24000	34.56	339.99	342.49
25000	36.00	364.63	367.13

MIN Static Head = 36.93
MAX Static Head = 39.43

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point B

FM System Curve - 16" (Inside the PS)

Diameter = 16 in
Area = 1.396263 ft^2
RH=D/4= 0.333333
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	16.00	0.00	0.00	16.75	100	0.0000	0.0000	2.05	0.000	0.0000
250.0	0.36	0.56	16.00	0.40	0.00	16.75	100	0.0001	0.0013	2.05	0.005	0.0064
500.0	0.72	1.11	16.00	0.80	0.01	16.75	100	0.0003	0.0047	2.05	0.020	0.0250
750.0	1.08	1.67	16.00	1.20	0.02	16.75	100	0.0006	0.0100	2.05	0.046	0.0556
1000.0	1.44	2.23	16.00	1.60	0.04	16.75	100	0.0010	0.0170	2.05	0.081	0.0981
1250.0	1.80	2.79	16.00	1.99	0.06	16.75	100	0.0015	0.0257	2.05	0.127	0.1524
1500.0	2.16	3.34	16.00	2.39	0.09	16.75	100	0.0022	0.0360	2.05	0.182	0.2184
1750.0	2.52	3.90	16.00	2.79	0.12	16.75	100	0.0029	0.0479	2.05	0.248	0.2962
2000.0	2.88	4.46	16.00	3.19	0.16	16.75	100	0.0037	0.0614	2.05	0.324	0.3856
2250.0	3.24	5.01	16.00	3.59	0.20	16.75	100	0.0046	0.0763	2.05	0.410	0.4867
2500.0	3.60	5.57	16.00	3.99	0.25	16.75	100	0.0055	0.0928	2.05	0.507	0.5994
2750.0	3.96	6.13	16.00	4.39	0.30	16.75	100	0.0066	0.1107	2.05	0.613	0.7238
3000.0	4.32	6.68	16.00	4.79	0.36	16.75	100	0.0078	0.1301	2.05	0.730	0.8596
3250.0	4.68	7.24	16.00	5.19	0.42	16.75	100	0.0090	0.1508	2.05	0.856	1.0071
3500.0	5.04	7.80	16.00	5.59	0.48	16.75	100	0.0103	0.1730	2.05	0.993	1.1661
3750.0	5.40	8.36	16.00	5.98	0.56	16.75	100	0.0117	0.1966	2.05	1.140	1.3366
4000.0	5.76	8.91	16.00	6.38	0.63	16.75	100	0.0132	0.2216	2.05	1.297	1.5186
4250.0	6.12	9.47	16.00	6.78	0.71	16.75	100	0.0148	0.2479	2.05	1.464	1.7121
4500.0	6.48	10.03	16.00	7.18	0.80	16.75	100	0.0165	0.2756	2.05	1.642	1.9171
4750.0	6.84	10.58	16.00	7.58	0.89	16.75	100	0.0182	0.3046	2.05	1.829	2.1336
5000.0	7.20	11.14	16.00	7.98	0.99	16.75	100	0.0200	0.3350	2.05	2.027	2.3616
5250.0	7.56	11.70	16.00	8.38	1.09	16.75	100	0.0219	0.3667	2.05	2.234	2.6010
5500.0	7.92	12.25	16.00	8.78	1.20	16.75	100	0.0239	0.3997	2.05	2.452	2.8518
5750.0	8.28	12.81	16.00	9.18	1.31	16.75	100	0.0259	0.4340	2.05	2.680	3.1141
6000.0	8.64	13.37	16.00	9.57	1.42	16.75	100	0.0280	0.4695	2.05	2.918	3.3878
6250.0	9.00	13.93	16.00	9.97	1.54	16.75	100	0.0302	0.5064	2.05	3.167	3.6730
6500.0	9.36	14.48	16.00	10.37	1.67	16.75	100	0.0325	0.5446	2.05	3.425	3.9695
6750.0	9.72	15.04	16.00	10.77	1.80	16.75	100	0.0349	0.5840	2.05	3.693	4.2775
7000.0	10.08	15.60	16.00	11.17	1.94	16.75	100	0.0373	0.6247	2.05	3.972	4.5968
7250.0	10.44	16.15	16.00	11.57	2.08	16.75	100	0.0398	0.6666	2.05	4.261	4.9275
7500.0	10.80	16.71	16.00	11.97	2.22	16.75	100	0.0424	0.7098	2.05	4.560	5.2697
7750.0	11.16	17.27	16.00	12.37	2.38	16.75	100	0.0450	0.7543	2.05	4.869	5.6232
8000.0	11.52	17.83	16.00	12.77	2.53	16.75	100	0.0478	0.7999	2.05	5.188	5.9880
8250.0	11.88	18.38	16.00	13.17	2.69	16.75	100	0.0506	0.8469	2.05	5.517	6.3643
8500.0	12.24	18.94	16.00	13.56	2.86	16.75	100	0.0534	0.8950	2.05	5.857	6.7519
8750.0	12.60	19.50	16.00	13.96	3.03	16.75	100	0.0564	0.9444	2.05	6.206	7.1508
9000.0	12.96	20.05	16.00	14.36	3.20	16.75	100	0.0594	0.9949	2.05	6.566	7.5611
9250.0	13.32	20.61	16.00	14.76	3.38	16.75	100	0.0625	1.0467	2.05	6.936	7.9828
9500.0	13.68	21.17	16.00	15.16	3.57	16.75	100	0.0657	1.0997	2.05	7.316	8.4157
9750.0	14.04	21.72	16.00	15.56	3.76	16.75	100	0.0689	1.1539	2.05	7.706	8.8601
10000.0	14.40	22.28	16.00	15.96	3.95	16.75	100	0.0722	1.2093	2.05	8.106	9.3157
11000.0	15.84	24.51	16.00	17.55	4.78	16.75	100	0.0861	1.4428	2.05	9.809	11.2515
12000.0	17.28	26.74	16.00	19.15	5.69	16.75	100	0.1012	1.6950	2.05	11.673	13.3682
13000.0	18.72	28.97	16.00	20.75	6.68	16.75	100	0.1174	1.9659	2.05	13.700	15.6657
14000.0	20.16	31.19	16.00	22.34	7.75	16.75	100	0.1346	2.2551	2.05	15.889	18.1436
15000.0	21.60	33.42	16.00	23.94	8.90	16.75	100	0.1530	2.5625	2.05	18.239	20.8018
16000.0	23.04	35.65	16.00	25.53	10.12	16.75	100	0.1724	2.8878	2.05	20.752	23.6402
17000.0	24.48	37.88	16.00	27.13	11.43	16.75	100	0.1929	3.2309	2.05	23.427	26.6584
18000.0	25.92	40.11	16.00	28.72	12.81	16.75	100	0.2144	3.5917	2.05	26.265	29.8564
19000.0	27.36	42.34	16.00	30.32	14.28	16.75	100	0.2370	3.9700	2.05	29.264	33.2340
20000.0	28.80	44.56	16.00	31.92	15.82	16.75	100	0.2606	4.3656	2.05	32.426	36.7912
21000.0	30.24	46.79	16.00	33.51	17.44	16.75	100	0.2853	4.7784	2.05	35.749	40.5276
22000.0	31.68	49.02	16.00	35.11	19.14	16.75	100	0.3109	5.2084	2.05	39.235	44.4433
23000.0	33.12	51.25	16.00	36.70	20.92	16.75	100	0.3376	5.6553	2.05	42.883	48.5381

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point B

24000.0	34.56	53.48	16.00	38.30	22.78	16.75	100	0.3653	6.1191	2.05	46.693	52.8119
25000.0	36.00	55.70	16.00	39.90	24.71	16.75	100	0.3940	6.5997	2.05	50.665	57.2646

FM System Curve - 16" (Outside the PS)

Diameter = 16 in
Area = 1.396263 ft^2
RH= 0.333333
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	16.00	0.00	0.00	98.00	100	0.0000	0.0000	2.90	0.000	0.0000
250.0	0.36	0.56	16.00	0.40	0.00	98.00	100	0.0001	0.0076	2.90	0.007	0.0148
500.0	0.72	1.11	16.00	0.80	0.01	98.00	100	0.0003	0.0276	2.90	0.029	0.0562
750.0	1.08	1.67	16.00	1.20	0.02	98.00	100	0.0006	0.0584	2.90	0.065	0.1229
1000.0	1.44	2.23	16.00	1.60	0.04	98.00	100	0.0010	0.0995	2.90	0.115	0.2142
1250.0	1.80	2.79	16.00	1.99	0.06	98.00	100	0.0015	0.1504	2.90	0.179	0.3296
1500.0	2.16	3.34	16.00	2.39	0.09	98.00	100	0.0022	0.2108	2.90	0.258	0.4688
1750.0	2.52	3.90	16.00	2.79	0.12	98.00	100	0.0029	0.2804	2.90	0.351	0.6316
2000.0	2.88	4.46	16.00	3.19	0.16	98.00	100	0.0037	0.3591	2.90	0.459	0.8178
2250.0	3.24	5.01	16.00	3.59	0.20	98.00	100	0.0046	0.4467	2.90	0.581	1.0272
2500.0	3.60	5.57	16.00	3.99	0.25	98.00	100	0.0055	0.5429	2.90	0.717	1.2596
2750.0	3.96	6.13	16.00	4.39	0.30	98.00	100	0.0066	0.6477	2.90	0.867	1.5150
3000.0	4.32	6.68	16.00	4.79	0.36	98.00	100	0.0078	0.7610	2.90	1.032	1.7931
3250.0	4.68	7.24	16.00	5.19	0.42	98.00	100	0.0090	0.8826	2.90	1.211	2.0938
3500.0	5.04	7.80	16.00	5.59	0.48	98.00	100	0.0103	1.0124	2.90	1.405	2.4172
3750.0	5.40	8.36	16.00	5.98	0.56	98.00	100	0.0117	1.1504	2.90	1.613	2.7630
4000.0	5.76	8.91	16.00	6.38	0.63	98.00	100	0.0132	1.2965	2.90	1.835	3.1313
4250.0	6.12	9.47	16.00	6.78	0.71	98.00	100	0.0148	1.4505	2.90	2.071	3.5219
4500.0	6.48	10.03	16.00	7.18	0.80	98.00	100	0.0165	1.6125	2.90	2.322	3.9347
4750.0	6.84	10.58	16.00	7.58	0.89	98.00	100	0.0182	1.7823	2.90	2.587	4.3697
5000.0	7.20	11.14	16.00	7.98	0.99	98.00	100	0.0200	1.9599	2.90	2.867	4.8268
5250.0	7.56	11.70	16.00	8.38	1.09	98.00	100	0.0219	2.1453	2.90	3.161	5.3060
5500.0	7.92	12.25	16.00	8.78	1.20	98.00	100	0.0239	2.3383	2.90	3.469	5.8072
5750.0	8.28	12.81	16.00	9.18	1.31	98.00	100	0.0259	2.5389	2.90	3.791	6.3304
6000.0	8.64	13.37	16.00	9.57	1.42	98.00	100	0.0280	2.7472	2.90	4.128	6.8755
6250.0	9.00	13.93	16.00	9.97	1.54	98.00	100	0.0302	2.9629	2.90	4.480	7.4424
6500.0	9.36	14.48	16.00	10.37	1.67	98.00	100	0.0325	3.1861	2.90	4.845	8.0312
6750.0	9.72	15.04	16.00	10.77	1.80	98.00	100	0.0349	3.4168	2.90	5.225	8.6417
7000.0	10.08	15.60	16.00	11.17	1.94	98.00	100	0.0373	3.6548	2.90	5.619	9.2740
7250.0	10.44	16.15	16.00	11.57	2.08	98.00	100	0.0398	3.9003	2.90	6.028	9.9279
7500.0	10.80	16.71	16.00	11.97	2.22	98.00	100	0.0424	4.1530	2.90	6.451	10.6035
7750.0	11.16	17.27	16.00	12.37	2.38	98.00	100	0.0450	4.4130	2.90	6.888	11.3007
8000.0	11.52	17.83	16.00	12.77	2.53	98.00	100	0.0478	4.6803	2.90	7.339	12.0195
8250.0	11.88	18.38	16.00	13.17	2.69	98.00	100	0.0506	4.9547	2.90	7.805	12.7599
8500.0	12.24	18.94	16.00	13.56	2.86	98.00	100	0.0534	5.2364	2.90	8.285	13.5217
8750.0	12.60	19.50	16.00	13.96	3.03	98.00	100	0.0564	5.5252	2.90	8.780	14.3050
9000.0	12.96	20.05	16.00	14.36	3.20	98.00	100	0.0594	5.8211	2.90	9.289	15.1098
9250.0	13.32	20.61	16.00	14.76	3.38	98.00	100	0.0625	6.1241	2.90	9.812	15.9360
9500.0	13.68	21.17	16.00	15.16	3.57	98.00	100	0.0657	6.4342	2.90	10.349	16.7836
9750.0	14.04	21.72	16.00	15.56	3.76	98.00	100	0.0689	6.7512	2.90	10.901	17.6526
10000.0	14.40	22.28	16.00	15.96	3.95	98.00	100	0.0722	7.0753	2.90	11.468	18.5429
11000.0	15.84	24.51	16.00	17.55	4.78	98.00	100	0.0861	8.4412	2.90	13.876	22.3170
12000.0	17.28	26.74	16.00	19.15	5.69	98.00	100	0.1012	9.9172	2.90	16.513	26.4306
13000.0	18.72	28.97	16.00	20.75	6.68	98.00	100	0.1174	11.5019	2.90	19.380	30.8821
14000.0	20.16	31.19	16.00	22.34	7.75	98.00	100	0.1346	13.1940	2.90	22.476	35.6705
15000.0	21.60	33.42	16.00	23.94	8.90	98.00	100	0.1530	14.9923	2.90	25.802	40.7944
16000.0	23.04	35.65	16.00	25.53	10.12	98.00	100	0.1724	16.8958	2.90	29.357	46.2528
17000.0	24.48	37.88	16.00	27.13	11.43	98.00	100	0.1929	18.9033	2.90	33.141	52.0446
18000.0	25.92	40.11	16.00	28.72	12.81	98.00	100	0.2144	21.0142	2.90	37.155	58.1691
19000.0	27.36	42.34	16.00	30.32	14.28	98.00	100	0.2370	23.2273	2.90	41.398	64.6253

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point B

20000.0	28.80	44.56	16.00	31.92	15.82	98.00	100	0.2606	25.5420	2.90	45.870	71.4123
21000.0	30.24	46.79	16.00	33.51	17.44	98.00	100	0.2853	27.9574	2.90	50.572	78.5295
22000.0	31.68	49.02	16.00	35.11	19.14	98.00	100	0.3109	30.4729	2.90	55.503	85.9760
23000.0	33.12	51.25	16.00	36.70	20.92	98.00	100	0.3376	33.0878	2.90	60.663	93.7512
24000.0	34.56	53.48	16.00	38.30	22.78	98.00	100	0.3653	35.8013	2.90	66.053	101.8545
25000.0	36.00	55.70	16.00	39.90	24.71	98.00	100	0.3940	38.6129	2.90	71.672	110.2852

FM System Curve - 24" PVC (Outside the PS)

Diameter = 24 in

Area = 3.141593 ft^2

RH= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	6124	100	0.0000	0.0000	5.81	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	6124	100	0.0000	0.0662	5.81	0.003	0.0690
500.0	0.72	1.11	24.00	0.35	0.00	6124	100	0.0000	0.2390	5.81	0.011	0.2503
750.0	1.08	1.67	24.00	0.53	0.00	6124	100	0.0001	0.5064	5.81	0.026	0.5319
1000.0	1.44	2.23	24.00	0.71	0.01	6124	100	0.0001	0.8627	5.81	0.045	0.9081
1250.0	1.80	2.79	24.00	0.89	0.01	6124	100	0.0002	1.3042	5.81	0.071	1.3751
1500.0	2.16	3.34	24.00	1.06	0.02	6124	100	0.0003	1.8280	5.81	0.102	1.9301
1750.0	2.52	3.90	24.00	1.24	0.02	6124	100	0.0004	2.4320	5.81	0.139	2.5710
2000.0	2.88	4.46	24.00	1.42	0.03	6124	100	0.0005	3.1143	5.81	0.182	3.2959
2250.0	3.24	5.01	24.00	1.60	0.04	6124	100	0.0006	3.8735	5.81	0.230	4.1032
2500.0	3.60	5.57	24.00	1.77	0.05	6124	100	0.0008	4.7081	5.81	0.284	4.9917
2750.0	3.96	6.13	24.00	1.95	0.06	6124	100	0.0009	5.6170	5.81	0.343	5.9602
3000.0	4.32	6.68	24.00	2.13	0.07	6124	100	0.0011	6.5991	5.81	0.408	7.0076
3250.0	4.68	7.24	24.00	2.31	0.08	6124	100	0.0012	7.6536	5.81	0.479	8.1330
3500.0	5.04	7.80	24.00	2.48	0.10	6124	100	0.0014	8.7795	5.81	0.556	9.3355
3750.0	5.40	8.36	24.00	2.66	0.11	6124	100	0.0016	9.9762	5.81	0.638	10.6144
4000.0	5.76	8.91	24.00	2.84	0.12	6124	100	0.0018	11.2428	5.81	0.726	11.9689
4250.0	6.12	9.47	24.00	3.01	0.14	6124	100	0.0021	12.5787	5.81	0.820	13.3984
4500.0	6.48	10.03	24.00	3.19	0.16	6124	100	0.0023	13.9832	5.81	0.919	14.9022
4750.0	6.84	10.58	24.00	3.37	0.18	6124	100	0.0025	15.4559	5.81	1.024	16.4798
5000.0	7.20	11.14	24.00	3.55	0.20	6124	100	0.0028	16.9962	5.81	1.135	18.1307
5250.0	7.56	11.70	24.00	3.72	0.22	6124	100	0.0030	18.6034	5.81	1.251	19.8543
5500.0	7.92	12.25	24.00	3.90	0.24	6124	100	0.0033	20.2773	5.81	1.373	21.6501
5750.0	8.28	12.81	24.00	4.08	0.26	6124	100	0.0036	22.0172	5.81	1.500	23.5177
6000.0	8.64	13.37	24.00	4.26	0.28	6124	100	0.0039	23.8229	5.81	1.634	25.4566
6250.0	9.00	13.93	24.00	4.43	0.31	6124	100	0.0042	25.6938	5.81	1.773	27.4665
6500.0	9.36	14.48	24.00	4.61	0.33	6124	100	0.0045	27.6295	5.81	1.917	29.5469
6750.0	9.72	15.04	24.00	4.79	0.36	6124	100	0.0048	29.6298	5.81	2.068	31.6975
7000.0	10.08	15.60	24.00	4.96	0.38	6124	100	0.0052	31.6942	5.81	2.224	33.9179
7250.0	10.44	16.15	24.00	5.14	0.41	6124	100	0.0055	33.8224	5.81	2.385	36.2078
7500.0	10.80	16.71	24.00	5.32	0.44	6124	100	0.0059	36.0140	5.81	2.553	38.5668
7750.0	11.16	17.27	24.00	5.50	0.47	6124	100	0.0062	38.2688	5.81	2.726	40.9946
8000.0	11.52	17.83	24.00	5.67	0.50	6124	100	0.0066	40.5864	5.81	2.904	43.4909
8250.0	11.88	18.38	24.00	5.85	0.53	6124	100	0.0070	42.9666	5.81	3.089	46.0554
8500.0	12.24	18.94	24.00	6.03	0.56	6124	100	0.0074	45.4090	5.81	3.279	48.6879
8750.0	12.60	19.50	24.00	6.21	0.60	6124	100	0.0078	47.9134	5.81	3.475	51.3880
9000.0	12.96	20.05	24.00	6.38	0.63	6124	100	0.0082	50.4795	5.81	3.676	54.1555
9250.0	13.32	20.61	24.00	6.56	0.67	6124	100	0.0087	53.1071	5.81	3.883	56.9901
9500.0	13.68	21.17	24.00	6.74	0.70	6124	100	0.0091	55.7959	5.81	4.096	59.8916
9750.0	14.04	21.72	24.00	6.92	0.74	6124	100	0.0096	58.5457	5.81	4.314	62.8598
10000.0	14.40	22.28	24.00	7.09	0.78	6124	100	0.0100	61.3562	5.81	4.538	65.8944
11000.0	15.84	24.51	24.00	7.80	0.95	6124	100	0.0120	73.2011	5.81	5.491	78.6923
12000.0	17.28	26.74	24.00	8.51	1.12	6124	100	0.0140	86.0007	5.81	6.535	92.5357
13000.0	18.72	28.97	24.00	9.22	1.32	6124	100	0.0163	99.7427	5.81	7.670	107.4123
14000.0	20.16	31.19	24.00	9.93	1.53	6124	100	0.0187	114.4161	5.81	8.895	123.3110
15000.0	21.60	33.42	24.00	10.64	1.76	6124	100	0.0212	130.0107	5.81	10.211	140.2217

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point B

16000.0	23.04	35.65	24.00	11.35	2.00	6124	100	0.0239	146.5171	5.81	11.618	158.1349
17000.0	24.48	37.88	24.00	12.06	2.26	6124	100	0.0268	163.9266	5.81	13.115	177.0421
18000.0	25.92	40.11	24.00	12.77	2.53	6124	100	0.0298	182.2312	5.81	14.704	196.9351
19000.0	27.36	42.34	24.00	13.48	2.82	6124	100	0.0329	201.4234	5.81	16.383	217.8063
20000.0	28.80	44.56	24.00	14.18	3.12	6124	100	0.0362	221.4959	5.81	18.153	239.6488
21000.0	30.24	46.79	24.00	14.89	3.44	6124	100	0.0396	242.4422	5.81	20.014	262.4558
22000.0	31.68	49.02	24.00	15.60	3.78	6124	100	0.0432	264.2561	5.81	21.965	286.2210
23000.0	33.12	51.25	24.00	16.31	4.13	6124	100	0.0469	286.9314	5.81	24.007	310.9386
24000.0	34.56	53.48	24.00	17.02	4.50	6124	100	0.0507	310.4627	5.81	26.140	336.6028
25000.0	36.00	55.70	24.00	17.73	4.88	6124	100	0.0547	334.8444	5.81	28.364	363.2082

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point B

Q (gpm)	Q (mgd)	Losses
0	0.00	0.00
250	0.36	0.09
500	0.72	0.33
750	1.08	0.71
1000	1.44	1.22
1250	1.80	1.86
1500	2.16	2.62
1750	2.52	3.50
2000	2.88	4.50
2250	3.24	5.62
2500	3.60	6.85
2750	3.96	8.20
3000	4.32	9.66
3250	4.68	11.23
3500	5.04	12.92
3750	5.40	14.71
4000	5.76	16.62
4250	6.12	18.63
4500	6.48	20.75
4750	6.84	22.98
5000	7.20	25.32
5250	7.56	27.76
5500	7.92	30.31
5750	8.28	32.96
6000	8.64	35.72
6250	9.00	38.58
6500	9.36	41.55
6750	9.72	44.62
7000	10.08	47.79
7250	10.44	51.06
7500	10.80	54.44
7750	11.16	57.92
8000	11.52	61.50
8250	11.88	65.18
8500	12.24	68.96
8750	12.60	72.84
9000	12.96	76.83
9250	13.32	80.91
9500	13.68	85.09
9750	14.04	89.37
10000	14.40	93.75
11000	15.84	112.26
12000	17.28	132.33
13000	18.72	153.96
14000	20.16	177.13
15000	21.60	201.82
16000	23.04	228.03
17000	24.48	255.75
18000	25.92	284.96
19000	27.36	315.67
20000	28.80	347.85
21000	30.24	381.51
22000	31.68	416.64
23000	33.12	453.23
24000	34.56	491.27
25000	36.00	530.76

Q (gpm)	Q (mgd)	Min Static	Max Static
0	0.00	35.40	37.90
250	0.36	35.49	37.99
500	0.72	35.73	38.23
750	1.08	36.11	38.61
1000	1.44	36.62	39.12
1250	1.80	37.26	39.76
1500	2.16	38.02	40.52
1750	2.52	38.90	41.40
2000	2.88	39.90	42.40
2250	3.24	41.02	43.52
2500	3.60	42.25	44.75
2750	3.96	43.60	46.10
3000	4.32	45.06	47.56
3250	4.68	46.63	49.13
3500	5.04	48.32	50.82
3750	5.40	50.11	52.61
4000	5.76	52.02	54.52
4250	6.12	54.03	56.53
4500	6.48	56.15	58.65
4750	6.84	58.38	60.88
5000	7.20	60.72	63.22
5250	7.56	63.16	65.66
5500	7.92	65.71	68.21
5750	8.28	68.36	70.86
6000	8.64	71.12	73.62
6250	9.00	73.98	76.48
6500	9.36	76.95	79.45
6750	9.72	80.02	82.52
7000	10.08	83.19	85.69
7250	10.44	86.46	88.96
7500	10.80	89.84	92.34
7750	11.16	93.32	95.82
8000	11.52	96.90	99.40
8250	11.88	100.58	103.08
8500	12.24	104.36	106.86
8750	12.60	108.24	110.74
9000	12.96	112.23	114.73
9250	13.32	116.31	118.81
9500	13.68	120.49	122.99
9750	14.04	124.77	127.27
10000	14.40	129.15	131.65
11000	15.84	147.66	150.16
12000	17.28	167.73	170.23
13000	18.72	189.36	191.86
14000	20.16	212.53	215.03
15000	21.60	237.22	239.72
16000	23.04	263.43	265.93
17000	24.48	291.15	293.65
18000	25.92	320.36	322.86
19000	27.36	351.07	353.57
20000	28.80	383.25	385.75
21000	30.24	416.91	419.41
22000	31.68	452.04	454.54
23000	33.12	488.63	491.13
24000	34.56	526.67	529.17
25000	36.00	566.16	568.66

MIN Static Head = 35.4
MAX Static Head = 37.9

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point C

FM System Curve - 16" (Inside the PS)

Diameter = 16 in

Area = 1.396263 ft^2

RH= 0.333333

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	16.00	0.00	0.00	16.75	100	0.0000	0.0000	2.05	0.000	0.0000
250.0	0.36	0.56	16.00	0.40	0.00	16.75	100	0.0001	0.0013	2.05	0.005	0.0064
500.0	0.72	1.11	16.00	0.80	0.01	16.75	100	0.0003	0.0047	2.05	0.020	0.0250
750.0	1.08	1.67	16.00	1.20	0.02	16.75	100	0.0006	0.0100	2.05	0.046	0.0556
1000.0	1.44	2.23	16.00	1.60	0.04	16.75	100	0.0010	0.0170	2.05	0.081	0.0981
1250.0	1.80	2.79	16.00	1.99	0.06	16.75	100	0.0015	0.0257	2.05	0.127	0.1524
1500.0	2.16	3.34	16.00	2.39	0.09	16.75	100	0.0022	0.0360	2.05	0.182	0.2184
1750.0	2.52	3.90	16.00	2.79	0.12	16.75	100	0.0029	0.0479	2.05	0.248	0.2962
2000.0	2.88	4.46	16.00	3.19	0.16	16.75	100	0.0037	0.0614	2.05	0.324	0.3856
2250.0	3.24	5.01	16.00	3.59	0.20	16.75	100	0.0046	0.0763	2.05	0.410	0.4867
2500.0	3.60	5.57	16.00	3.99	0.25	16.75	100	0.0055	0.0928	2.05	0.507	0.5994
2750.0	3.96	6.13	16.00	4.39	0.30	16.75	100	0.0066	0.1107	2.05	0.613	0.7238
3000.0	4.32	6.68	16.00	4.79	0.36	16.75	100	0.0078	0.1301	2.05	0.730	0.8596
3250.0	4.68	7.24	16.00	5.19	0.42	16.75	100	0.0090	0.1508	2.05	0.856	1.0071
3500.0	5.04	7.80	16.00	5.59	0.48	16.75	100	0.0103	0.1730	2.05	0.993	1.1661
3750.0	5.40	8.36	16.00	5.98	0.56	16.75	100	0.0117	0.1966	2.05	1.140	1.3366
4000.0	5.76	8.91	16.00	6.38	0.63	16.75	100	0.0132	0.2216	2.05	1.297	1.5186
4250.0	6.12	9.47	16.00	6.78	0.71	16.75	100	0.0148	0.2479	2.05	1.464	1.7121
4500.0	6.48	10.03	16.00	7.18	0.80	16.75	100	0.0165	0.2756	2.05	1.642	1.9171
4750.0	6.84	10.58	16.00	7.58	0.89	16.75	100	0.0182	0.3046	2.05	1.829	2.1336
5000.0	7.20	11.14	16.00	7.98	0.99	16.75	100	0.0200	0.3350	2.05	2.027	2.3616
5250.0	7.56	11.70	16.00	8.38	1.09	16.75	100	0.0219	0.3667	2.05	2.234	2.6010
5500.0	7.92	12.25	16.00	8.78	1.20	16.75	100	0.0239	0.3997	2.05	2.452	2.8518
5750.0	8.28	12.81	16.00	9.18	1.31	16.75	100	0.0259	0.4340	2.05	2.680	3.1141
6000.0	8.64	13.37	16.00	9.57	1.42	16.75	100	0.0280	0.4695	2.05	2.918	3.3878
6250.0	9.00	13.93	16.00	9.97	1.54	16.75	100	0.0302	0.5064	2.05	3.167	3.6730
6500.0	9.36	14.48	16.00	10.37	1.67	16.75	100	0.0325	0.5446	2.05	3.425	3.9695
6750.0	9.72	15.04	16.00	10.77	1.80	16.75	100	0.0349	0.5840	2.05	3.693	4.2775
7000.0	10.08	15.60	16.00	11.17	1.94	16.75	100	0.0373	0.6247	2.05	3.972	4.5968
7250.0	10.44	16.15	16.00	11.57	2.08	16.75	100	0.0398	0.6666	2.05	4.261	4.9275
7500.0	10.80	16.71	16.00	11.97	2.22	16.75	100	0.0424	0.7098	2.05	4.560	5.2697
7750.0	11.16	17.27	16.00	12.37	2.38	16.75	100	0.0450	0.7543	2.05	4.869	5.6232
8000.0	11.52	17.83	16.00	12.77	2.53	16.75	100	0.0478	0.7999	2.05	5.188	5.9880
8250.0	11.88	18.38	16.00	13.17	2.69	16.75	100	0.0506	0.8469	2.05	5.517	6.3643
8500.0	12.24	18.94	16.00	13.56	2.86	16.75	100	0.0534	0.8950	2.05	5.857	6.7519
8750.0	12.60	19.50	16.00	13.96	3.03	16.75	100	0.0564	0.9444	2.05	6.206	7.1508
9000.0	12.96	20.05	16.00	14.36	3.20	16.75	100	0.0594	0.9949	2.05	6.566	7.5611
9250.0	13.32	20.61	16.00	14.76	3.38	16.75	100	0.0625	1.0467	2.05	6.936	7.9828
9500.0	13.68	21.17	16.00	15.16	3.57	16.75	100	0.0657	1.0997	2.05	7.316	8.4157
9750.0	14.04	21.72	16.00	15.56	3.76	16.75	100	0.0689	1.1539	2.05	7.706	8.8601
10000.0	14.40	22.28	16.00	15.96	3.95	16.75	100	0.0722	1.2093	2.05	8.106	9.3157
11000.0	15.84	24.51	16.00	17.55	4.78	16.75	100	0.0861	1.4428	2.05	9.809	11.2515
12000.0	17.28	26.74	16.00	19.15	5.69	16.75	100	0.1012	1.6950	2.05	11.673	13.3682
13000.0	18.72	28.97	16.00	20.75	6.68	16.75	100	0.1174	1.9659	2.05	13.700	15.6657
14000.0	20.16	31.19	16.00	22.34	7.75	16.75	100	0.1346	2.2551	2.05	15.889	18.1436
15000.0	21.60	33.42	16.00	23.94	8.90	16.75	100	0.1530	2.5625	2.05	18.239	20.8018
16000.0	23.04	35.65	16.00	25.53	10.12	16.75	100	0.1724	2.8878	2.05	20.752	23.6402
17000.0	24.48	37.88	16.00	27.13	11.43	16.75	100	0.1929	3.2309	2.05	23.427	26.6584
18000.0	25.92	40.11	16.00	28.72	12.81	16.75	100	0.2144	3.5917	2.05	26.265	29.8564
19000.0	27.36	42.34	16.00	30.32	14.28	16.75	100	0.2370	3.9700	2.05	29.264	33.2340
20000.0	28.80	44.56	16.00	31.92	15.82	16.75	100	0.2606	4.3656	2.05	32.426	36.7912
21000.0	30.24	46.79	16.00	33.51	17.44	16.75	100	0.2853	4.7784	2.05	35.749	40.5276
22000.0	31.68	49.02	16.00	35.11	19.14	16.75	100	0.3109	5.2084	2.05	39.235	44.4433
23000.0	33.12	51.25	16.00	36.70	20.92	16.75	100	0.3376	5.6553	2.05	42.883	48.5381

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point C

24000.0	34.56	53.48	16.00	38.30	22.78	16.75	100	0.3653	6.1191	2.05	46.693	52.8119
25000.0	36.00	55.70	16.00	39.90	24.71	16.75	100	0.3940	6.5997	2.05	50.665	57.2646

FM System Curve - 16" (Outside the PS)

Diameter = 16 in
Area = 1.396263 ft^2
RH= 0.333333
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	16.00	0.00	0.00	98.00	100	0.0000	0.0000	2.90	0.000	0.0000
250.0	0.36	0.56	16.00	0.40	0.00	98.00	100	0.0001	0.0076	2.90	0.007	0.0148
500.0	0.72	1.11	16.00	0.80	0.01	98.00	100	0.0003	0.0276	2.90	0.029	0.0562
750.0	1.08	1.67	16.00	1.20	0.02	98.00	100	0.0006	0.0584	2.90	0.065	0.1229
1000.0	1.44	2.23	16.00	1.60	0.04	98.00	100	0.0010	0.0995	2.90	0.115	0.2142
1250.0	1.80	2.79	16.00	1.99	0.06	98.00	100	0.0015	0.1504	2.90	0.179	0.3296
1500.0	2.16	3.34	16.00	2.39	0.09	98.00	100	0.0022	0.2108	2.90	0.258	0.4688
1750.0	2.52	3.90	16.00	2.79	0.12	98.00	100	0.0029	0.2804	2.90	0.351	0.6316
2000.0	2.88	4.46	16.00	3.19	0.16	98.00	100	0.0037	0.3591	2.90	0.459	0.8178
2250.0	3.24	5.01	16.00	3.59	0.20	98.00	100	0.0046	0.4467	2.90	0.581	1.0272
2500.0	3.60	5.57	16.00	3.99	0.25	98.00	100	0.0055	0.5429	2.90	0.717	1.2596
2750.0	3.96	6.13	16.00	4.39	0.30	98.00	100	0.0066	0.6477	2.90	0.867	1.5150
3000.0	4.32	6.68	16.00	4.79	0.36	98.00	100	0.0078	0.7610	2.90	1.032	1.7931
3250.0	4.68	7.24	16.00	5.19	0.42	98.00	100	0.0090	0.8826	2.90	1.211	2.0938
3500.0	5.04	7.80	16.00	5.59	0.48	98.00	100	0.0103	1.0124	2.90	1.405	2.4172
3750.0	5.40	8.36	16.00	5.98	0.56	98.00	100	0.0117	1.1504	2.90	1.613	2.7630
4000.0	5.76	8.91	16.00	6.38	0.63	98.00	100	0.0132	1.2965	2.90	1.835	3.1313
4250.0	6.12	9.47	16.00	6.78	0.71	98.00	100	0.0148	1.4505	2.90	2.071	3.5219
4500.0	6.48	10.03	16.00	7.18	0.80	98.00	100	0.0165	1.6125	2.90	2.322	3.9347
4750.0	6.84	10.58	16.00	7.58	0.89	98.00	100	0.0182	1.7823	2.90	2.587	4.3697
5000.0	7.20	11.14	16.00	7.98	0.99	98.00	100	0.0200	1.9599	2.90	2.867	4.8268
5250.0	7.56	11.70	16.00	8.38	1.09	98.00	100	0.0219	2.1453	2.90	3.161	5.3060
5500.0	7.92	12.25	16.00	8.78	1.20	98.00	100	0.0239	2.3383	2.90	3.469	5.8072
5750.0	8.28	12.81	16.00	9.18	1.31	98.00	100	0.0259	2.5389	2.90	3.791	6.3304
6000.0	8.64	13.37	16.00	9.57	1.42	98.00	100	0.0280	2.7472	2.90	4.128	6.8755
6250.0	9.00	13.93	16.00	9.97	1.54	98.00	100	0.0302	2.9629	2.90	4.480	7.4424
6500.0	9.36	14.48	16.00	10.37	1.67	98.00	100	0.0325	3.1861	2.90	4.845	8.0312
6750.0	9.72	15.04	16.00	10.77	1.80	98.00	100	0.0349	3.4168	2.90	5.225	8.6417
7000.0	10.08	15.60	16.00	11.17	1.94	98.00	100	0.0373	3.6548	2.90	5.619	9.2740
7250.0	10.44	16.15	16.00	11.57	2.08	98.00	100	0.0398	3.9003	2.90	6.028	9.9279
7500.0	10.80	16.71	16.00	11.97	2.22	98.00	100	0.0424	4.1530	2.90	6.451	10.6035
7750.0	11.16	17.27	16.00	12.37	2.38	98.00	100	0.0450	4.4130	2.90	6.888	11.3007
8000.0	11.52	17.83	16.00	12.77	2.53	98.00	100	0.0478	4.6803	2.90	7.339	12.0195
8250.0	11.88	18.38	16.00	13.17	2.69	98.00	100	0.0506	4.9547	2.90	7.805	12.7599
8500.0	12.24	18.94	16.00	13.56	2.86	98.00	100	0.0534	5.2364	2.90	8.285	13.5217
8750.0	12.60	19.50	16.00	13.96	3.03	98.00	100	0.0564	5.5252	2.90	8.780	14.3050
9000.0	12.96	20.05	16.00	14.36	3.20	98.00	100	0.0594	5.8211	2.90	9.289	15.1098
9250.0	13.32	20.61	16.00	14.76	3.38	98.00	100	0.0625	6.1241	2.90	9.812	15.9360
9500.0	13.68	21.17	16.00	15.16	3.57	98.00	100	0.0657	6.4342	2.90	10.349	16.7836
9750.0	14.04	21.72	16.00	15.56	3.76	98.00	100	0.0689	6.7512	2.90	10.901	17.6526
10000.0	14.40	22.28	16.00	15.96	3.95	98.00	100	0.0722	7.0753	2.90	11.468	18.5429
11000.0	15.84	24.51	16.00	17.55	4.78	98.00	100	0.0861	8.4412	2.90	13.876	22.3170
12000.0	17.28	26.74	16.00	19.15	5.69	98.00	100	0.1012	9.9172	2.90	16.513	26.4306
13000.0	18.72	28.97	16.00	20.75	6.68	98.00	100	0.1174	11.5019	2.90	19.380	30.8821
14000.0	20.16	31.19	16.00	22.34	7.75	98.00	100	0.1346	13.1940	2.90	22.476	35.6705
15000.0	21.60	33.42	16.00	23.94	8.90	98.00	100	0.1530	14.9923	2.90	25.802	40.7944
16000.0	23.04	35.65	16.00	25.53	10.12	98.00	100	0.1724	16.8958	2.90	29.357	46.2528
17000.0	24.48	37.88	16.00	27.13	11.43	98.00	100	0.1929	18.9033	2.90	33.141	52.0446
18000.0	25.92	40.11	16.00	28.72	12.81	98.00	100	0.2144	21.0142	2.90	37.155	58.1691
19000.0	27.36	42.34	16.00	30.32	14.28	98.00	100	0.2370	23.2273	2.90	41.398	64.6253

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point C

20000.0	28.80	44.56	16.00	31.92	15.82	98.00	100	0.2606	25.5420	2.90	45.870	71.4123
21000.0	30.24	46.79	16.00	33.51	17.44	98.00	100	0.2853	27.9574	2.90	50.572	78.5295
22000.0	31.68	49.02	16.00	35.11	19.14	98.00	100	0.3109	30.4729	2.90	55.503	85.9760
23000.0	33.12	51.25	16.00	36.70	20.92	98.00	100	0.3376	33.0878	2.90	60.663	93.7512
24000.0	34.56	53.48	16.00	38.30	22.78	98.00	100	0.3653	35.8013	2.90	66.053	101.8545
25000.0	36.00	55.70	16.00	39.90	24.71	98.00	100	0.3940	38.6129	2.90	71.672	110.2852

FM System Curve - 24" PVC (Outside the PS)

Diameter = 24 in

Area = 3.141593 ft^2

RH= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	11009	100	0.0000	0.0000	8.31	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	11009	100	0.0000	0.1190	8.31	0.004	0.1231
500.0	0.72	1.11	24.00	0.35	0.00	11009	100	0.0000	0.4296	8.31	0.016	0.4458
750.0	1.08	1.67	24.00	0.53	0.00	11009	100	0.0001	0.9103	8.31	0.037	0.9468
1000.0	1.44	2.23	24.00	0.71	0.01	11009	100	0.0001	1.5509	8.31	0.065	1.6158
1250.0	1.80	2.79	24.00	0.89	0.01	11009	100	0.0002	2.3445	8.31	0.101	2.4459
1500.0	2.16	3.34	24.00	1.06	0.02	11009	100	0.0003	3.2862	8.31	0.146	3.4322
1750.0	2.52	3.90	24.00	1.24	0.02	11009	100	0.0004	4.3720	8.31	0.199	4.5708
2000.0	2.88	4.46	24.00	1.42	0.03	11009	100	0.0005	5.5986	8.31	0.260	5.8582
2250.0	3.24	5.01	24.00	1.60	0.04	11009	100	0.0006	6.9633	8.31	0.329	7.2919
2500.0	3.60	5.57	24.00	1.77	0.05	11009	100	0.0008	8.4636	8.31	0.406	8.8693
2750.0	3.96	6.13	24.00	1.95	0.06	11009	100	0.0009	10.0975	8.31	0.491	10.5884
3000.0	4.32	6.68	24.00	2.13	0.07	11009	100	0.0011	11.8631	8.31	0.584	12.4473
3250.0	4.68	7.24	24.00	2.31	0.08	11009	100	0.0012	13.7587	8.31	0.686	14.4444
3500.0	5.04	7.80	24.00	2.48	0.10	11009	100	0.0014	15.7828	8.31	0.795	16.5780
3750.0	5.40	8.36	24.00	2.66	0.11	11009	100	0.0016	17.9340	8.31	0.913	18.8468
4000.0	5.76	8.91	24.00	2.84	0.12	11009	100	0.0018	20.2109	8.31	1.039	21.2495
4250.0	6.12	9.47	24.00	3.01	0.14	11009	100	0.0021	22.6124	8.31	1.172	23.7849
4500.0	6.48	10.03	24.00	3.19	0.16	11009	100	0.0023	25.1374	8.31	1.314	26.4518
4750.0	6.84	10.58	24.00	3.37	0.18	11009	100	0.0025	27.7848	8.31	1.465	29.2493
5000.0	7.20	11.14	24.00	3.55	0.20	11009	100	0.0028	30.5537	8.31	1.623	32.1764
5250.0	7.56	11.70	24.00	3.72	0.22	11009	100	0.0030	33.4431	8.31	1.789	35.2321
5500.0	7.92	12.25	24.00	3.90	0.24	11009	100	0.0033	36.4521	8.31	1.964	38.4156
5750.0	8.28	12.81	24.00	4.08	0.26	11009	100	0.0036	39.5800	8.31	2.146	41.7261
6000.0	8.64	13.37	24.00	4.26	0.28	11009	100	0.0039	42.8259	8.31	2.337	45.1627
6250.0	9.00	13.93	24.00	4.43	0.31	11009	100	0.0042	46.1892	8.31	2.536	48.7248
6500.0	9.36	14.48	24.00	4.61	0.33	11009	100	0.0045	49.6691	8.31	2.742	52.4115
6750.0	9.72	15.04	24.00	4.79	0.36	11009	100	0.0048	53.2649	8.31	2.957	56.2224
7000.0	10.08	15.60	24.00	4.96	0.38	11009	100	0.0052	56.9761	8.31	3.181	60.1566
7250.0	10.44	16.15	24.00	5.14	0.41	11009	100	0.0055	60.8019	8.31	3.412	64.2137
7500.0	10.80	16.71	24.00	5.32	0.44	11009	100	0.0059	64.7417	8.31	3.651	68.3929
7750.0	11.16	17.27	24.00	5.50	0.47	11009	100	0.0062	68.7951	8.31	3.899	72.6938
8000.0	11.52	17.83	24.00	5.67	0.50	11009	100	0.0066	72.9615	8.31	4.154	77.1157
8250.0	11.88	18.38	24.00	5.85	0.53	11009	100	0.0070	77.2402	8.31	4.418	81.6581
8500.0	12.24	18.94	24.00	6.03	0.56	11009	100	0.0074	81.6309	8.31	4.690	86.3206
8750.0	12.60	19.50	24.00	6.21	0.60	11009	100	0.0078	86.1330	8.31	4.970	91.1027
9000.0	12.96	20.05	24.00	6.38	0.63	11009	100	0.0082	90.7461	8.31	5.258	96.0038
9250.0	13.32	20.61	24.00	6.56	0.67	11009	100	0.0087	95.4697	8.31	5.554	101.0235
9500.0	13.68	21.17	24.00	6.74	0.70	11009	100	0.0091	100.3032	8.31	5.858	106.1613
9750.0	14.04	21.72	24.00	6.92	0.74	11009	100	0.0096	105.2464	8.31	6.170	111.4169
10000.0	14.40	22.28	24.00	7.09	0.78	11009	100	0.0100	110.2988	8.31	6.491	116.7898
11000.0	15.84	24.51	24.00	7.80	0.95	11009	100	0.0120	131.5922	8.31	7.854	139.4463
12000.0	17.28	26.74	24.00	8.51	1.12	11009	100	0.0140	154.6018	8.31	9.347	163.9488
13000.0	18.72	28.97	24.00	9.22	1.32	11009	100	0.0163	179.3056	8.31	10.970	190.2754
14000.0	20.16	31.19	24.00	9.93	1.53	11009	100	0.0187	205.6837	8.31	12.722	218.4061
15000.0	21.60	33.42	24.00	10.64	1.76	11009	100	0.0212	233.7178	8.31	14.605	248.3225

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point C

16000.0	23.04	35.65	24.00	11.35	2.00	11009	100	0.0239	263.3911	8.31	16.617	280.0080
17000.0	24.48	37.88	24.00	12.06	2.26	11009	100	0.0268	294.6879	8.31	18.759	313.4468
18000.0	25.92	40.11	24.00	12.77	2.53	11009	100	0.0298	327.5937	8.31	21.031	348.6244
19000.0	27.36	42.34	24.00	13.48	2.82	11009	100	0.0329	362.0950	8.31	23.432	385.5274
20000.0	28.80	44.56	24.00	14.18	3.12	11009	100	0.0362	398.1790	8.31	25.964	424.1429
21000.0	30.24	46.79	24.00	14.89	3.44	11009	100	0.0396	435.8339	8.31	28.625	464.4591
22000.0	31.68	49.02	24.00	15.60	3.78	11009	100	0.0432	475.0482	8.31	31.416	506.4645
23000.0	33.12	51.25	24.00	16.31	4.13	11009	100	0.0469	515.8112	8.31	34.337	550.1485
24000.0	34.56	53.48	24.00	17.02	4.50	11009	100	0.0507	558.1129	8.31	37.388	595.5009
25000.0	36.00	55.70	24.00	17.73	4.88	11009	100	0.0547	601.9435	8.31	40.569	642.5121

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point C

Q (gpm)	Q (mgd)	Losses
0	0.00	0.00
250	0.36	0.14
500	0.72	0.53
750	1.08	1.13
1000	1.44	1.93
1250	1.80	2.93
1500	2.16	4.12
1750	2.52	5.50
2000	2.88	7.06
2250	3.24	8.81
2500	3.60	10.73
2750	3.96	12.83
3000	4.32	15.10
3250	4.68	17.55
3500	5.04	20.16
3750	5.40	22.95
4000	5.76	25.90
4250	6.12	29.02
4500	6.48	32.30
4750	6.84	35.75
5000	7.20	39.36
5250	7.56	43.14
5500	7.92	47.07
5750	8.28	51.17
6000	8.64	55.43
6250	9.00	59.84
6500	9.36	64.41
6750	9.72	69.14
7000	10.08	74.03
7250	10.44	79.07
7500	10.80	84.27
7750	11.16	89.62
8000	11.52	95.12
8250	11.88	100.78
8500	12.24	106.59
8750	12.60	112.56
9000	12.96	118.67
9250	13.32	124.94
9500	13.68	131.36
9750	14.04	137.93
10000	14.40	144.65
11000	15.84	173.01
12000	17.28	203.75
13000	18.72	236.82
14000	20.16	272.22
15000	21.60	309.92
16000	23.04	349.90
17000	24.48	392.15
18000	25.92	436.65
19000	27.36	483.39
20000	28.80	532.35
21000	30.24	583.52
22000	31.68	636.88
23000	33.12	692.44
24000	34.56	750.17
25000	36.00	810.06

Q (gpm)	Q (mgd)	Min Static	Max Static
0	0.00	28.90	31.40
250	0.36	29.04	31.54
500	0.72	29.43	31.93
750	1.08	30.03	32.53
1000	1.44	30.83	33.33
1250	1.80	31.83	34.33
1500	2.16	33.02	35.52
1750	2.52	34.40	36.90
2000	2.88	35.96	38.46
2250	3.24	37.71	40.21
2500	3.60	39.63	42.13
2750	3.96	41.73	44.23
3000	4.32	44.00	46.50
3250	4.68	46.45	48.95
3500	5.04	49.06	51.56
3750	5.40	51.85	54.35
4000	5.76	54.80	57.30
4250	6.12	57.92	60.42
4500	6.48	61.20	63.70
4750	6.84	64.65	67.15
5000	7.20	68.26	70.76
5250	7.56	72.04	74.54
5500	7.92	75.97	78.47
5750	8.28	80.07	82.57
6000	8.64	84.33	86.83
6250	9.00	88.74	91.24
6500	9.36	93.31	95.81
6750	9.72	98.04	100.54
7000	10.08	102.93	105.43
7250	10.44	107.97	110.47
7500	10.80	113.17	115.67
7750	11.16	118.52	121.02
8000	11.52	124.02	126.52
8250	11.88	129.68	132.18
8500	12.24	135.49	137.99
8750	12.60	141.46	143.96
9000	12.96	147.57	150.07
9250	13.32	153.84	156.34
9500	13.68	160.26	162.76
9750	14.04	166.83	169.33
10000	14.40	173.55	176.05
11000	15.84	201.91	204.41
12000	17.28	232.65	235.15
13000	18.72	265.72	268.22
14000	20.16	301.12	303.62
15000	21.60	338.82	341.32
16000	23.04	378.80	381.30
17000	24.48	421.05	423.55
18000	25.92	465.55	468.05
19000	27.36	512.29	514.79
20000	28.80	561.25	563.75
21000	30.24	612.42	614.92
22000	31.68	665.78	668.28
23000	33.12	721.34	723.84
24000	34.56	779.07	781.57
25000	36.00	838.96	841.46

MIN Static Head = 28.9
MAX Static Head = 31.4

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point D

FM System Curve - 16" (Inside the PS)

Diameter = 16 in
Area = 1.396263 ft^2
RH=D/4= 0.333333
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	16.00	0.00	0.00	16.75	100	0.0000	0.0000	2.05	0.000	0.0000
250.0	0.36	0.56	16.00	0.40	0.00	16.75	100	0.0001	0.0013	2.05	0.005	0.0064
500.0	0.72	1.11	16.00	0.80	0.01	16.75	100	0.0003	0.0047	2.05	0.020	0.0250
750.0	1.08	1.67	16.00	1.20	0.02	16.75	100	0.0006	0.0100	2.05	0.046	0.0556
1000.0	1.44	2.23	16.00	1.60	0.04	16.75	100	0.0010	0.0170	2.05	0.081	0.0981
1250.0	1.80	2.79	16.00	1.99	0.06	16.75	100	0.0015	0.0257	2.05	0.127	0.1524
1500.0	2.16	3.34	16.00	2.39	0.09	16.75	100	0.0022	0.0360	2.05	0.182	0.2184
1750.0	2.52	3.90	16.00	2.79	0.12	16.75	100	0.0029	0.0479	2.05	0.248	0.2962
2000.0	2.88	4.46	16.00	3.19	0.16	16.75	100	0.0037	0.0614	2.05	0.324	0.3856
2250.0	3.24	5.01	16.00	3.59	0.20	16.75	100	0.0046	0.0763	2.05	0.410	0.4867
2500.0	3.60	5.57	16.00	3.99	0.25	16.75	100	0.0055	0.0928	2.05	0.507	0.5994
2750.0	3.96	6.13	16.00	4.39	0.30	16.75	100	0.0066	0.1107	2.05	0.613	0.7238
3000.0	4.32	6.68	16.00	4.79	0.36	16.75	100	0.0078	0.1301	2.05	0.730	0.8596
3250.0	4.68	7.24	16.00	5.19	0.42	16.75	100	0.0090	0.1508	2.05	0.856	1.0071
3500.0	5.04	7.80	16.00	5.59	0.48	16.75	100	0.0103	0.1730	2.05	0.993	1.1661
3750.0	5.40	8.36	16.00	5.98	0.56	16.75	100	0.0117	0.1966	2.05	1.140	1.3366
4000.0	5.76	8.91	16.00	6.38	0.63	16.75	100	0.0132	0.2216	2.05	1.297	1.5186
4250.0	6.12	9.47	16.00	6.78	0.71	16.75	100	0.0148	0.2479	2.05	1.464	1.7121
4500.0	6.48	10.03	16.00	7.18	0.80	16.75	100	0.0165	0.2756	2.05	1.642	1.9171
4750.0	6.84	10.58	16.00	7.58	0.89	16.75	100	0.0182	0.3046	2.05	1.829	2.1336
5000.0	7.20	11.14	16.00	7.98	0.99	16.75	100	0.0200	0.3350	2.05	2.027	2.3616
5250.0	7.56	11.70	16.00	8.38	1.09	16.75	100	0.0219	0.3667	2.05	2.234	2.6010
5500.0	7.92	12.25	16.00	8.78	1.20	16.75	100	0.0239	0.3997	2.05	2.452	2.8518
5750.0	8.28	12.81	16.00	9.18	1.31	16.75	100	0.0259	0.4340	2.05	2.680	3.1141
6000.0	8.64	13.37	16.00	9.57	1.42	16.75	100	0.0280	0.4695	2.05	2.918	3.3878
6250.0	9.00	13.93	16.00	9.97	1.54	16.75	100	0.0302	0.5064	2.05	3.167	3.6730
6500.0	9.36	14.48	16.00	10.37	1.67	16.75	100	0.0325	0.5446	2.05	3.425	3.9695
6750.0	9.72	15.04	16.00	10.77	1.80	16.75	100	0.0349	0.5840	2.05	3.693	4.2775
7000.0	10.08	15.60	16.00	11.17	1.94	16.75	100	0.0373	0.6247	2.05	3.972	4.5968
7250.0	10.44	16.15	16.00	11.57	2.08	16.75	100	0.0398	0.6666	2.05	4.261	4.9275
7500.0	10.80	16.71	16.00	11.97	2.22	16.75	100	0.0424	0.7098	2.05	4.560	5.2697
7750.0	11.16	17.27	16.00	12.37	2.38	16.75	100	0.0450	0.7543	2.05	4.869	5.6232
8000.0	11.52	17.83	16.00	12.77	2.53	16.75	100	0.0478	0.7999	2.05	5.188	5.9880
8250.0	11.88	18.38	16.00	13.17	2.69	16.75	100	0.0506	0.8469	2.05	5.517	6.3643
8500.0	12.24	18.94	16.00	13.56	2.86	16.75	100	0.0534	0.8950	2.05	5.857	6.7519
8750.0	12.60	19.50	16.00	13.96	3.03	16.75	100	0.0564	0.9444	2.05	6.206	7.1508
9000.0	12.96	20.05	16.00	14.36	3.20	16.75	100	0.0594	0.9949	2.05	6.566	7.5611
9250.0	13.32	20.61	16.00	14.76	3.38	16.75	100	0.0625	1.0467	2.05	6.936	7.9828
9500.0	13.68	21.17	16.00	15.16	3.57	16.75	100	0.0657	1.0997	2.05	7.316	8.4157
9750.0	14.04	21.72	16.00	15.56	3.76	16.75	100	0.0689	1.1539	2.05	7.706	8.8601
10000.0	14.40	22.28	16.00	15.96	3.95	16.75	100	0.0722	1.2093	2.05	8.106	9.3157
11000.0	15.84	24.51	16.00	17.55	4.78	16.75	100	0.0861	1.4428	2.05	9.809	11.2515
12000.0	17.28	26.74	16.00	19.15	5.69	16.75	100	0.1012	1.6950	2.05	11.673	13.3682
13000.0	18.72	28.97	16.00	20.75	6.68	16.75	100	0.1174	1.9659	2.05	13.700	15.6657
14000.0	20.16	31.19	16.00	22.34	7.75	16.75	100	0.1346	2.2551	2.05	15.889	18.1436
15000.0	21.60	33.42	16.00	23.94	8.90	16.75	100	0.1530	2.5625	2.05	18.239	20.8018
16000.0	23.04	35.65	16.00	25.53	10.12	16.75	100	0.1724	2.8878	2.05	20.752	23.6402
17000.0	24.48	37.88	16.00	27.13	11.43	16.75	100	0.1929	3.2309	2.05	23.427	26.6584
18000.0	25.92	40.11	16.00	28.72	12.81	16.75	100	0.2144	3.5917	2.05	26.265	29.8564
19000.0	27.36	42.34	16.00	30.32	14.28	16.75	100	0.2370	3.9700	2.05	29.264	33.2340
20000.0	28.80	44.56	16.00	31.92	15.82	16.75	100	0.2606	4.3656	2.05	32.426	36.7912
21000.0	30.24	46.79	16.00	33.51	17.44	16.75	100	0.2853	4.7784	2.05	35.749	40.5276
22000.0	31.68	49.02	16.00	35.11	19.14	16.75	100	0.3109	5.2084	2.05	39.235	44.4433
23000.0	33.12	51.25	16.00	36.70	20.92	16.75	100	0.3376	5.6553	2.05	42.883	48.5381

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point D

24000.0	34.56	53.48	16.00	38.30	22.78	16.75	100	0.3653	6.1191	2.05	46.693	52.8119
25000.0	36.00	55.70	16.00	39.90	24.71	16.75	100	0.3940	6.5997	2.05	50.665	57.2646

FM System Curve - 16" (Outside the PS)

Diameter = 16 in
Area = 1.396263 ft^2
RH= 0.333333
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	16.00	0.00	0.00	98.00	100	0.0000	0.0000	2.90	0.000	0.0000
250.0	0.36	0.56	16.00	0.40	0.00	98.00	100	0.0001	0.0076	2.90	0.007	0.0148
500.0	0.72	1.11	16.00	0.80	0.01	98.00	100	0.0003	0.0276	2.90	0.029	0.0562
750.0	1.08	1.67	16.00	1.20	0.02	98.00	100	0.0006	0.0584	2.90	0.065	0.1229
1000.0	1.44	2.23	16.00	1.60	0.04	98.00	100	0.0010	0.0995	2.90	0.115	0.2142
1250.0	1.80	2.79	16.00	1.99	0.06	98.00	100	0.0015	0.1504	2.90	0.179	0.3296
1500.0	2.16	3.34	16.00	2.39	0.09	98.00	100	0.0022	0.2108	2.90	0.258	0.4688
1750.0	2.52	3.90	16.00	2.79	0.12	98.00	100	0.0029	0.2804	2.90	0.351	0.6316
2000.0	2.88	4.46	16.00	3.19	0.16	98.00	100	0.0037	0.3591	2.90	0.459	0.8178
2250.0	3.24	5.01	16.00	3.59	0.20	98.00	100	0.0046	0.4467	2.90	0.581	1.0272
2500.0	3.60	5.57	16.00	3.99	0.25	98.00	100	0.0055	0.5429	2.90	0.717	1.2596
2750.0	3.96	6.13	16.00	4.39	0.30	98.00	100	0.0066	0.6477	2.90	0.867	1.5150
3000.0	4.32	6.68	16.00	4.79	0.36	98.00	100	0.0078	0.7610	2.90	1.032	1.7931
3250.0	4.68	7.24	16.00	5.19	0.42	98.00	100	0.0090	0.8826	2.90	1.211	2.0938
3500.0	5.04	7.80	16.00	5.59	0.48	98.00	100	0.0103	1.0124	2.90	1.405	2.4172
3750.0	5.40	8.36	16.00	5.98	0.56	98.00	100	0.0117	1.1504	2.90	1.613	2.7630
4000.0	5.76	8.91	16.00	6.38	0.63	98.00	100	0.0132	1.2965	2.90	1.835	3.1313
4250.0	6.12	9.47	16.00	6.78	0.71	98.00	100	0.0148	1.4505	2.90	2.071	3.5219
4500.0	6.48	10.03	16.00	7.18	0.80	98.00	100	0.0165	1.6125	2.90	2.322	3.9347
4750.0	6.84	10.58	16.00	7.58	0.89	98.00	100	0.0182	1.7823	2.90	2.587	4.3697
5000.0	7.20	11.14	16.00	7.98	0.99	98.00	100	0.0200	1.9599	2.90	2.867	4.8268
5250.0	7.56	11.70	16.00	8.38	1.09	98.00	100	0.0219	2.1453	2.90	3.161	5.3060
5500.0	7.92	12.25	16.00	8.78	1.20	98.00	100	0.0239	2.3383	2.90	3.469	5.8072
5750.0	8.28	12.81	16.00	9.18	1.31	98.00	100	0.0259	2.5389	2.90	3.791	6.3304
6000.0	8.64	13.37	16.00	9.57	1.42	98.00	100	0.0280	2.7472	2.90	4.128	6.8755
6250.0	9.00	13.93	16.00	9.97	1.54	98.00	100	0.0302	2.9629	2.90	4.480	7.4424
6500.0	9.36	14.48	16.00	10.37	1.67	98.00	100	0.0325	3.1861	2.90	4.845	8.0312
6750.0	9.72	15.04	16.00	10.77	1.80	98.00	100	0.0349	3.4168	2.90	5.225	8.6417
7000.0	10.08	15.60	16.00	11.17	1.94	98.00	100	0.0373	3.6548	2.90	5.619	9.2740
7250.0	10.44	16.15	16.00	11.57	2.08	98.00	100	0.0398	3.9003	2.90	6.028	9.9279
7500.0	10.80	16.71	16.00	11.97	2.22	98.00	100	0.0424	4.1530	2.90	6.451	10.6035
7750.0	11.16	17.27	16.00	12.37	2.38	98.00	100	0.0450	4.4130	2.90	6.888	11.3007
8000.0	11.52	17.83	16.00	12.77	2.53	98.00	100	0.0478	4.6803	2.90	7.339	12.0195
8250.0	11.88	18.38	16.00	13.17	2.69	98.00	100	0.0506	4.9547	2.90	7.805	12.7599
8500.0	12.24	18.94	16.00	13.56	2.86	98.00	100	0.0534	5.2364	2.90	8.285	13.5217
8750.0	12.60	19.50	16.00	13.96	3.03	98.00	100	0.0564	5.5252	2.90	8.780	14.3050
9000.0	12.96	20.05	16.00	14.36	3.20	98.00	100	0.0594	5.8211	2.90	9.289	15.1098
9250.0	13.32	20.61	16.00	14.76	3.38	98.00	100	0.0625	6.1241	2.90	9.812	15.9360
9500.0	13.68	21.17	16.00	15.16	3.57	98.00	100	0.0657	6.4342	2.90	10.349	16.7836
9750.0	14.04	21.72	16.00	15.56	3.76	98.00	100	0.0689	6.7512	2.90	10.901	17.6526
10000.0	14.40	22.28	16.00	15.96	3.95	98.00	100	0.0722	7.0753	2.90	11.468	18.5429
11000.0	15.84	24.51	16.00	17.55	4.78	98.00	100	0.0861	8.4412	2.90	13.876	22.3170
12000.0	17.28	26.74	16.00	19.15	5.69	98.00	100	0.1012	9.9172	2.90	16.513	26.4306
13000.0	18.72	28.97	16.00	20.75	6.68	98.00	100	0.1174	11.5019	2.90	19.380	30.8821
14000.0	20.16	31.19	16.00	22.34	7.75	98.00	100	0.1346	13.1940	2.90	22.476	35.6705
15000.0	21.60	33.42	16.00	23.94	8.90	98.00	100	0.1530	14.9923	2.90	25.802	40.7944
16000.0	23.04	35.65	16.00	25.53	10.12	98.00	100	0.1724	16.8958	2.90	29.357	46.2528
17000.0	24.48	37.88	16.00	27.13	11.43	98.00	100	0.1929	18.9033	2.90	33.141	52.0446
18000.0	25.92	40.11	16.00	28.72	12.81	98.00	100	0.2144	21.0142	2.90	37.155	58.1691
19000.0	27.36	42.34	16.00	30.32	14.28	98.00	100	0.2370	23.2273	2.90	41.398	64.6253

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point D

20000.0	28.80	44.56	16.00	31.92	15.82	98.00	100	0.2606	25.5420	2.90	45.870	71.4123
21000.0	30.24	46.79	16.00	33.51	17.44	98.00	100	0.2853	27.9574	2.90	50.572	78.5295
22000.0	31.68	49.02	16.00	35.11	19.14	98.00	100	0.3109	30.4729	2.90	55.503	85.9760
23000.0	33.12	51.25	16.00	36.70	20.92	98.00	100	0.3376	33.0878	2.90	60.663	93.7512
24000.0	34.56	53.48	16.00	38.30	22.78	98.00	100	0.3653	35.8013	2.90	66.053	101.8545
25000.0	36.00	55.70	16.00	39.90	24.71	98.00	100	0.3940	38.6129	2.90	71.672	110.2852

FM System Curve - 24" PVC (Outside the PS)

Diameter = 24 in

Area = 3.141593 ft^2

RH= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	13533	100	0.0000	0.0000	9.31	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	13533	100	0.0000	0.1463	9.31	0.005	0.1508
500.0	0.72	1.11	24.00	0.35	0.00	13533	100	0.0000	0.5281	9.31	0.018	0.5463
750.0	1.08	1.67	24.00	0.53	0.00	13533	100	0.0001	1.1190	9.31	0.041	1.1599
1000.0	1.44	2.23	24.00	0.71	0.01	13533	100	0.0001	1.9064	9.31	0.073	1.9791
1250.0	1.80	2.79	24.00	0.89	0.01	13533	100	0.0002	2.8820	9.31	0.114	2.9956
1500.0	2.16	3.34	24.00	1.06	0.02	13533	100	0.0003	4.0396	9.31	0.164	4.2032
1750.0	2.52	3.90	24.00	1.24	0.02	13533	100	0.0004	5.3743	9.31	0.223	5.5970
2000.0	2.88	4.46	24.00	1.42	0.03	13533	100	0.0005	6.8822	9.31	0.291	7.1730
2250.0	3.24	5.01	24.00	1.60	0.04	13533	100	0.0006	8.5597	9.31	0.368	8.9279
2500.0	3.60	5.57	24.00	1.77	0.05	13533	100	0.0008	10.4040	9.31	0.455	10.8585
2750.0	3.96	6.13	24.00	1.95	0.06	13533	100	0.0009	12.4126	9.31	0.550	12.9625
3000.0	4.32	6.68	24.00	2.13	0.07	13533	100	0.0011	14.5830	9.31	0.654	15.2374
3250.0	4.68	7.24	24.00	2.31	0.08	13533	100	0.0012	16.9132	9.31	0.768	17.6813
3500.0	5.04	7.80	24.00	2.48	0.10	13533	100	0.0014	19.4013	9.31	0.891	20.2921
3750.0	5.40	8.36	24.00	2.66	0.11	13533	100	0.0016	22.0457	9.31	1.023	23.0683
4000.0	5.76	8.91	24.00	2.84	0.12	13533	100	0.0018	24.8446	9.31	1.164	26.0081
4250.0	6.12	9.47	24.00	3.01	0.14	13533	100	0.0021	27.7967	9.31	1.314	29.1102
4500.0	6.48	10.03	24.00	3.19	0.16	13533	100	0.0023	30.9006	9.31	1.473	32.3732
4750.0	6.84	10.58	24.00	3.37	0.18	13533	100	0.0025	34.1549	9.31	1.641	35.7957
5000.0	7.20	11.14	24.00	3.55	0.20	13533	100	0.0028	37.5586	9.31	1.818	39.3766
5250.0	7.56	11.70	24.00	3.72	0.22	13533	100	0.0030	41.1104	9.31	2.004	43.1148
5500.0	7.92	12.25	24.00	3.90	0.24	13533	100	0.0033	44.8094	9.31	2.200	47.0092
5750.0	8.28	12.81	24.00	4.08	0.26	13533	100	0.0036	48.6544	9.31	2.404	51.0587
6000.0	8.64	13.37	24.00	4.26	0.28	13533	100	0.0039	52.6445	9.31	2.618	55.2625
6250.0	9.00	13.93	24.00	4.43	0.31	13533	100	0.0042	56.7789	9.31	2.841	59.6195
6500.0	9.36	14.48	24.00	4.61	0.33	13533	100	0.0045	61.0566	9.31	3.072	64.1290
6750.0	9.72	15.04	24.00	4.79	0.36	13533	100	0.0048	65.4768	9.31	3.313	68.7902
7000.0	10.08	15.60	24.00	4.96	0.38	13533	100	0.0052	70.0388	9.31	3.563	73.6021
7250.0	10.44	16.15	24.00	5.14	0.41	13533	100	0.0055	74.7417	9.31	3.822	78.5641
7500.0	10.80	16.71	24.00	5.32	0.44	13533	100	0.0059	79.5849	9.31	4.091	83.6754
7750.0	11.16	17.27	24.00	5.50	0.47	13533	100	0.0062	84.5676	9.31	4.368	88.9354
8000.0	11.52	17.83	24.00	5.67	0.50	13533	100	0.0066	89.6891	9.31	4.654	94.3432
8250.0	11.88	18.38	24.00	5.85	0.53	13533	100	0.0070	94.9489	9.31	4.950	99.8984
8500.0	12.24	18.94	24.00	6.03	0.56	13533	100	0.0074	100.3462	9.31	5.254	105.6003
8750.0	12.60	19.50	24.00	6.21	0.60	13533	100	0.0078	105.8805	9.31	5.568	111.4482
9000.0	12.96	20.05	24.00	6.38	0.63	13533	100	0.0082	111.5512	9.31	5.890	117.4416
9250.0	13.32	20.61	24.00	6.56	0.67	13533	100	0.0087	117.3577	9.31	6.222	123.5799
9500.0	13.68	21.17	24.00	6.74	0.70	13533	100	0.0091	123.2995	9.31	6.563	129.8625
9750.0	14.04	21.72	24.00	6.92	0.74	13533	100	0.0096	129.3760	9.31	6.913	136.2890
10000.0	14.40	22.28	24.00	7.09	0.78	13533	100	0.0100	135.5867	9.31	7.272	142.8588
11000.0	15.84	24.51	24.00	7.80	0.95	13533	100	0.0120	161.7619	9.31	8.799	170.5611
12000.0	17.28	26.74	24.00	8.51	1.12	13533	100	0.0140	190.0469	9.31	10.472	200.5187
13000.0	18.72	28.97	24.00	9.22	1.32	13533	100	0.0163	220.4145	9.31	12.290	232.7043
14000.0	20.16	31.19	24.00	9.93	1.53	13533	100	0.0187	252.8402	9.31	14.253	267.0935
15000.0	21.60	33.42	24.00	10.64	1.76	13533	100	0.0212	287.3016	9.31	16.362	303.6638

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point D

16000.0	23.04	35.65	24.00	11.35	2.00	13533	100	0.0239	323.7779	9.31	18.617	342.3945
17000.0	24.48	37.88	24.00	12.06	2.26	13533	100	0.0268	362.2501	9.31	21.016	383.2664
18000.0	25.92	40.11	24.00	12.77	2.53	13533	100	0.0298	402.7001	9.31	23.562	426.2616
19000.0	27.36	42.34	24.00	13.48	2.82	13533	100	0.0329	445.1114	9.31	26.252	471.3636
20000.0	28.80	44.56	24.00	14.18	3.12	13533	100	0.0362	489.4683	9.31	29.088	518.5566
21000.0	30.24	46.79	24.00	14.89	3.44	13533	100	0.0396	535.7562	9.31	32.070	567.8260
22000.0	31.68	49.02	24.00	15.60	3.78	13533	100	0.0432	583.9610	9.31	35.197	619.1579
23000.0	33.12	51.25	24.00	16.31	4.13	13533	100	0.0469	634.0697	9.31	38.469	672.5390
24000.0	34.56	53.48	24.00	17.02	4.50	13533	100	0.0507	686.0698	9.31	41.887	727.9569
25000.0	36.00	55.70	24.00	17.73	4.88	13533	100	0.0547	739.9493	9.31	45.450	785.3998

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point D

Q (gpm)	Q (mgd)	Losses
0	0.00	0.00
250	0.36	0.17
500	0.72	0.63
750	1.08	1.34
1000	1.44	2.29
1250	1.80	3.48
1500	2.16	4.89
1750	2.52	6.52
2000	2.88	8.38
2250	3.24	10.44
2500	3.60	12.72
2750	3.96	15.20
3000	4.32	17.89
3250	4.68	20.78
3500	5.04	23.88
3750	5.40	27.17
4000	5.76	30.66
4250	6.12	34.34
4500	6.48	38.22
4750	6.84	42.30
5000	7.20	46.57
5250	7.56	51.02
5500	7.92	55.67
5750	8.28	60.50
6000	8.64	65.53
6250	9.00	70.73
6500	9.36	76.13
6750	9.72	81.71
7000	10.08	87.47
7250	10.44	93.42
7500	10.80	99.55
7750	11.16	105.86
8000	11.52	112.35
8250	11.88	119.02
8500	12.24	125.87
8750	12.60	132.90
9000	12.96	140.11
9250	13.32	147.50
9500	13.68	155.06
9750	14.04	162.80
10000	14.40	170.72
11000	15.84	204.13
12000	17.28	240.32
13000	18.72	279.25
14000	20.16	320.91
15000	21.60	365.26
16000	23.04	412.29
17000	24.48	461.97
18000	25.92	514.29
19000	27.36	569.22
20000	28.80	626.76
21000	30.24	686.88
22000	31.68	749.58
23000	33.12	814.83
24000	34.56	882.62
25000	36.00	952.95

Q (gpm)	Q (mgd)	Min Static	Max Static
0	0.00	28.23	30.73
250	0.36	28.40	30.90
500	0.72	28.86	31.36
750	1.08	29.57	32.07
1000	1.44	30.52	33.02
1250	1.80	31.71	34.21
1500	2.16	33.12	35.62
1750	2.52	34.75	37.25
2000	2.88	36.61	39.11
2250	3.24	38.67	41.17
2500	3.60	40.95	43.45
2750	3.96	43.43	45.93
3000	4.32	46.12	48.62
3250	4.68	49.01	51.51
3500	5.04	52.11	54.61
3750	5.40	55.40	57.90
4000	5.76	58.89	61.39
4250	6.12	62.57	65.07
4500	6.48	66.45	68.95
4750	6.84	70.53	73.03
5000	7.20	74.80	77.30
5250	7.56	79.25	81.75
5500	7.92	83.90	86.40
5750	8.28	88.73	91.23
6000	8.64	93.76	96.26
6250	9.00	98.96	101.46
6500	9.36	104.36	106.86
6750	9.72	109.94	112.44
7000	10.08	115.70	118.20
7250	10.44	121.65	124.15
7500	10.80	127.78	130.28
7750	11.16	134.09	136.59
8000	11.52	140.58	143.08
8250	11.88	147.25	149.75
8500	12.24	154.10	156.60
8750	12.60	161.13	163.63
9000	12.96	168.34	170.84
9250	13.32	175.73	178.23
9500	13.68	183.29	185.79
9750	14.04	191.03	193.53
10000	14.40	198.95	201.45
11000	15.84	232.36	234.86
12000	17.28	268.55	271.05
13000	18.72	307.48	309.98
14000	20.16	349.14	351.64
15000	21.60	393.49	395.99
16000	23.04	440.52	443.02
17000	24.48	490.20	492.70
18000	25.92	542.52	545.02
19000	27.36	597.45	599.95
20000	28.80	654.99	657.49
21000	30.24	715.11	717.61
22000	31.68	777.81	780.31
23000	33.12	843.06	845.56
24000	34.56	910.85	913.35
25000	36.00	981.18	983.68

MIN Static Head = 28.23
MAX Static Head = 30.73

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point E

FM System Curve - 16" (Inside the PS)

Diameter = 16 in

Area = 1.396263 ft^2

RH= 0.333333

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	16.00	0.00	0.00	16.75	100	0.0000	0.0000	2.05	0.000	0.0000
250.0	0.36	0.56	16.00	0.40	0.00	16.75	100	0.0001	0.0013	2.05	0.005	0.0064
500.0	0.72	1.11	16.00	0.80	0.01	16.75	100	0.0003	0.0047	2.05	0.020	0.0250
750.0	1.08	1.67	16.00	1.20	0.02	16.75	100	0.0006	0.0100	2.05	0.046	0.0556
1000.0	1.44	2.23	16.00	1.60	0.04	16.75	100	0.0010	0.0170	2.05	0.081	0.0981
1250.0	1.80	2.79	16.00	1.99	0.06	16.75	100	0.0015	0.0257	2.05	0.127	0.1524
1500.0	2.16	3.34	16.00	2.39	0.09	16.75	100	0.0022	0.0360	2.05	0.182	0.2184
1750.0	2.52	3.90	16.00	2.79	0.12	16.75	100	0.0029	0.0479	2.05	0.248	0.2962
2000.0	2.88	4.46	16.00	3.19	0.16	16.75	100	0.0037	0.0614	2.05	0.324	0.3856
2250.0	3.24	5.01	16.00	3.59	0.20	16.75	100	0.0046	0.0763	2.05	0.410	0.4867
2500.0	3.60	5.57	16.00	3.99	0.25	16.75	100	0.0055	0.0928	2.05	0.507	0.5994
2750.0	3.96	6.13	16.00	4.39	0.30	16.75	100	0.0066	0.1107	2.05	0.613	0.7238
3000.0	4.32	6.68	16.00	4.79	0.36	16.75	100	0.0078	0.1301	2.05	0.730	0.8596
3250.0	4.68	7.24	16.00	5.19	0.42	16.75	100	0.0090	0.1508	2.05	0.856	1.0071
3500.0	5.04	7.80	16.00	5.59	0.48	16.75	100	0.0103	0.1730	2.05	0.993	1.1661
3750.0	5.40	8.36	16.00	5.98	0.56	16.75	100	0.0117	0.1966	2.05	1.140	1.3366
4000.0	5.76	8.91	16.00	6.38	0.63	16.75	100	0.0132	0.2216	2.05	1.297	1.5186
4250.0	6.12	9.47	16.00	6.78	0.71	16.75	100	0.0148	0.2479	2.05	1.464	1.7121
4500.0	6.48	10.03	16.00	7.18	0.80	16.75	100	0.0165	0.2756	2.05	1.642	1.9171
4750.0	6.84	10.58	16.00	7.58	0.89	16.75	100	0.0182	0.3046	2.05	1.829	2.1336
5000.0	7.20	11.14	16.00	7.98	0.99	16.75	100	0.0200	0.3350	2.05	2.027	2.3616
5250.0	7.56	11.70	16.00	8.38	1.09	16.75	100	0.0219	0.3667	2.05	2.234	2.6010
5500.0	7.92	12.25	16.00	8.78	1.20	16.75	100	0.0239	0.3997	2.05	2.452	2.8518
5750.0	8.28	12.81	16.00	9.18	1.31	16.75	100	0.0259	0.4340	2.05	2.680	3.1141
6000.0	8.64	13.37	16.00	9.57	1.42	16.75	100	0.0280	0.4695	2.05	2.918	3.3878
6250.0	9.00	13.93	16.00	9.97	1.54	16.75	100	0.0302	0.5064	2.05	3.167	3.6730
6500.0	9.36	14.48	16.00	10.37	1.67	16.75	100	0.0325	0.5446	2.05	3.425	3.9695
6750.0	9.72	15.04	16.00	10.77	1.80	16.75	100	0.0349	0.5840	2.05	3.693	4.2775
7000.0	10.08	15.60	16.00	11.17	1.94	16.75	100	0.0373	0.6247	2.05	3.972	4.5968
7250.0	10.44	16.15	16.00	11.57	2.08	16.75	100	0.0398	0.6666	2.05	4.261	4.9275
7500.0	10.80	16.71	16.00	11.97	2.22	16.75	100	0.0424	0.7098	2.05	4.560	5.2697
7750.0	11.16	17.27	16.00	12.37	2.38	16.75	100	0.0450	0.7543	2.05	4.869	5.6232
8000.0	11.52	17.83	16.00	12.77	2.53	16.75	100	0.0478	0.7999	2.05	5.188	5.9880
8250.0	11.88	18.38	16.00	13.17	2.69	16.75	100	0.0506	0.8469	2.05	5.517	6.3643
8500.0	12.24	18.94	16.00	13.56	2.86	16.75	100	0.0534	0.8950	2.05	5.857	6.7519
8750.0	12.60	19.50	16.00	13.96	3.03	16.75	100	0.0564	0.9444	2.05	6.206	7.1508
9000.0	12.96	20.05	16.00	14.36	3.20	16.75	100	0.0594	0.9949	2.05	6.566	7.5611
9250.0	13.32	20.61	16.00	14.76	3.38	16.75	100	0.0625	1.0467	2.05	6.936	7.9828
9500.0	13.68	21.17	16.00	15.16	3.57	16.75	100	0.0657	1.0997	2.05	7.316	8.4157
9750.0	14.04	21.72	16.00	15.56	3.76	16.75	100	0.0689	1.1539	2.05	7.706	8.8601
10000.0	14.40	22.28	16.00	15.96	3.95	16.75	100	0.0722	1.2093	2.05	8.106	9.3157
11000.0	15.84	24.51	16.00	17.55	4.78	16.75	100	0.0861	1.4428	2.05	9.809	11.2515
12000.0	17.28	26.74	16.00	19.15	5.69	16.75	100	0.1012	1.6950	2.05	11.673	13.3682
13000.0	18.72	28.97	16.00	20.75	6.68	16.75	100	0.1174	1.9659	2.05	13.700	15.6657
14000.0	20.16	31.19	16.00	22.34	7.75	16.75	100	0.1346	2.2551	2.05	15.889	18.1436
15000.0	21.60	33.42	16.00	23.94	8.90	16.75	100	0.1530	2.5625	2.05	18.239	20.8018
16000.0	23.04	35.65	16.00	25.53	10.12	16.75	100	0.1724	2.8878	2.05	20.752	23.6402
17000.0	24.48	37.88	16.00	27.13	11.43	16.75	100	0.1929	3.2309	2.05	23.427	26.6584
18000.0	25.92	40.11	16.00	28.72	12.81	16.75	100	0.2144	3.5917	2.05	26.265	29.8564
19000.0	27.36	42.34	16.00	30.32	14.28	16.75	100	0.2370	3.9700	2.05	29.264	33.2340
20000.0	28.80	44.56	16.00	31.92	15.82	16.75	100	0.2606	4.3656	2.05	32.426	36.7912
21000.0	30.24	46.79	16.00	33.51	17.44	16.75	100	0.2853	4.7784	2.05	35.749	40.5276
22000.0	31.68	49.02	16.00	35.11	19.14	16.75	100	0.3109	5.2084	2.05	39.235	44.4433
23000.0	33.12	51.25	16.00	36.70	20.92	16.75	100	0.3376	5.6553	2.05	42.883	48.5381

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point E

24000.0	34.56	53.48	16.00	38.30	22.78	16.75	100	0.3653	6.1191	2.05	46.693	52.8119
25000.0	36.00	55.70	16.00	39.90	24.71	16.75	100	0.3940	6.5997	2.05	50.665	57.2646

FM System Curve - 16" (Outside the PS)

Diameter = 16 in
Area = 1.396263 ft^2
RH= 0.333333
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	16.00	0.00	0.00	98.00	100	0.0000	0.0000	2.90	0.000	0.0000
250.0	0.36	0.56	16.00	0.40	0.00	98.00	100	0.0001	0.0076	2.90	0.007	0.0148
500.0	0.72	1.11	16.00	0.80	0.01	98.00	100	0.0003	0.0276	2.90	0.029	0.0562
750.0	1.08	1.67	16.00	1.20	0.02	98.00	100	0.0006	0.0584	2.90	0.065	0.1229
1000.0	1.44	2.23	16.00	1.60	0.04	98.00	100	0.0010	0.0995	2.90	0.115	0.2142
1250.0	1.80	2.79	16.00	1.99	0.06	98.00	100	0.0015	0.1504	2.90	0.179	0.3296
1500.0	2.16	3.34	16.00	2.39	0.09	98.00	100	0.0022	0.2108	2.90	0.258	0.4688
1750.0	2.52	3.90	16.00	2.79	0.12	98.00	100	0.0029	0.2804	2.90	0.351	0.6316
2000.0	2.88	4.46	16.00	3.19	0.16	98.00	100	0.0037	0.3591	2.90	0.459	0.8178
2250.0	3.24	5.01	16.00	3.59	0.20	98.00	100	0.0046	0.4467	2.90	0.581	1.0272
2500.0	3.60	5.57	16.00	3.99	0.25	98.00	100	0.0055	0.5429	2.90	0.717	1.2596
2750.0	3.96	6.13	16.00	4.39	0.30	98.00	100	0.0066	0.6477	2.90	0.867	1.5150
3000.0	4.32	6.68	16.00	4.79	0.36	98.00	100	0.0078	0.7610	2.90	1.032	1.7931
3250.0	4.68	7.24	16.00	5.19	0.42	98.00	100	0.0090	0.8826	2.90	1.211	2.0938
3500.0	5.04	7.80	16.00	5.59	0.48	98.00	100	0.0103	1.0124	2.90	1.405	2.4172
3750.0	5.40	8.36	16.00	5.98	0.56	98.00	100	0.0117	1.1504	2.90	1.613	2.7630
4000.0	5.76	8.91	16.00	6.38	0.63	98.00	100	0.0132	1.2965	2.90	1.835	3.1313
4250.0	6.12	9.47	16.00	6.78	0.71	98.00	100	0.0148	1.4505	2.90	2.071	3.5219
4500.0	6.48	10.03	16.00	7.18	0.80	98.00	100	0.0165	1.6125	2.90	2.322	3.9347
4750.0	6.84	10.58	16.00	7.58	0.89	98.00	100	0.0182	1.7823	2.90	2.587	4.3697
5000.0	7.20	11.14	16.00	7.98	0.99	98.00	100	0.0200	1.9599	2.90	2.867	4.8268
5250.0	7.56	11.70	16.00	8.38	1.09	98.00	100	0.0219	2.1453	2.90	3.161	5.3060
5500.0	7.92	12.25	16.00	8.78	1.20	98.00	100	0.0239	2.3383	2.90	3.469	5.8072
5750.0	8.28	12.81	16.00	9.18	1.31	98.00	100	0.0259	2.5389	2.90	3.791	6.3304
6000.0	8.64	13.37	16.00	9.57	1.42	98.00	100	0.0280	2.7472	2.90	4.128	6.8755
6250.0	9.00	13.93	16.00	9.97	1.54	98.00	100	0.0302	2.9629	2.90	4.480	7.4424
6500.0	9.36	14.48	16.00	10.37	1.67	98.00	100	0.0325	3.1861	2.90	4.845	8.0312
6750.0	9.72	15.04	16.00	10.77	1.80	98.00	100	0.0349	3.4168	2.90	5.225	8.6417
7000.0	10.08	15.60	16.00	11.17	1.94	98.00	100	0.0373	3.6548	2.90	5.619	9.2740
7250.0	10.44	16.15	16.00	11.57	2.08	98.00	100	0.0398	3.9003	2.90	6.028	9.9279
7500.0	10.80	16.71	16.00	11.97	2.22	98.00	100	0.0424	4.1530	2.90	6.451	10.6035
7750.0	11.16	17.27	16.00	12.37	2.38	98.00	100	0.0450	4.4130	2.90	6.888	11.3007
8000.0	11.52	17.83	16.00	12.77	2.53	98.00	100	0.0478	4.6803	2.90	7.339	12.0195
8250.0	11.88	18.38	16.00	13.17	2.69	98.00	100	0.0506	4.9547	2.90	7.805	12.7599
8500.0	12.24	18.94	16.00	13.56	2.86	98.00	100	0.0534	5.2364	2.90	8.285	13.5217
8750.0	12.60	19.50	16.00	13.96	3.03	98.00	100	0.0564	5.5252	2.90	8.780	14.3050
9000.0	12.96	20.05	16.00	14.36	3.20	98.00	100	0.0594	5.8211	2.90	9.289	15.1098
9250.0	13.32	20.61	16.00	14.76	3.38	98.00	100	0.0625	6.1241	2.90	9.812	15.9360
9500.0	13.68	21.17	16.00	15.16	3.57	98.00	100	0.0657	6.4342	2.90	10.349	16.7836
9750.0	14.04	21.72	16.00	15.56	3.76	98.00	100	0.0689	6.7512	2.90	10.901	17.6526
10000.0	14.40	22.28	16.00	15.96	3.95	98.00	100	0.0722	7.0753	2.90	11.468	18.5429
11000.0	15.84	24.51	16.00	17.55	4.78	98.00	100	0.0861	8.4412	2.90	13.876	22.3170
12000.0	17.28	26.74	16.00	19.15	5.69	98.00	100	0.1012	9.9172	2.90	16.513	26.4306
13000.0	18.72	28.97	16.00	20.75	6.68	98.00	100	0.1174	11.5019	2.90	19.380	30.8821
14000.0	20.16	31.19	16.00	22.34	7.75	98.00	100	0.1346	13.1940	2.90	22.476	35.6705
15000.0	21.60	33.42	16.00	23.94	8.90	98.00	100	0.1530	14.9923	2.90	25.802	40.7944
16000.0	23.04	35.65	16.00	25.53	10.12	98.00	100	0.1724	16.8958	2.90	29.357	46.2528
17000.0	24.48	37.88	16.00	27.13	11.43	98.00	100	0.1929	18.9033	2.90	33.141	52.0446
18000.0	25.92	40.11	16.00	28.72	12.81	98.00	100	0.2144	21.0142	2.90	37.155	58.1691
19000.0	27.36	42.34	16.00	30.32	14.28	98.00	100	0.2370	23.2273	2.90	41.398	64.6253

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point E

20000.0	28.80	44.56	16.00	31.92	15.82	98.00	100	0.2606	25.5420	2.90	45.870	71.4123
21000.0	30.24	46.79	16.00	33.51	17.44	98.00	100	0.2853	27.9574	2.90	50.572	78.5295
22000.0	31.68	49.02	16.00	35.11	19.14	98.00	100	0.3109	30.4729	2.90	55.503	85.9760
23000.0	33.12	51.25	16.00	36.70	20.92	98.00	100	0.3376	33.0878	2.90	60.663	93.7512
24000.0	34.56	53.48	16.00	38.30	22.78	98.00	100	0.3653	35.8013	2.90	66.053	101.8545
25000.0	36.00	55.70	16.00	39.90	24.71	98.00	100	0.3940	38.6129	2.90	71.672	110.2852

FM System Curve - 24" PVC (Outside the PS)

Diameter = 24 in

Area = 3.141593 ft^2

RH= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	15782	100	0.0000	0.0000	13.09	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	15782	100	0.0000	0.1706	13.09	0.006	0.1770
500.0	0.72	1.11	24.00	0.35	0.00	15782	100	0.0000	0.6159	13.09	0.026	0.6414
750.0	1.08	1.67	24.00	0.53	0.00	15782	100	0.0001	1.3050	13.09	0.058	1.3625
1000.0	1.44	2.23	24.00	0.71	0.01	15782	100	0.0001	2.2232	13.09	0.102	2.3255
1250.0	1.80	2.79	24.00	0.89	0.01	15782	100	0.0002	3.3610	13.09	0.160	3.5207
1500.0	2.16	3.34	24.00	1.06	0.02	15782	100	0.0003	4.7109	13.09	0.230	4.9410
1750.0	2.52	3.90	24.00	1.24	0.02	15782	100	0.0004	6.2675	13.09	0.313	6.5806
2000.0	2.88	4.46	24.00	1.42	0.03	15782	100	0.0005	8.0259	13.09	0.409	8.4349
2250.0	3.24	5.01	24.00	1.60	0.04	15782	100	0.0006	9.9822	13.09	0.518	10.4998
2500.0	3.60	5.57	24.00	1.77	0.05	15782	100	0.0008	12.1330	13.09	0.639	12.7721
2750.0	3.96	6.13	24.00	1.95	0.06	15782	100	0.0009	14.4754	13.09	0.773	15.2486
3000.0	4.32	6.68	24.00	2.13	0.07	15782	100	0.0011	17.0064	13.09	0.920	17.9267
3250.0	4.68	7.24	24.00	2.31	0.08	15782	100	0.0012	19.7239	13.09	1.080	20.8039
3500.0	5.04	7.80	24.00	2.48	0.10	15782	100	0.0014	22.6255	13.09	1.253	23.8781
3750.0	5.40	8.36	24.00	2.66	0.11	15782	100	0.0016	25.7093	13.09	1.438	27.1472
4000.0	5.76	8.91	24.00	2.84	0.12	15782	100	0.0018	28.9734	13.09	1.636	30.6094
4250.0	6.12	9.47	24.00	3.01	0.14	15782	100	0.0021	32.4161	13.09	1.847	34.2630
4500.0	6.48	10.03	24.00	3.19	0.16	15782	100	0.0023	36.0358	13.09	2.070	38.1063
4750.0	6.84	10.58	24.00	3.37	0.18	15782	100	0.0025	39.8310	13.09	2.307	42.1380
5000.0	7.20	11.14	24.00	3.55	0.20	15782	100	0.0028	43.8003	13.09	2.556	46.3565
5250.0	7.56	11.70	24.00	3.72	0.22	15782	100	0.0030	47.9424	13.09	2.818	50.7606
5500.0	7.92	12.25	24.00	3.90	0.24	15782	100	0.0033	52.2561	13.09	3.093	55.3490
5750.0	8.28	12.81	24.00	4.08	0.26	15782	100	0.0036	56.7401	13.09	3.381	60.1206
6000.0	8.64	13.37	24.00	4.26	0.28	15782	100	0.0039	61.3933	13.09	3.681	65.0742
6250.0	9.00	13.93	24.00	4.43	0.31	15782	100	0.0042	66.2148	13.09	3.994	70.2088
6500.0	9.36	14.48	24.00	4.61	0.33	15782	100	0.0045	71.2034	13.09	4.320	75.5233
6750.0	9.72	15.04	24.00	4.79	0.36	15782	100	0.0048	76.3582	13.09	4.659	81.0168
7000.0	10.08	15.60	24.00	4.96	0.38	15782	100	0.0052	81.6783	13.09	5.010	86.6884
7250.0	10.44	16.15	24.00	5.14	0.41	15782	100	0.0055	87.1628	13.09	5.374	92.5371
7500.0	10.80	16.71	24.00	5.32	0.44	15782	100	0.0059	92.8108	13.09	5.751	98.5622
7750.0	11.16	17.27	24.00	5.50	0.47	15782	100	0.0062	98.6215	13.09	6.141	104.7627
8000.0	11.52	17.83	24.00	5.67	0.50	15782	100	0.0066	104.5942	13.09	6.544	111.1380
8250.0	11.88	18.38	24.00	5.85	0.53	15782	100	0.0070	110.7281	13.09	6.959	117.6872
8500.0	12.24	18.94	24.00	6.03	0.56	15782	100	0.0074	117.0224	13.09	7.387	124.4097
8750.0	12.60	19.50	24.00	6.21	0.60	15782	100	0.0078	123.4764	13.09	7.828	131.3046
9000.0	12.96	20.05	24.00	6.38	0.63	15782	100	0.0082	130.0895	13.09	8.282	138.3714
9250.0	13.32	20.61	24.00	6.56	0.67	15782	100	0.0087	136.8609	13.09	8.748	145.6094
9500.0	13.68	21.17	24.00	6.74	0.70	15782	100	0.0091	143.7901	13.09	9.228	153.0179
9750.0	14.04	21.72	24.00	6.92	0.74	15782	100	0.0096	150.8765	13.09	9.720	160.5963
10000.0	14.40	22.28	24.00	7.09	0.78	15782	100	0.0100	158.1193	13.09	10.225	168.3440
11000.0	15.84	24.51	24.00	7.80	0.95	15782	100	0.0120	188.6446	13.09	12.372	201.0164
12000.0	17.28	26.74	24.00	8.51	1.12	15782	100	0.0140	221.6301	13.09	14.723	236.3536
13000.0	18.72	28.97	24.00	9.22	1.32	15782	100	0.0163	257.0444	13.09	17.280	274.3240
14000.0	20.16	31.19	24.00	9.93	1.53	15782	100	0.0187	294.8588	13.09	20.040	314.8991
15000.0	21.60	33.42	24.00	10.64	1.76	15782	100	0.0212	335.0472	13.09	23.005	358.0527

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point E

16000.0	23.04	35.65	24.00	11.35	2.00	15782	100	0.0239	377.5854	13.09	26.175	403.7605
17000.0	24.48	37.88	24.00	12.06	2.26	15782	100	0.0268	422.4511	13.09	29.549	452.0003
18000.0	25.92	40.11	24.00	12.77	2.53	15782	100	0.0298	469.6234	13.09	33.128	502.7512
19000.0	27.36	42.34	24.00	13.48	2.82	15782	100	0.0329	519.0829	13.09	36.911	555.9938
20000.0	28.80	44.56	24.00	14.18	3.12	15782	100	0.0362	570.8113	13.09	40.899	611.7099
21000.0	30.24	46.79	24.00	14.89	3.44	15782	100	0.0396	624.7916	13.09	45.091	669.8823
22000.0	31.68	49.02	24.00	15.60	3.78	15782	100	0.0432	681.0074	13.09	49.487	730.4947
23000.0	33.12	51.25	24.00	16.31	4.13	15782	100	0.0469	739.4435	13.09	54.088	793.5318
24000.0	34.56	53.48	24.00	17.02	4.50	15782	100	0.0507	800.0852	13.09	58.894	858.9792
25000.0	36.00	55.70	24.00	17.73	4.88	15782	100	0.0547	862.9188	13.09	63.904	926.8228

Antioch Pump Station with AFM102

Forcemain AFM102 – High Point E

Q (gpm)	Q (mgd)	Losses
0	0.00	0.00
250	0.36	0.20
500	0.72	0.72
750	1.08	1.54
1000	1.44	2.64
1250	1.80	4.00
1500	2.16	5.63
1750	2.52	7.51
2000	2.88	9.64
2250	3.24	12.01
2500	3.60	14.63
2750	3.96	17.49
3000	4.32	20.58
3250	4.68	23.90
3500	5.04	27.46
3750	5.40	31.25
4000	5.76	35.26
4250	6.12	39.50
4500	6.48	43.96
4750	6.84	48.64
5000	7.20	53.54
5250	7.56	58.67
5500	7.92	64.01
5750	8.28	69.57
6000	8.64	75.34
6250	9.00	81.32
6500	9.36	87.52
6750	9.72	93.94
7000	10.08	100.56
7250	10.44	107.39
7500	10.80	114.44
7750	11.16	121.69
8000	11.52	129.15
8250	11.88	136.81
8500	12.24	144.68
8750	12.60	152.76
9000	12.96	161.04
9250	13.32	169.53
9500	13.68	178.22
9750	14.04	187.11
10000	14.40	196.20
11000	15.84	234.58
12000	17.28	276.15
13000	18.72	320.87
14000	20.16	368.71
15000	21.60	419.65
16000	23.04	473.65
17000	24.48	530.70
18000	25.92	590.78
19000	27.36	653.85
20000	28.80	719.91
21000	30.24	788.94
22000	31.68	860.91
23000	33.12	935.82
24000	34.56	1013.65
25000	36.00	1094.37

Q (gpm)	Q (mgd)	Min Static	Max Static
0	0.00	23.90	26.40
250	0.36	24.10	26.60
500	0.72	24.62	27.12
750	1.08	25.44	27.94
1000	1.44	26.54	29.04
1250	1.80	27.90	30.40
1500	2.16	29.53	32.03
1750	2.52	31.41	33.91
2000	2.88	33.54	36.04
2250	3.24	35.91	38.41
2500	3.60	38.53	41.03
2750	3.96	41.39	43.89
3000	4.32	44.48	46.98
3250	4.68	47.80	50.30
3500	5.04	51.36	53.86
3750	5.40	55.15	57.65
4000	5.76	59.16	61.66
4250	6.12	63.40	65.90
4500	6.48	67.86	70.36
4750	6.84	72.54	75.04
5000	7.20	77.44	79.94
5250	7.56	82.57	85.07
5500	7.92	87.91	90.41
5750	8.28	93.47	95.97
6000	8.64	99.24	101.74
6250	9.00	105.22	107.72
6500	9.36	111.42	113.92
6750	9.72	117.84	120.34
7000	10.08	124.46	126.96
7250	10.44	131.29	133.79
7500	10.80	138.34	140.84
7750	11.16	145.59	148.09
8000	11.52	153.05	155.55
8250	11.88	160.71	163.21
8500	12.24	168.58	171.08
8750	12.60	176.66	179.16
9000	12.96	184.94	187.44
9250	13.32	193.43	195.93
9500	13.68	202.12	204.62
9750	14.04	211.01	213.51
10000	14.40	220.10	222.60
11000	15.84	258.48	260.98
12000	17.28	300.05	302.55
13000	18.72	344.77	347.27
14000	20.16	392.61	395.11
15000	21.60	443.55	446.05
16000	23.04	497.55	500.05
17000	24.48	554.60	557.10
18000	25.92	614.68	617.18
19000	27.36	677.75	680.25
20000	28.80	743.81	746.31
21000	30.24	812.84	815.34
22000	31.68	884.81	887.31
23000	33.12	959.72	962.22
24000	34.56	1037.55	1040.05
25000	36.00	1118.27	1120.77

MIN Static Head = 23.9
MAX Static Head = 26.4

Antioch Pump Station with AFM102

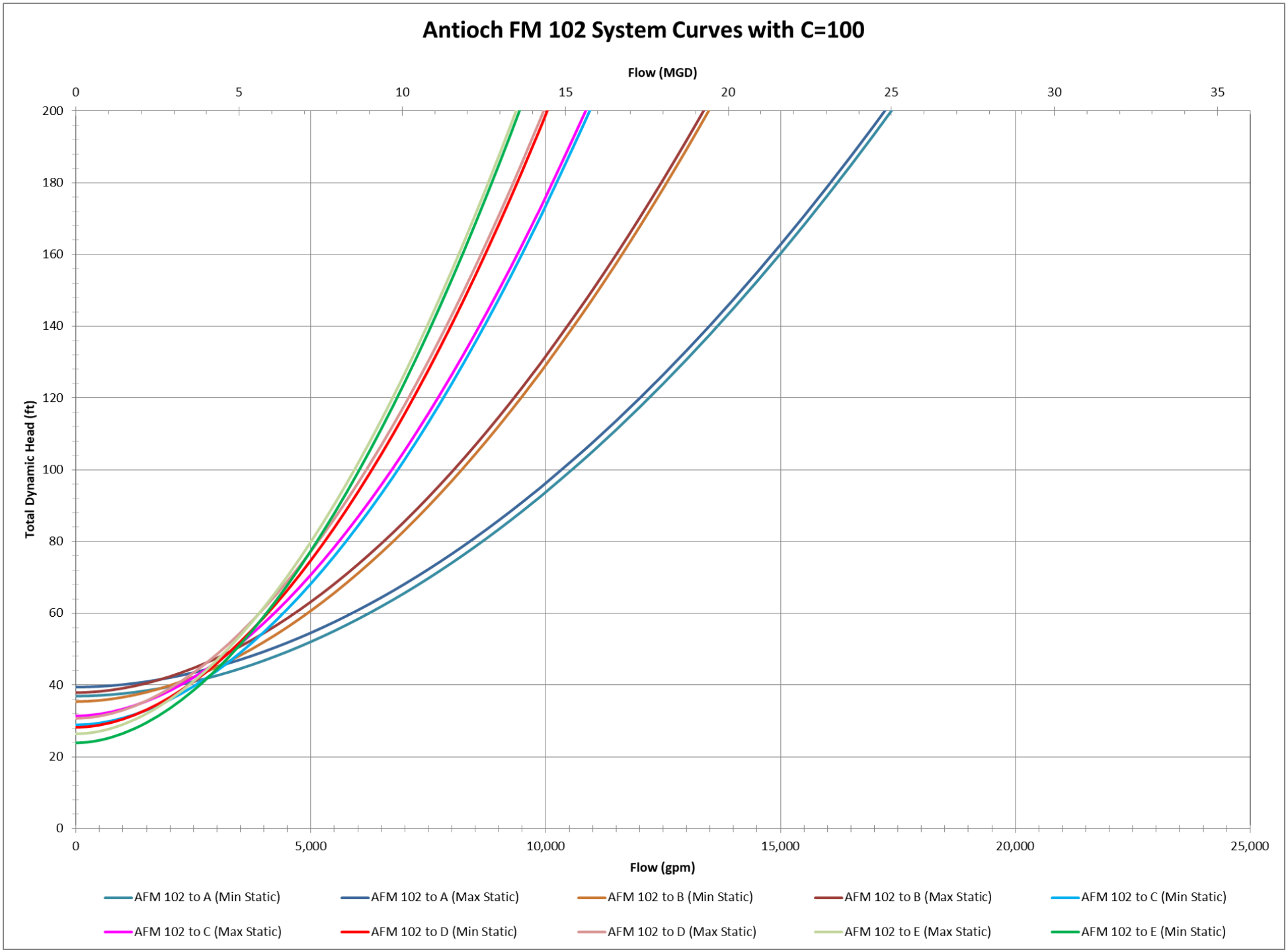
Forcemain AFM102 – Final Curve

Q (gpm)	Q (mgd)	Total Losses For Pump MIN Static (ft)	Total Losses For Pump MAX Static (ft)
0	0	36.93	39.43
250	0.36	36.98	39.48
500	0.72	37.12	39.62
750	1.08	37.34	39.84
1000	1.44	37.64	40.14
1250	1.8	38.01	40.51
1500	2.16	38.46	40.96
1750	2.52	38.98	41.48
1800	2.592	39.10	41.60
2250	3.24	41.02	43.52
2500	3.6	42.25	44.75
2785	4.0104	43.80	46.30
3000	4.32	46.12	48.62
3250	4.68	49.01	51.51
3500	5.04	52.11	54.61
3750	5.4	55.40	57.90
3870	5.5728	57.05	59.55
4000	5.76	59.16	61.66
4250	6.12	63.40	65.90
4500	6.48	67.86	70.36
4750	6.84	72.54	75.04
5000	7.2	77.44	79.94
5250	7.56	82.57	85.07
5500	7.92	87.91	90.41
5750	8.28	93.47	95.97
6000	8.64	99.24	101.74
6250	9	105.22	107.72
6500	9.36	111.42	113.92
6750	9.72	117.84	120.34
7000	10.08	124.46	126.96
7250	10.44	131.29	133.79
7500	10.8	138.34	140.84
7750	11.16	145.59	148.09
8000	11.52	153.05	155.55
8250	11.88	160.71	163.21
8500	12.24	168.58	171.08
8750	12.6	176.66	179.16
9000	12.96	184.94	187.44
9250	13.32	193.43	195.93
9500	13.68	202.12	204.62
9750	14.04	211.01	213.51
10000	14.4	220.10	222.60
11000	15.84	258.48	260.98
12000	17.28	300.05	302.55
13000	18.72	344.77	347.27
14000	20.16	392.61	395.11
15000	21.6	443.55	446.05
16000	23.04	497.55	500.05
17000	24.48	554.60	557.10
18000	25.92	614.68	617.18
19000	27.36	677.75	680.25
20000	28.8	743.81	746.31
21000	30.24	812.84	815.34
22000	31.68	884.81	887.31
23000	33.12	959.72	962.22
24000	34.56	1037.55	1040.05
25000	36	1118.27	1120.77

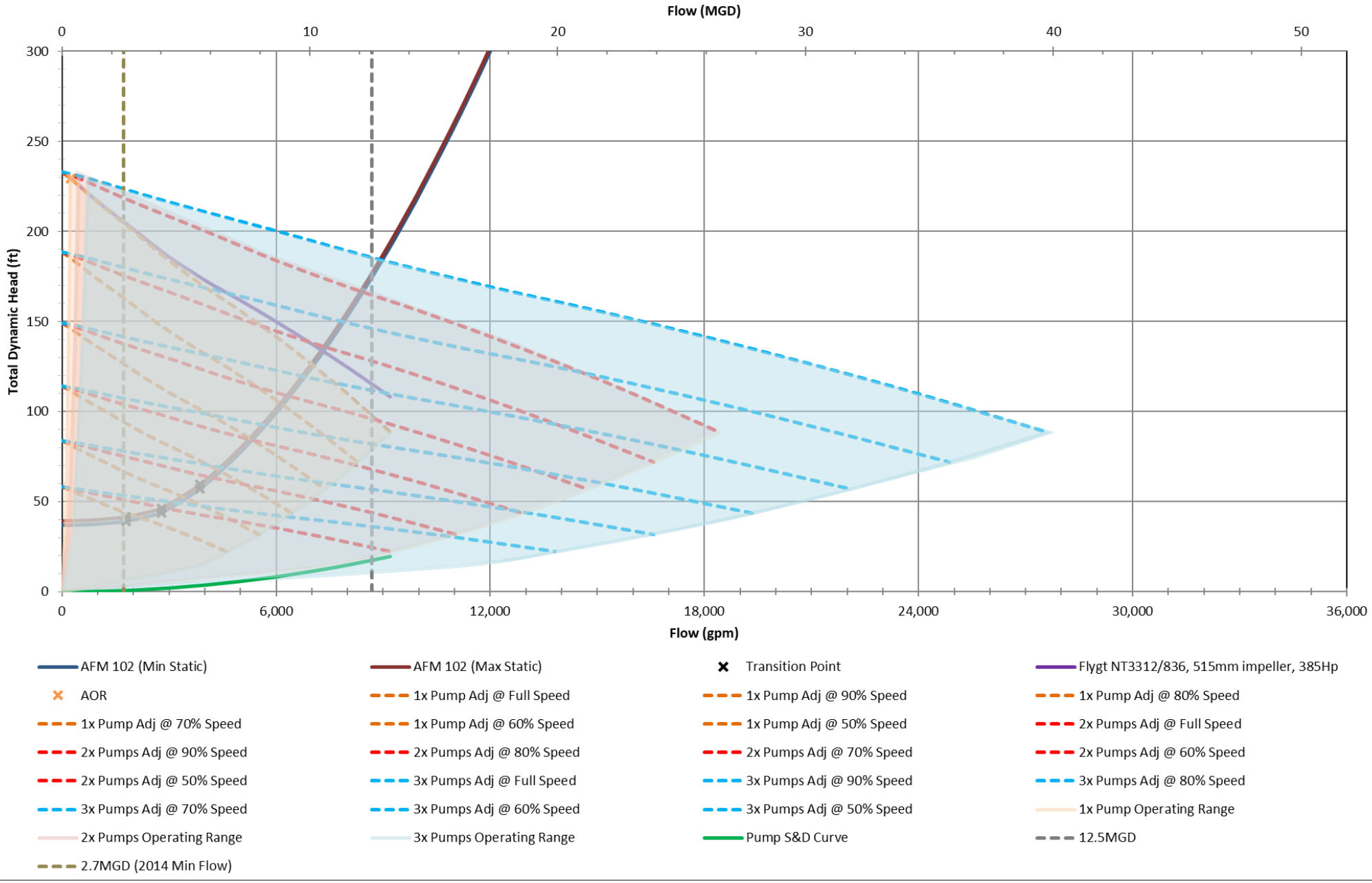
Antioch Pump Station with AFM102

Forcemain AFM102 – Final Curve

26000	37.44	1201.89	1204.39
27000	38.88	1288.38	1290.88
28000	40.32	1377.73	1380.23
29000	41.76	1469.94	1472.44
30000	43.20	1564.98	1567.48
31000	44.64	1662.85	1665.35
32000	46.08	1763.54	1766.04
33000	47.52	1867.04	1869.54
34000	48.96	1973.33	1975.83
35000	50.40	2082.40	2084.90
36000	51.84	2194.26	2196.76


Antioch FM 102 System Curves with C=100
Flow (MGD)
0
5
10
15
20
25
30
35
Total Dynamic Head (ft)
0
20
40
60
80
100
120
140
160
180
200
Flow (gpm)
0
5,000
10,000
15,000
20,000
25,000
AFM 102 to A (Min Static)
AFM 102 to A (Max Static)
AFM 102 to B (Min Static)
AFM 102 to B (Max Static)
AFM 102 to C (Min Static)
AFM 102 to C (Max Static)
AFM 102 to D (Min Static)
AFM 102 to D (Max Static)
AFM 102 to E (Max Static)
AFM 102 to E (Min Static)

Antioch PS w/ AFM 102 (C=100) w/ Equal Sized Pumps

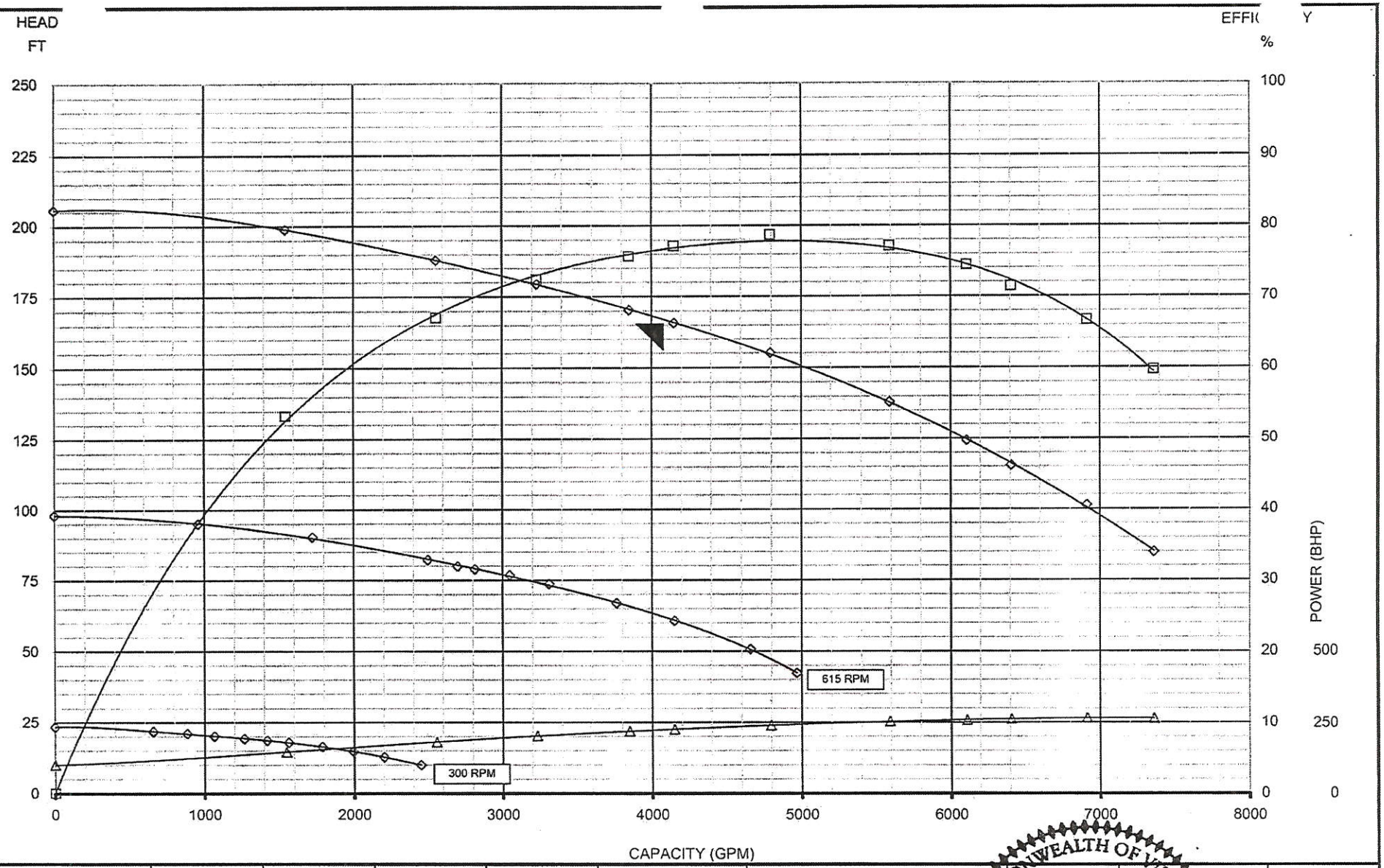


V.W. HOUSEN & ASSOCIATES

Appendix D. BHPS w/ AFM102: Main Pump Station – Pump and Hydraulic Information

V.W. HOUSEN & ASSOCIATES

BHPS w/ AFM102: Main Pump Station – Existing Fairbanks Morse Pump Information



0802MS004468-1	S4468	10MFC27	1	MAIN WELL	PUMP	JOB	12x9	03/12/08	1WB
SERIAL NO.	ORDER NO.	MODEL	STAGES	TEST LOOP	TYPE OF TEST	TEST MOTOR	VENTURI	DATE TESTED	CURVE NO

CASING DATA		IMPELLER DATA		CONDITIONS OF SERVICE	
2.5-3% NI CI	MATERIAL	2.5-3% NI CI	#2 FINISH	4084 GPM	166 FT
		MATERIAL		FLOW	HEAD
1A	FINISH	26.61	DIAMETER	1	895 RPM
				SG	SPEED
N/A	TONGUE	DEBURR	TIP		93
					TEMP. (F)

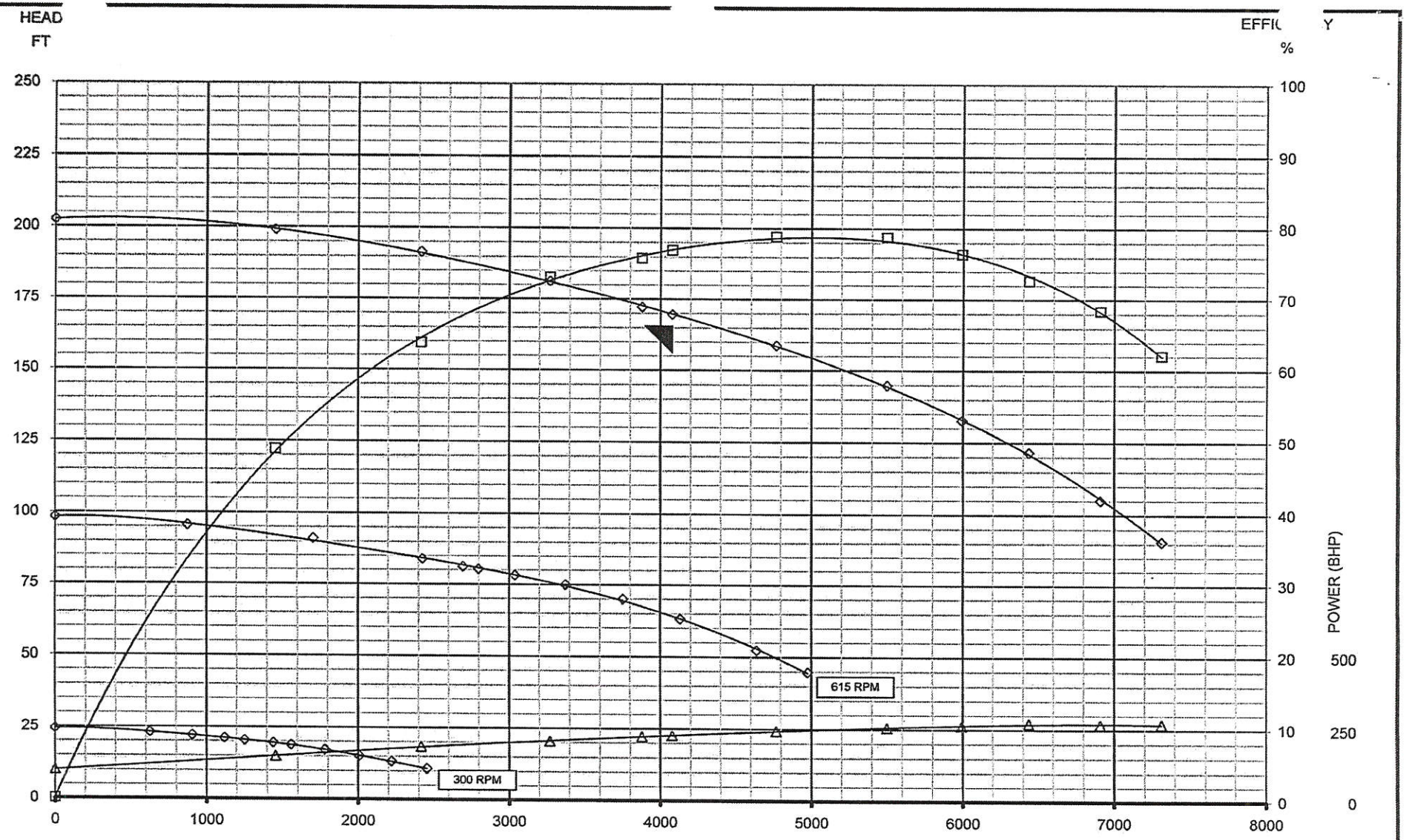
I CERTIFY THAT WITHIN THE ACCURACY OF THE TEST INSTRUMENTATION, THIS TEST REPRESENTS THE PERFORMANCE OF 0802MS004468-1

TEST WITNESSED BY: Lance Anderson 3/12/2008

LANCE ANDERSON REGISTERED PE, STATE OFVIRGINIA 037070

COMMONWEALTH OF VIRGINIA
LANCE D. ANDERSON
No. 37070
PROFESSIONAL ENGINEER

FLOWSERVE



0802MS004468-2 SERIAL NO.	S4468 ORDER NO.	10MFC27 MODEL	1 STAGES	MAIN WELL TEST LOOP	PUMP TYPE OF TEST	JOB TEST MOTOR	VENTURI	02/21/08 DATE TESTED	2WA CURVE NO

CASING DATA	IMPELLER DATA		CONDITIONS OF SERVICE	
2.5-3% NI CI MATERIAL	2.5-3% NI CI MATERIAL	#2 FINISH	4084 GPM FLOW	166 FT HEAD
1A FINISH	26.61 DIAMETER		1 SG	895 RPM SPEED
N/A TONGUE	DEBURR TIP			91 TEMP. (F)

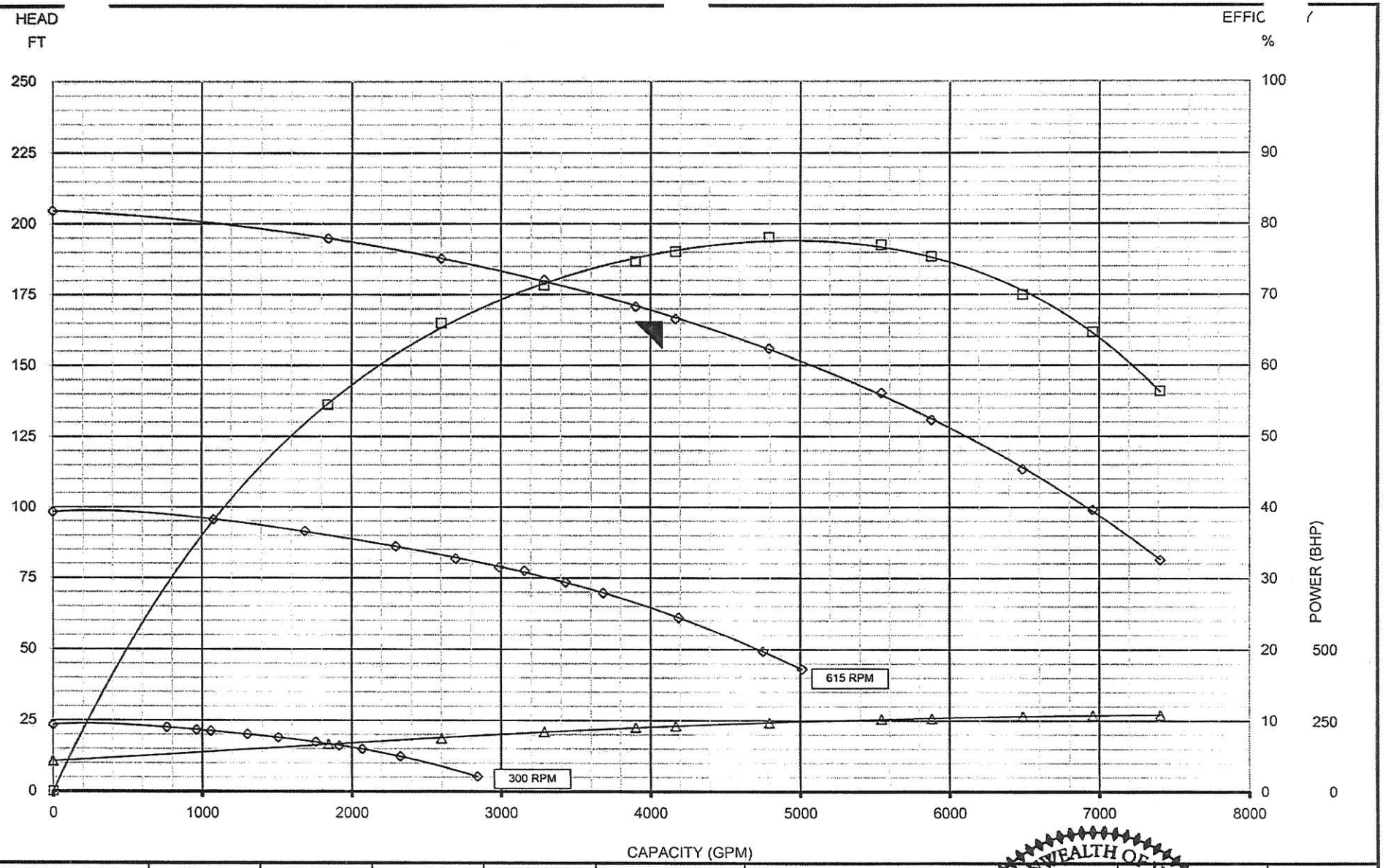
I CERTIFY THAT WITHIN THE ACCURACY OF THE TEST INSTRUMENTATION, THIS TEST REPRESENTS THE PERFORMANCE OF 0802MS004468-2

TEST WITNESSED BY: Lance Anderson 2/21/2008

LANCE ANDERSON REGISTERED PE, STATE OFVIRGINIA 37070

COMMONWEALTH OF VIRGINIA
LANCE D. ANDERSON
No. 37070
PROFESSIONAL ENGINEER

FLOWSERVE



0802MS004468-3 SERIAL NO.	S4468 ORDER NO.	10MFC27 MODEL	1 STAGES	MAIN WELL TEST LOOP	PUMP TYPE OF TEST	JOB TEST MOTOR	12x9 VENTURI	02/22/08 DATE TESTED	3WA CURVE NO

CASING DATA		IMPELLER DATA		CONDITIONS OF SERVICE	
2.5-3% NI CI	MATERIAL	2.5-3% NI CI	#2 FINISH	4084 GPM	166 FT
		MATERIAL		FLOW	HEAD
1A	FINISH	26.61	DIAMETER	1	895 RPM
				SG	SPEED
N/A	TONGUE	DEBURR	TIP		93 TEMP. (F)

I CERTIFY THAT WITHIN THE ACCURACY OF THE TEST INSTRUMENTATION, THIS TEST REPRESENTS THE PERFORMANCE OF 0802MS004468-3

TEST WITNESSED BY: Lance Anderson 2/22/2008

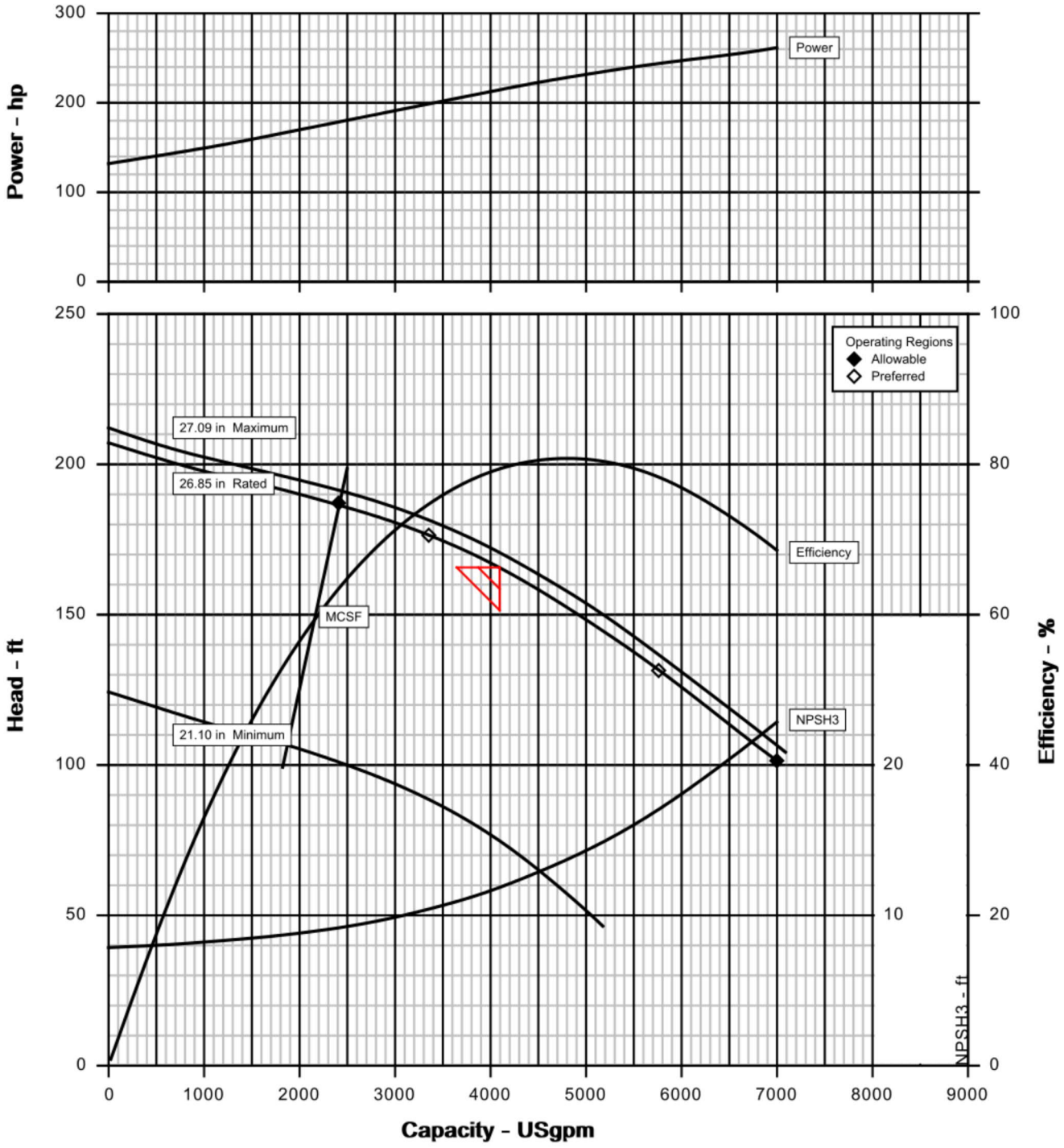
LANCE ANDERSON REGISTERED PE, STATE OFVIRGINIA 037070

COMMONWEALTH OF VIRGINIA
LANCE D. ANDERSON
No. 37070
PROFESSIONAL ENGINEER

FLOWSERVE

		Pump size & type / Stages	: 10MF27A FR7A / 1
		Based on curve no.	: 89116867
		Impeller diameter	: 26.85 in
Customer	: PACIFIC WATER RESOURCES	Capacity	: 4084.0 USgpm
Item number	: Sewage Pumps	Head	: 166.00 ft
Service	: -	Density / Specific gravity	: - / 1.000
Flowserve reference	: 2662524417	Pump speed	: 895 rpm
Date	: July 24, 2020	Ns / Nss	: 1408 / 8780 (US units)
		Test tolerance	: ANSI/HI 14.6 Grade 1U

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.



FLOWSERVE

Hydraulic Datasheet

Customer	: PACIFIC WATER RESOURCES	Pump / Stages	: 10MF27A FR7A	/ 1
Customer reference	: -	Based on curve no.	: 89116867	
Item number	: Sewage Pumps	Flowserve reference	: 2662524417	
Service	: -	Date	: July 24, 2020	

Operating Conditions

Capacity (rated/normal)	: 4084.0 USgpm / -
Water capacity (CQ=1.00)	: -
Total developed head	: 166.00 ft
Water head (CH=1.00)	: -
NPSHa/NPSHa less margin	: 34.0 ft / -
Maximum suction pressure	: 0.0 psig

Liquid

Liquid type	: Other
Liquid description	: -
Temperature	: 60 °F
Density / Specific gravity	: - / 1.000
Solid Size - Actual / Limit	: - / 4.00 in
Viscosity / Vapor pressure	: 1.00 cP / -

Materials / Specification

Material column code	: CI
Pump specification	: -

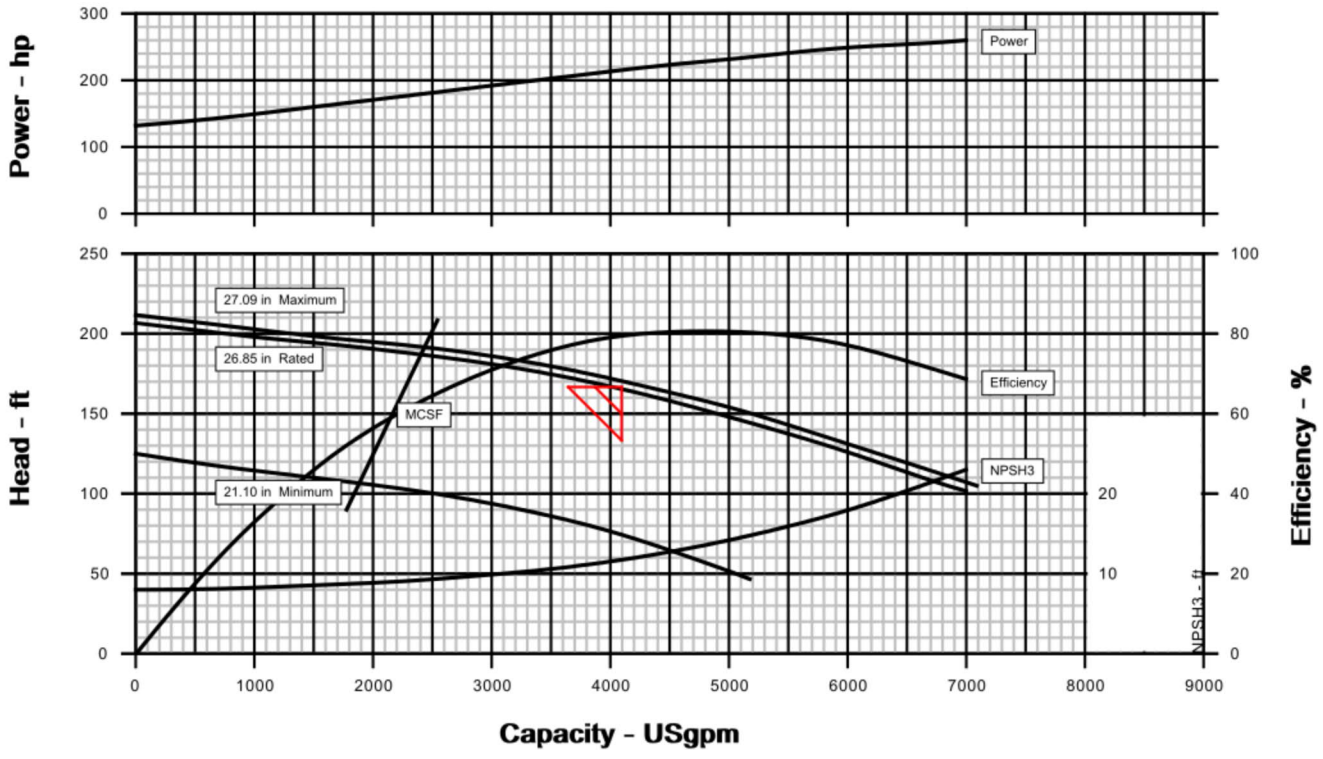
Other Requirements

Hydraulic selection : No specification
Construction : No specification
Test tolerance : ANSI/HI 14.6 Grade 1U
Speed Set : 895 rpm
Driver Sizing : Max Power (SO to EOC) not using SF

Performance

Hydraulic power	: 171 hp	Impeller diameter	
Pump speed	: 895 rpm	Rated	: 26.85 in
Pump overall efficiency (CE=1.00)	: 79.5 %	Maximum	: 27.09 in
NPSH required (NPSH3)	: 11.8 ft	Minimum	: 21.10 in
Rated brake power	: 215 hp	Ns / Nss	: 1408 / 8780 (US units)
		Minimum continuous flow	: 2411.7 USgpm
Maximum brake power	: 261 hp	Maximum head at rated diameter	: 207.44 ft
Driver power rating	: 300 hp / 224 kW	Flow at BEP	: 4799.4 USgpm
Casing working pressure	: 89.8 psig	Flow as % of BEP	: 85.1 %
(based on shut off @ cut dia/rated SG)		Efficiency at normal flow	: -
Maximum allowable	: 115.0 psig	Impeller diameter ratio (rated/max)	: 99.1 %
Hydrostatic test pressure	: 150.0 psig	Head rise to shut off	: 25.0 %
Estimated rated seal chamber pressure	: -	Total head ratio (rated / max) / (max / rated)	: 97.1 % / 103.0 %

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.



V.W. HOUSEN & ASSOCIATES

BHPS w/ AFM102: Main Pump Station – Hydraulic Calculations

Bridgehead Pump Station with AFM102

Pump and Suction and Discharge Loss Curves – Main Pumps

Suction & Discharge - 14”

Diameter = 14 in
Area for = 1.069014 ft^2
RH=D/4= 0.291666
C= 120

Q (gpm)	Q (mgd)	Q (cfs)	Pipe Dia. (in)	V (fps)	$V^2/2g$ (ft)	L (ft)	C	S	Friction Losses S x L (ft)	K	Minor Losses K x ($v^2/2g$) (ft)	Total Losses (ft)
0.0	0.00	0.00	14.00	0.00	0.00	15.00	120	0.0000	0.0000	4	0.000	0.0000
1000.0	1.44	2.23	14.00	2.08	0.07	15.00	120	0.0014	0.0208	4	0.270	0.2907
2000.0	2.88	4.46	14.00	4.17	0.27	15.00	120	0.0050	0.0752	4	1.079	1.1545
3000.0	4.32	6.68	14.00	6.25	0.61	15.00	120	0.0106	0.1592	4	2.429	2.5878
4000.0	5.76	8.91	14.00	8.34	1.08	15.00	120	0.0181	0.2713	4	4.317	4.5887
5000.0	7.20	11.14	14.00	10.42	1.69	15.00	120	0.0273	0.4101	4	6.746	7.1561
6000.0	8.64	13.37	14.00	12.51	2.43	15.00	120	0.0383	0.5749	4	9.714	10.2890
7000.0	10.08	15.60	14.00	14.59	3.31	15.00	120	0.0510	0.7648	4	13.222	13.9868
7360.0	10.60	16.40	14.00	15.34	3.65	15.00	120	0.0560	0.8393	4	14.617	15.4562
7500.0	10.80	16.71	14.00	15.63	3.79	15.00	120	0.0579	0.8691	4	15.178	16.0474

Suction & Discharge - 16”

Diameter = 16 in
Area for = 1.396263 ft^2
RH=D/4= 0.333333
C= 120

Q (gpm)	Q (mgd)	Q (cfs)	Pipe Dia. (in)	V (fps)	$V^2/2g$ (ft)	L (ft)	C	S	Friction Losses S x L (ft)	K	Minor Losses K x ($v^2/2g$) (ft)	Total Losses (ft)
0.0	0.00	0.00	16.00	0.00	0.00	17.00	120	0.0000	0.0000	1.3	0.000	0.0000
1000.0	1.44	2.23	16.00	1.60	0.04	17.00	120	0.0007	0.0123	1.3	0.051	0.0637
2000.0	2.88	4.46	16.00	3.19	0.16	17.00	120	0.0026	0.0444	1.3	0.206	0.2501
3000.0	4.32	6.68	16.00	4.79	0.36	17.00	120	0.0055	0.0942	1.3	0.463	0.5568
4000.0	5.76	8.91	16.00	6.38	0.63	17.00	120	0.0094	0.1605	1.3	0.823	0.9830
5000.0	7.20	11.14	16.00	7.98	0.99	17.00	120	0.0143	0.2426	1.3	1.285	1.5277
6000.0	8.64	13.37	16.00	9.57	1.42	17.00	120	0.0200	0.3400	1.3	1.851	2.1906
7000.0	10.08	15.60	16.00	11.17	1.94	17.00	120	0.0266	0.4523	1.3	2.519	2.9712
7360.0	10.60	16.40	16.00	11.75	2.14	17.00	120	0.0292	0.4963	1.3	2.785	3.2810
7500.0	10.80	16.71	16.00	11.97	2.22	17.00	120	0.0302	0.5140	1.3	2.892	3.4056

Bridgehead Pump Station with AFM102

Pump and Suction and Discharge Loss Curves – Main Pumps

Suction & Discharge - 24”

Diameter = 24 in
Area for = 3.141593 ft^2
RH=D/4= 0.5
C= 120

Q (gpm)	Q (mgd)	Q (cfs)	Pipe Dia. (in)	V (fps)	$V^2/2g$ (ft)	L (ft)	C	S	Friction Losses S x L (ft)	K	Minor Losses K x ($v^2/2g$) (ft)	Total Losses (ft)
0.0	0.00	0.00	24.00	0.00	0.00	8.25	120	0.0000	0.0000	1.19	0.000	0.0000
1000.00	1.44	2.23	24.00	0.71	0.01	8.25	120	0.0001	0.0008	1.19	0.009	0.0101
2000.0	2.88	4.46	24.00	1.42	0.03	8.25	120	0.0004	0.0030	1.19	0.037	0.0402
3000.00	4.32	6.68	24.00	2.13	0.07	8.25	120	0.0008	0.0063	1.19	0.084	0.0900
4000.0	5.76	8.91	24.00	2.84	0.12	8.25	120	0.0013	0.0108	1.19	0.149	0.1595
5000.00	7.20	11.14	24.00	3.55	0.20	8.25	120	0.0020	0.0163	1.19	0.232	0.2487
6000.0	8.64	13.37	24.00	4.26	0.28	8.25	120	0.0028	0.0229	1.19	0.335	0.3575
7000.0	10.08	15.60	24.00	4.96	0.38	8.25	120	0.0037	0.0305	1.19	0.455	0.4859
7360.0	10.60	16.40	24.00	5.22	0.42	8.25	120	0.0041	0.0334	1.19	0.504	0.5369
7500.0	10.80	16.71	24.00	5.32	0.44	8.25	120	0.0042	0.0346	1.19	0.523	0.5575

Pump Suction and Discharge Losses

Q (gpm)	Q (mgd)	Total Losses S&D (ft)
0.0	0.00	0.0000
1000.0	1.44	0.3645
2000.0	2.88	1.4447
3000.0	4.32	3.2346
4000.0	5.76	5.7312
5000.0	7.20	8.9325
6000.0	8.64	12.8371
7000.0	10.08	17.4440
7360.0	10.60	19.2742
7500.0	10.80	20.0104

Bridgehead Pump Station with AFM102

Pump and Suction and Discharge Loss Curves – Main Pumps

Pumps

Mfr Pump Curve

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
0	0.00	205.60
1000	1.44	203.02
2000	2.88	193.96
3000	4.32	181.90
4000	5.76	168.10
5000	7.20	150.00
6000	8.64	126.72
7000	10.08	96.98
7360	10.60	85.00

S&D Losses S&D
(ft)
0.0000
0.3645
1.4447
3.2346
5.7312
8.9325
12.8371
17.4440
19.2742

Adjusted Pump Curves

1 PUMP

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	205.60
1000	1.44	202.66
2000	2.88	192.52
3000	4.32	178.67
4000	5.76	162.37
5000	7.20	141.07
6000	8.64	113.88
7000	10.08	79.54
7360	10.60	65.73

2 PUMPS

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	205.6
2000	2.88	202.7
4000	5.76	192.5
6000	8.64	178.7
8000	11.52	162.4
10000	14.40	141.1
12000	17.28	113.9
14000	20.16	79.5
14720	21.20	65.7

Reduced Speed Curves @ 90%

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
0	0.00	166.536
900	1.30	164.4462
1800	2.59	157.1076
2700	3.89	147.339
3600	5.18	136.161
4500	6.48	121.5
5400	7.78	102.6432
6300	9.07	78.5538
6624	9.54	68.85

S&D Losses S&D
(ft)
0.0000
0.2957
1.1718
2.6233
4.6479
7.2438
10.4100
14.1455
15.6295

Adjusted Pump Curves

1 PUMP

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	166.5
900	1.30	164.2
1800	2.59	155.9
2700	3.89	144.7
3600	5.18	131.5
4500	6.48	114.3
5400	7.78	92.2
6300	9.07	64.4
6624	9.54	53.2

2 PUMPS

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	166.5
1800	2.59	164.2
3600	5.18	155.9
5400	7.78	144.7
7200	10.37	131.5
9000	12.96	114.3
10800	15.55	92.2
12600	18.14	64.4
13248	19.08	53.2

Reduced Speed Curves @ 80%

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
0	0.00	131.584
800	1.15	129.9328
1600	2.30	124.1344
2400	3.46	116.416
3200	4.61	107.584
4000	5.76	96
4800	6.91	81.1008
5600	8.06	62.0672
5888	8.48	54.4

S&D Losses S&D
(ft)
0.0000
0.2340
0.9273
2.0757
3.6775
5.7312
8.2359
11.1910
12.3649

Adjusted Pump Curves

1 PUMP

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	131.6
800	1.15	129.7
1600	2.30	123.2
2400	3.46	114.3
3200	4.61	103.9
4000	5.76	90.3
4800	6.91	72.9
5600	8.06	50.9
5888	8.48	42.0

2 PUMPS

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	131.6
1600	2.30	129.7
3200	4.61	123.2
4800	6.91	114.3
6400	9.22	103.9
8000	11.52	90.3
9600	13.82	72.9
11200	16.13	50.9
11776	16.96	42.0

Reduced Speed Curves @ 70%

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
0	0.00	100.744
700	1.01	99.4798
1400	2.02	95.0404
2100	3.02	89.131
2800	4.03	82.369
3500	5.04	73.5
4200	6.05	62.0928
4900	7.06	47.5202
5152	7.42	41.65

S&D Losses S&D
(ft)
0.0000
0.1795
0.7112
1.5919
2.8200
4.3947
6.3151
8.5807
9.4807

Adjusted Pump Curves

1 PUMP

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	100.7
700	1.01	99.3
1400	2.02	94.3
2100	3.02	87.5
2800	4.03	79.5
3500	5.04	69.1
4200	6.05	55.8
4900	7.06	38.9
5152	7.42	32.2

2 PUMPS

Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	100.7
1400	2.02	99.3
2800	4.03	94.3
4200	6.05	87.5
5600	8.06	79.5
7000	10.08	69.1
8400	12.10	55.8
9800	14.11	38.9
10304	14.84	32.2

Bridgehead Pump Station with AFM102

Pump and Suction and Discharge Loss Curves – Main Pumps

Reduced Speed Curves @ 68%

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
0	0.00	95.06944
680	0.98	93.876448
1360	1.96	89.687104
2040	2.94	84.11056
2720	3.92	77.72944
3400	4.90	69.36
4080	5.88	58.595328
4760	6.85	44.843552
5005	7.21	39.304

S&D Losses S&D
(ft)
0.0000
0.1695
0.6714
1.5027
2.6621
4.1486
5.9614
8.1000
8.9496

Adjusted Pump Curves

1 PUMP		
Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	95.1
680	0.98	93.7
1360	1.96	89.0
2040	2.94	82.6
2720	3.92	75.1
3400	4.90	65.2
4080	5.88	52.6
4760	6.85	36.7
5005	7.21	30.4

2 PUMPS		
Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	95.1
1360	1.96	93.7
2720	3.92	89.0
4080	5.88	82.6
5440	7.83	75.1
6800	9.79	65.2
8160	11.75	52.6
9520	13.71	36.7
10010	14.41	30.4

Reduced Speed Curves @ 60%

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
0	0.00	74.016
600	0.86	73.0872
1200	1.73	69.8256
1800	2.59	65.484
2400	3.46	60.516
3000	4.32	54
3600	5.18	45.6192
4200	6.05	34.9128
4416	6.36	30.6

S&D Losses S&D
(ft)
0.0000
0.1322
0.5236
1.1718
2.0757
3.2346
4.6479
6.3151
6.9774

Adjusted Pump Curves

1 PUMP		
Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	74.0
600	0.86	73.0
1200	1.73	69.3
1800	2.59	64.3
2400	3.46	58.4
3000	4.32	50.8
3600	5.18	41.0
4200	6.05	28.6
4416	6.36	23.6

2 PUMPS		
Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	74.0
1200	1.73	73.0
2400	3.46	69.3
3600	5.18	64.3
4800	6.91	58.4
6000	8.64	50.8
7200	10.37	41.0
8400	12.10	28.6
8832	12.72	23.6

Reduced Speed Curves @ 50%

Q	Q	Mfr Curve Head
(gpm)	(mgd)	(ft)
	0.00	51.4
500	0.72	50.755
1000	1.44	48.49
1500	2.16	45.475
2000	2.88	42.025
2500	3.60	37.5
3000	4.32	31.68
3500	5.04	24.245
3680	5.30	21.25

S&D Losses S&D
(ft)
0.0000
0.0920
0.3645
0.8157
1.4447
2.2512
3.2346
4.3947
4.8555

Adjusted Pump Curves

1 PUMP		
Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	51.4
500	0.72	50.7
1000	1.44	48.1
1500	2.16	44.7
2000	2.88	40.6
2500	3.60	35.2
3000	4.32	28.4
3500	5.04	19.9
3680	5.30	16.4

2 PUMPS		
Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)
0	0.00	51.4
1000	1.44	50.7
2000	2.88	48.1
3000	4.32	44.7
4000	5.76	40.6
5000	7.20	35.2
6000	8.64	28.4
7000	10.08	19.9
7360	10.60	16.4

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To 1st High Point (Wilber Ave Bridge) – Final Curve

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FM System Curve – 24"

Diameter = 24 in
Area = 3.141593 ft^2
RH=D/4= 0.5
C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To 1st High Point (Wilber Ave Bridge) – Final Curve

13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve – 24" (14" Parallel FM Portion)

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	316.00	100	0.0000	0.0000	3.8	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	316.00	100	0.0000	0.0034	3.8	0.002	0.0053
500.0	0.72	1.11	24.00	0.35	0.00	316.00	100	0.0000	0.0123	3.8	0.007	0.0198
750.0	1.08	1.67	24.00	0.53	0.00	316.00	100	0.0001	0.0261	3.8	0.017	0.0428
1000.0	1.44	2.23	24.00	0.71	0.01	316.00	100	0.0001	0.0445	3.8	0.030	0.0742
1250.0	1.80	2.79	24.00	0.89	0.01	316.00	100	0.0002	0.0673	3.8	0.046	0.1137
1500.0	2.16	3.34	24.00	1.06	0.02	316.00	100	0.0003	0.0943	3.8	0.067	0.1611
1750.0	2.52	3.90	24.00	1.24	0.02	316.00	100	0.0004	0.1255	3.8	0.091	0.2164
2000.0	2.88	4.46	24.00	1.42	0.03	316.00	100	0.0005	0.1607	3.8	0.119	0.2794
2250.0	3.24	5.01	24.00	1.60	0.04	316.00	100	0.0006	0.1999	3.8	0.150	0.3501
2500.0	3.60	5.57	24.00	1.77	0.05	316.00	100	0.0008	0.2429	3.8	0.186	0.4284
2750.0	3.96	6.13	24.00	1.95	0.06	316.00	100	0.0009	0.2898	3.8	0.224	0.5143
3000.0	4.32	6.68	24.00	2.13	0.07	316.00	100	0.0011	0.3405	3.8	0.267	0.6077
3250.0	4.68	7.24	24.00	2.31	0.08	316.00	100	0.0012	0.3949	3.8	0.314	0.7084
3500.0	5.04	7.80	24.00	2.48	0.10	316.00	100	0.0014	0.4530	3.8	0.364	0.8166
3750.0	5.40	8.36	24.00	2.66	0.11	316.00	100	0.0016	0.5148	3.8	0.417	0.9322
4000.0	5.76	8.91	24.00	2.84	0.12	316.00	100	0.0018	0.5801	3.8	0.475	1.0550
4250.0	6.12	9.47	24.00	3.01	0.14	316.00	100	0.0021	0.6491	3.8	0.536	1.1852
4500.0	6.48	10.03	24.00	3.19	0.16	316.00	100	0.0023	0.7215	3.8	0.601	1.3226
4750.0	6.84	10.58	24.00	3.37	0.18	316.00	100	0.0025	0.7975	3.8	0.670	1.4672
5000.0	7.20	11.14	24.00	3.55	0.20	316.00	100	0.0028	0.8770	3.8	0.742	1.6191
5250.0	7.56	11.70	24.00	3.72	0.22	316.00	100	0.0030	0.9599	3.8	0.818	1.7781
5500.0	7.92	12.25	24.00	3.90	0.24	316.00	100	0.0033	1.0463	3.8	0.898	1.9442
5750.0	8.28	12.81	24.00	4.08	0.26	316.00	100	0.0036	1.1361	3.8	0.981	2.1175
6000.0	8.64	13.37	24.00	4.26	0.28	316.00	100	0.0039	1.2293	3.8	1.069	2.2978
6250.0	9.00	13.93	24.00	4.43	0.31	316.00	100	0.0042	1.3258	3.8	1.159	2.4853
6500.0	9.36	14.48	24.00	4.61	0.33	316.00	100	0.0045	1.4257	3.8	1.254	2.6798
6750.0	9.72	15.04	24.00	4.79	0.36	316.00	100	0.0048	1.5289	3.8	1.352	2.8813
7000.0	10.08	15.60	24.00	4.96	0.38	316.00	100	0.0052	1.6354	3.8	1.454	3.0898
7250.0	10.44	16.15	24.00	5.14	0.41	316.00	100	0.0055	1.7452	3.8	1.560	3.3054
7500.0	10.80	16.71	24.00	5.32	0.44	316.00	100	0.0059	1.8583	3.8	1.670	3.5279
7750.0	11.16	17.27	24.00	5.50	0.47	316.00	100	0.0062	1.9747	3.8	1.783	3.7575
8000.0	11.52	17.83	24.00	5.67	0.50	316.00	100	0.0066	2.0943	3.8	1.900	3.9939

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To 1st High Point (Wilber Ave Bridge) – Final Curve

8250.0	11.88	18.38	24.00	5.85	0.53	316.00	100	0.0070	2.2171	3.8	2.020	4.2373
8500.0	12.24	18.94	24.00	6.03	0.56	316.00	100	0.0074	2.3431	3.8	2.145	4.4876
8750.0	12.60	19.50	24.00	6.21	0.60	316.00	100	0.0078	2.4723	3.8	2.273	4.7449
9000.0	12.96	20.05	24.00	6.38	0.63	316.00	100	0.0082	2.6048	3.8	2.404	5.0090
9250.0	13.32	20.61	24.00	6.56	0.67	316.00	100	0.0087	2.7403	3.8	2.540	5.2800
9500.0	13.68	21.17	24.00	6.74	0.70	316.00	100	0.0091	2.8791	3.8	2.679	5.5579
9750.0	14.04	21.72	24.00	6.92	0.74	316.00	100	0.0096	3.0210	3.8	2.822	5.8426
10000.0	14.40	22.28	24.00	7.09	0.78	316.00	100	0.0100	3.1660	3.8	2.968	6.1342
10250.0	14.76	22.84	24.00	7.27	0.82	316.00	100	0.0105	3.3141	3.8	3.118	6.4326
10500.0	15.12	23.40	24.00	7.45	0.86	316.00	100	0.0110	3.4654	3.8	3.272	6.7378
10750.0	15.48	23.95	24.00	7.62	0.90	316.00	100	0.0115	3.6197	3.8	3.430	7.0499
11000.0	15.84	24.51	24.00	7.80	0.95	316.00	100	0.0120	3.7772	3.8	3.592	7.3687
11250.0	16.20	25.07	24.00	7.98	0.99	316.00	100	0.0125	3.9377	3.8	3.757	7.6943
11500.0	16.56	25.62	24.00	8.16	1.03	316.00	100	0.0130	4.1013	3.8	3.925	8.0267
11750.0	16.92	26.18	24.00	8.33	1.08	316.00	100	0.0135	4.2680	3.8	4.098	8.3659
12000.0	17.28	26.74	24.00	8.51	1.12	316.00	100	0.0140	4.4377	3.8	4.274	8.7119
12250.0	17.64	27.30	24.00	8.69	1.17	316.00	100	0.0146	4.6104	3.8	4.454	9.0645
12500.0	18.00	27.85	24.00	8.87	1.22	316.00	100	0.0151	4.7862	3.8	4.638	9.4240
12750.0	18.36	28.41	24.00	9.04	1.27	316.00	100	0.0157	4.9650	3.8	4.825	9.7901
13000.0	18.72	28.97	24.00	9.22	1.32	316.00	100	0.0163	5.1468	3.8	5.016	10.1630
13250.0	19.08	29.52	24.00	9.40	1.37	316.00	100	0.0169	5.3316	3.8	5.211	10.5426
13500.0	19.44	30.08	24.00	9.57	1.42	316.00	100	0.0175	5.5194	3.8	5.410	10.9289
13750.0	19.80	30.64	24.00	9.75	1.48	316.00	100	0.0181	5.7101	3.8	5.612	11.3219
14000.0	20.16	31.19	24.00	9.93	1.53	316.00	100	0.0187	5.9039	3.8	5.818	11.7216
14250.0	20.52	31.75	24.00	10.11	1.59	316.00	100	0.0193	6.1006	3.8	6.027	12.1279
14500.0	20.88	32.31	24.00	10.28	1.64	316.00	100	0.0199	6.3003	3.8	6.241	12.5410
14750.0	21.24	32.87	24.00	10.46	1.70	316.00	100	0.0206	6.5030	3.8	6.458	12.9607
15000.0	21.60	33.42	24.00	10.64	1.76	316.00	100	0.0212	6.7086	3.8	6.678	13.3870
15250.0	21.96	33.98	24.00	10.82	1.82	316.00	100	0.0219	6.9171	3.8	6.903	13.8200
15500.0	22.32	34.54	24.00	10.99	1.88	316.00	100	0.0226	7.1286	3.8	7.131	14.2597
15750.0	22.68	35.09	24.00	11.17	1.94	316.00	100	0.0232	7.3430	3.8	7.363	14.7060
16000.0	23.04	35.65	24.00	11.35	2.00	316.00	100	0.0239	7.5603	3.8	7.599	15.1589

FM System Curve – 14" (14" Parallel FM Portion)

Diameter = 14 in

Area = 1.069014 ft^2

RH=D/4= 0.291667

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	14.00	0.00	0.00	68.50	100	0.0000	0.0000	1.72	0.000	0.0000
250.0	0.36	0.56	14.00	0.52	0.00	68.50	100	0.0001	0.0102	1.72	0.007	0.0175
500.0	0.72	1.11	14.00	1.04	0.02	68.50	100	0.0005	0.0369	1.72	0.029	0.0659
750.0	1.08	1.67	14.00	1.56	0.04	68.50	100	0.0011	0.0782	1.72	0.065	0.1435
1000.0	1.44	2.23	14.00	2.08	0.07	68.50	100	0.0019	0.1333	1.72	0.116	0.2493
1250.0	1.80	2.79	14.00	2.61	0.11	68.50	100	0.0029	0.2014	1.72	0.181	0.3827
1500.0	2.16	3.34	14.00	3.13	0.15	68.50	100	0.0041	0.2824	1.72	0.261	0.5434
1750.0	2.52	3.90	14.00	3.65	0.21	68.50	100	0.0055	0.3756	1.72	0.355	0.7310
2000.0	2.88	4.46	14.00	4.17	0.27	68.50	100	0.0070	0.4810	1.72	0.464	0.9452
2250.0	3.24	5.01	14.00	4.69	0.34	68.50	100	0.0087	0.5983	1.72	0.587	1.1857
2500.0	3.60	5.57	14.00	5.21	0.42	68.50	100	0.0106	0.7272	1.72	0.725	1.4524
2750.0	3.96	6.13	14.00	5.73	0.51	68.50	100	0.0127	0.8676	1.72	0.877	1.7451
3000.0	4.32	6.68	14.00	6.25	0.61	68.50	100	0.0149	1.0193	1.72	1.044	2.0636
3250.0	4.68	7.24	14.00	6.77	0.71	68.50	100	0.0173	1.1822	1.72	1.226	2.4077
3500.0	5.04	7.80	14.00	7.30	0.83	68.50	100	0.0198	1.3561	1.72	1.421	2.7775
3750.0	5.40	8.36	14.00	7.82	0.95	68.50	100	0.0225	1.5409	1.72	1.632	3.1726
4000.0	5.76	8.91	14.00	8.34	1.08	68.50	100	0.0254	1.7366	1.72	1.856	3.5930
4250.0	6.12	9.47	14.00	8.86	1.22	68.50	100	0.0284	1.9429	1.72	2.096	4.0387
4500.0	6.48	10.03	14.00	9.38	1.37	68.50	100	0.0315	2.1599	1.72	2.350	4.5095
4750.0	6.84	10.58	14.00	9.90	1.52	68.50	100	0.0349	2.3873	1.72	2.618	5.0053
5000.0	7.20	11.14	14.00	10.42	1.69	68.50	100	0.0383	2.6252	1.72	2.901	5.5260

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To 1st High Point (Wilber Ave Bridge) – Final Curve

5250.0	7.56	11.70	14.00	10.94	1.86	68.50	100	0.0419	2.8735	1.72	3.198	6.0716
5500.0	7.92	12.25	14.00	11.46	2.04	68.50	100	0.0457	3.1320	1.72	3.510	6.6420
5750.0	8.28	12.81	14.00	11.98	2.23	68.50	100	0.0496	3.4008	1.72	3.836	7.2370
6000.0	8.64	13.37	14.00	12.51	2.43	68.50	100	0.0537	3.6797	1.72	4.177	7.8568
6250.0	9.00	13.93	14.00	13.03	2.64	68.50	100	0.0579	3.9687	1.72	4.532	8.5011
6500.0	9.36	14.48	14.00	13.55	2.85	68.50	100	0.0623	4.2677	1.72	4.902	9.1699
6750.0	9.72	15.04	14.00	14.07	3.07	68.50	100	0.0668	4.5766	1.72	5.287	9.8633
7000.0	10.08	15.60	14.00	14.59	3.31	68.50	100	0.0715	4.8955	1.72	5.685	10.5810
7250.0	10.44	16.15	14.00	15.11	3.55	68.50	100	0.0763	5.2242	1.72	6.099	11.3231
7500.0	10.80	16.71	14.00	15.63	3.79	68.50	100	0.0812	5.5628	1.72	6.527	12.0894
7750.0	11.16	17.27	14.00	16.15	4.05	68.50	100	0.0863	5.9110	1.72	6.969	12.8801
8000.0	11.52	17.83	14.00	16.67	4.32	68.50	100	0.0915	6.2690	1.72	7.426	13.6949
8250.0	11.88	18.38	14.00	17.20	4.59	68.50	100	0.0969	6.6367	1.72	7.897	14.5339
8500.0	12.24	18.94	14.00	17.72	4.87	68.50	100	0.1024	7.0139	1.72	8.383	15.3971
8750.0	12.60	19.50	14.00	18.24	5.16	68.50	100	0.1080	7.4007	1.72	8.884	16.2843
9000.0	12.96	20.05	14.00	18.76	5.46	68.50	100	0.1138	7.7971	1.72	9.398	17.1955
9250.0	13.32	20.61	14.00	19.28	5.77	68.50	100	0.1198	8.2030	1.72	9.928	18.1308
9500.0	13.68	21.17	14.00	19.80	6.09	68.50	100	0.1258	8.6183	1.72	10.472	19.0900
9750.0	14.04	21.72	14.00	20.32	6.41	68.50	100	0.1320	9.0430	1.72	11.030	20.0731
10000.0	14.40	22.28	14.00	20.84	6.75	68.50	100	0.1384	9.4771	1.72	11.603	21.0801
10250.0	14.76	22.84	14.00	21.36	7.09	68.50	100	0.1448	9.9206	1.72	12.190	22.1110
10500.0	15.12	23.40	14.00	21.89	7.44	68.50	100	0.1514	10.3734	1.72	12.792	23.1657
10750.0	15.48	23.95	14.00	22.41	7.80	68.50	100	0.1582	10.8354	1.72	13.409	24.2441
11000.0	15.84	24.51	14.00	22.93	8.16	68.50	100	0.1651	11.3067	1.72	14.040	25.3463
11250.0	16.20	25.07	14.00	23.45	8.54	68.50	100	0.1721	11.7872	1.72	14.685	26.4722
11500.0	16.56	25.62	14.00	23.97	8.92	68.50	100	0.1792	12.2769	1.72	15.345	27.6219
11750.0	16.92	26.18	14.00	24.49	9.31	68.50	100	0.1865	12.7758	1.72	16.019	28.7951
12000.0	17.28	26.74	14.00	25.01	9.71	68.50	100	0.1939	13.2837	1.72	16.708	29.9920
12250.0	17.64	27.30	14.00	25.53	10.12	68.50	100	0.2015	13.8008	1.72	17.412	31.2126
12500.0	18.00	27.85	14.00	26.05	10.54	68.50	100	0.2092	14.3270	1.72	18.130	32.4566
12750.0	18.36	28.41	14.00	26.58	10.97	68.50	100	0.2170	14.8621	1.72	18.862	33.7243
13000.0	18.72	28.97	14.00	27.10	11.40	68.50	100	0.2249	15.4063	1.72	19.609	35.0154
13250.0	19.08	29.52	14.00	27.62	11.84	68.50	100	0.2330	15.9595	1.72	20.371	36.3300
13500.0	19.44	30.08	14.00	28.14	12.29	68.50	100	0.2412	16.5217	1.72	21.146	37.6682
13750.0	19.80	30.64	14.00	28.66	12.75	68.50	100	0.2495	17.0928	1.72	21.937	39.0297
14000.0	20.16	31.19	14.00	29.18	13.22	68.50	100	0.2580	17.6728	1.72	22.742	40.4147
14250.0	20.52	31.75	14.00	29.70	13.70	68.50	100	0.2666	18.2617	1.72	23.561	41.8230
14500.0	20.88	32.31	14.00	30.22	14.18	68.50	100	0.2753	18.8595	1.72	24.395	43.2548
14750.0	21.24	32.87	14.00	30.74	14.68	68.50	100	0.2842	19.4661	1.72	25.244	44.7099
15000.0	21.60	33.42	14.00	31.26	15.18	68.50	100	0.2932	20.0816	1.72	26.107	46.1883
15250.0	21.96	33.98	14.00	31.79	15.69	68.50	100	0.3023	20.7058	1.72	26.984	47.6900
15500.0	22.32	34.54	14.00	32.31	16.21	68.50	100	0.3115	21.3388	1.72	27.876	49.2150
15750.0	22.68	35.09	14.00	32.83	16.73	68.50	100	0.3209	21.9806	1.72	28.783	50.7633
16000.0	23.04	35.65	14.00	33.35	17.27	68.50	100	0.3304	22.6312	1.72	29.704	52.3348

FM System Curve – 13.5" (14" Parallel FM Portion)

Diameter = 13.5 in

Area = 0.99402 ft^2

RH=D/4= 0.28125

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	13.50	0.00	0.00	10640.5	120	0.0000	0.0000	3.1	0.000	0.0000
250.0	0.36	0.56	13.50	0.56	0.00	10640.5	120	0.0001	1.3528	3.1	0.015	1.3679
500.0	0.72	1.11	13.50	1.12	0.02	10640.5	120	0.0005	4.8835	3.1	0.060	4.9439
750.0	1.08	1.67	13.50	1.68	0.04	10640.5	120	0.0010	10.3478	3.1	0.136	10.4839
1000.0	1.44	2.23	13.50	2.24	0.08	10640.5	120	0.0017	17.6293	3.1	0.242	17.8711
1250.0	1.80	2.79	13.50	2.80	0.12	10640.5	120	0.0025	26.6509	3.1	0.378	27.0288
1500.0	2.16	3.34	13.50	3.36	0.18	10640.5	120	0.0035	37.3556	3.1	0.544	37.8998
1750.0	2.52	3.90	13.50	3.92	0.24	10640.5	120	0.0047	49.6982	3.1	0.741	50.4390
2000.0	2.88	4.46	13.50	4.48	0.31	10640.5	120	0.0060	63.6417	3.1	0.967	64.6092

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To 1st High Point (Wilber Ave Bridge) – Final Curve

2250.0	3.24	5.01	13.50	5.04	0.39	10640.5	120	0.0074	79.1547	3.1	1.224	80.3791
2500.0	3.60	5.57	13.50	5.60	0.49	10640.5	120	0.0090	96.2098	3.1	1.512	97.7215
2750.0	3.96	6.13	13.50	6.16	0.59	10640.5	120	0.0108	114.7833	3.1	1.829	116.6124
3000.0	4.32	6.68	13.50	6.72	0.70	10640.5	120	0.0127	134.8538	3.1	2.177	137.0306
3250.0	4.68	7.24	13.50	7.29	0.82	10640.5	120	0.0147	156.4021	3.1	2.555	158.9568
3500.0	5.04	7.80	13.50	7.85	0.96	10640.5	120	0.0169	179.4108	3.1	2.963	182.3737
3750.0	5.40	8.36	13.50	8.41	1.10	10640.5	120	0.0192	203.8640	3.1	3.401	207.2652
4000.0	5.76	8.91	13.50	8.97	1.25	10640.5	120	0.0216	229.7469	3.1	3.870	233.6168
4250.0	6.12	9.47	13.50	9.53	1.41	10640.5	120	0.0242	257.0460	3.1	4.369	261.4148
4500.0	6.48	10.03	13.50	10.09	1.58	10640.5	120	0.0269	285.7486	3.1	4.898	290.6465
4750.0	6.84	10.58	13.50	10.65	1.76	10640.5	120	0.0297	315.8429	3.1	5.457	321.3001
5000.0	7.20	11.14	13.50	11.21	1.95	10640.5	120	0.0326	347.3178	3.1	6.047	353.3645
5250.0	7.56	11.70	13.50	11.77	2.15	10640.5	120	0.0357	380.1628	3.1	6.667	386.8293
5500.0	7.92	12.25	13.50	12.33	2.36	10640.5	120	0.0389	414.3680	3.1	7.317	421.6846
5750.0	8.28	12.81	13.50	12.89	2.58	10640.5	120	0.0423	449.9242	3.1	7.997	457.9210
6000.0	8.64	13.37	13.50	13.45	2.81	10640.5	120	0.0458	486.8225	3.1	8.707	495.5298
6250.0	9.00	13.93	13.50	14.01	3.05	10640.5	120	0.0493	525.0544	3.1	9.448	534.5025
6500.0	9.36	14.48	13.50	14.57	3.30	10640.5	120	0.0531	564.6120	3.1	10.219	574.8309
6750.0	9.72	15.04	13.50	15.13	3.55	10640.5	120	0.0569	605.4874	3.1	11.020	616.5076
7000.0	10.08	15.60	13.50	15.69	3.82	10640.5	120	0.0609	647.6735	3.1	11.852	659.5251
7250.0	10.44	16.15	13.50	16.25	4.10	10640.5	120	0.0650	691.1631	3.1	12.713	703.8763
7500.0	10.80	16.71	13.50	16.81	4.39	10640.5	120	0.0692	735.9495	3.1	13.605	749.5546
7750.0	11.16	17.27	13.50	17.37	4.69	10640.5	120	0.0735	782.0262	3.1	14.527	796.5535
8000.0	11.52	17.83	13.50	17.93	4.99	10640.5	120	0.0779	829.3870	3.1	15.480	844.8666
8250.0	11.88	18.38	13.50	18.49	5.31	10640.5	120	0.0825	878.0258	3.1	16.462	894.4880
8500.0	12.24	18.94	13.50	19.05	5.64	10640.5	120	0.0872	927.9368	3.1	17.475	945.4118
8750.0	12.60	19.50	13.50	19.61	5.97	10640.5	120	0.0920	979.1145	3.1	18.518	997.6326
9000.0	12.96	20.05	13.50	20.17	6.32	10640.5	120	0.0969	1031.5533	3.1	19.591	1051.1447
9250.0	13.32	20.61	13.50	20.73	6.68	10640.5	120	0.1020	1085.2481	3.1	20.695	1105.9430
9500.0	13.68	21.17	13.50	21.29	7.04	10640.5	120	0.1072	1140.1938	3.1	21.829	1162.0225
9750.0	14.04	21.72	13.50	21.86	7.42	10640.5	120	0.1124	1196.3854	3.1	22.993	1219.3781
10000.0	14.40	22.28	13.50	22.42	7.80	10640.5	120	0.1178	1253.8181	3.1	24.187	1278.0050
10250.0	14.76	22.84	13.50	22.98	8.20	10640.5	120	0.1233	1312.4874	3.1	25.411	1337.8988
10500.0	15.12	23.40	13.50	23.54	8.60	10640.5	120	0.1290	1372.3887	3.1	26.666	1399.0548
10750.0	15.48	23.95	13.50	24.10	9.02	10640.5	120	0.1347	1433.5176	3.1	27.951	1461.4686
11000.0	15.84	24.51	13.50	24.66	9.44	10640.5	120	0.1406	1495.8698	3.1	29.266	1525.1360
11250.0	16.20	25.07	13.50	25.22	9.87	10640.5	120	0.1466	1559.4413	3.1	30.612	1590.0528
11500.0	16.56	25.62	13.50	25.78	10.32	10640.5	120	0.1526	1624.2278	3.1	31.987	1656.2150
11750.0	16.92	26.18	13.50	26.34	10.77	10640.5	120	0.1588	1690.2256	3.1	33.393	1723.6187
12000.0	17.28	26.74	13.50	26.90	11.24	10640.5	120	0.1652	1757.4307	3.1	34.829	1792.2599
12250.0	17.64	27.30	13.50	27.46	11.71	10640.5	120	0.1716	1825.8394	3.1	36.295	1862.1349
12500.0	18.00	27.85	13.50	28.02	12.19	10640.5	120	0.1781	1895.4481	3.1	37.792	1933.2401
12750.0	18.36	28.41	13.50	28.58	12.68	10640.5	120	0.1848	1966.2531	3.1	39.319	2005.5719
13000.0	18.72	28.97	13.50	29.14	13.19	10640.5	120	0.1916	2038.2509	3.1	40.876	2079.1267
13250.0	19.08	29.52	13.50	29.70	13.70	10640.5	120	0.1984	2111.4381	3.1	42.463	2153.9012
13500.0	19.44	30.08	13.50	30.26	14.22	10640.5	120	0.2054	2185.8114	3.1	44.081	2229.8920
13750.0	19.80	30.64	13.50	30.82	14.75	10640.5	120	0.2125	2261.3675	3.1	45.728	2307.0959
14000.0	20.16	31.19	13.50	31.38	15.29	10640.5	120	0.2197	2338.1032	3.1	47.406	2385.5095
14250.0	20.52	31.75	13.50	31.94	15.84	10640.5	120	0.2271	2416.0153	3.1	49.115	2465.1298
14500.0	20.88	32.31	13.50	32.50	16.40	10640.5	120	0.2345	2495.1008	3.1	50.853	2545.9537
14750.0	21.24	32.87	13.50	33.06	16.97	10640.5	120	0.2420	2575.3566	3.1	52.622	2627.9782
15000.0	21.60	33.42	13.50	33.62	17.56	10640.5	120	0.2497	2656.7798	3.1	54.421	2711.2003
15250.0	21.96	33.98	13.50	34.18	18.15	10640.5	120	0.2574	2739.3675	3.1	56.250	2795.6172
15500.0	22.32	34.54	13.50	34.74	18.74	10640.5	120	0.2653	2823.1168	3.1	58.109	2881.2259
15750.0	22.68	35.09	13.50	35.30	19.35	10640.5	120	0.2733	2908.0250	3.1	59.999	2968.0237
16000.0	23.04	35.65	13.50	35.87	19.97	10640.5	120	0.2814	2994.0893	3.1	61.918	3056.0078

FM System Curve – 23.85" (28" Parallel FM Portion)

Diameter = 23.85 in

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To 1st High Point (Wilber Ave Bridge) – Final Curve

Area = 3.102445 ft^2
RH=D/4= 0.456875
C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	619.99	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	619.99	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	619.99	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	619.99	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	619.99	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	619.99	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	619.99	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	619.99	120	0.0003	0.1811	2.7	0.066	0.2473
2000.0	2.88	4.46	23.85	1.44	0.03	619.99	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	619.99	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	619.99	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	619.99	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	619.99	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	619.99	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	619.99	120	0.0011	0.6538	2.7	0.265	0.9187
3750.0	5.40	8.36	23.85	2.69	0.11	619.99	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	619.99	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	619.99	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	619.99	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	619.99	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	619.99	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	619.99	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	619.99	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	619.99	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	619.99	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	619.99	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	619.99	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	619.99	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	619.99	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	619.99	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	619.99	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	619.99	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	619.99	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	619.99	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	619.99	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	619.99	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	619.99	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	619.99	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	619.99	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	619.99	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	619.99	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	619.99	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	619.99	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	619.99	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	619.99	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	619.99	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	619.99	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	619.99	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	619.99	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	619.99	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	619.99	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	619.99	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	619.99	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	619.99	120	0.0124	7.6943	2.7	3.797	11.4909

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To 1st High Point (Wilber Ave Bridge) – Final Curve

13500.0	19.44	30.08	23.85	9.70	1.46	619.99	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	619.99	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	619.99	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	619.99	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	619.99	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	619.99	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	619.99	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	619.99	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	619.99	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	619.99	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	619.99	120	0.0176	10.9108	2.7	5.536	16.4469

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To 1st High Point (Wilber Ave Bridge) – Final Curve

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	1.40
500.0	0.72	5.06
750.0	1.08	10.73
1000.0	1.44	18.30
1250.0	1.80	27.69
1500.0	2.16	38.84
1750.0	2.52	51.70
2000.0	2.88	66.24
2250.0	3.24	82.42
2500.0	3.60	100.22
2750.0	3.96	119.62
3000.0	4.32	140.58
3250.0	4.68	163.10
3500.0	5.04	187.15
3750.0	5.40	212.71
4000.0	5.76	239.78
4250.0	6.12	268.35
4500.0	6.48	298.38
4750.0	6.84	329.88
5000.0	7.20	362.84
5250.0	7.56	397.23
5500.0	7.92	433.06
5750.0	8.28	470.31
6000.0	8.64	508.98
6250.0	9.00	549.05
6500.0	9.36	590.52
6750.0	9.72	633.38
7000.0	10.08	677.62
7250.0	10.44	723.24
7500.0	10.80	770.22
7750.0	11.16	818.57
8000.0	11.52	868.27
8250.0	11.88	919.32
8500.0	12.24	971.71
8750.0	12.60	1025.44
9000.0	12.96	1080.50
9250.0	13.32	1136.89
9500.0	13.68	1194.61
9750.0	14.04	1253.63
10000.0	14.40	1313.97
10250.0	14.76	1375.62
10500.0	15.12	1438.57
10750.0	15.48	1502.81
11000.0	15.84	1568.35
11250.0	16.20	1635.18
11500.0	16.56	1703.30
11750.0	16.92	1772.70
12000.0	17.28	1843.37
12250.0	17.64	1915.32
12500.0	18.00	1988.54
12750.0	18.36	2063.02
13000.0	18.72	2138.77
13250.0	19.08	2215.77
13500.0	19.44	2294.03
13750.0	19.80	2373.55
14000.0	20.16	2454.31
14250.0	20.52	2536.32
14500.0	20.88	2619.57
14750.0	21.24	2704.07
15000.0	21.60	2789.80
15250.0	21.96	2876.76
15500.0	22.32	2964.95
15750.0	22.68	3054.38
16000.0	23.04	3145.02

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	58.13	62.63
250.0	0.36	59.53	64.03
500.0	0.72	63.19	67.69
750.0	1.08	68.86	73.36
1000.0	1.44	76.43	80.93
1250.0	1.80	85.82	90.32
1500.0	2.16	96.97	101.47
1750.0	2.52	109.83	114.33
2000.0	2.88	124.37	128.87
2250.0	3.24	140.55	145.05
2500.0	3.60	158.35	162.85
2750.0	3.96	177.75	182.25
3000.0	4.32	198.71	203.21
3250.0	4.68	221.23	225.73
3500.0	5.04	245.28	249.78
3750.0	5.40	270.84	275.34
4000.0	5.76	297.91	302.41
4250.0	6.12	326.48	330.98
4500.0	6.48	356.51	361.01
4750.0	6.84	388.01	392.51
5000.0	7.20	420.97	425.47
5250.0	7.56	455.36	459.86
5500.0	7.92	491.19	495.69
5750.0	8.28	528.44	532.94
6000.0	8.64	567.11	571.61
6250.0	9.00	607.18	611.68
6500.0	9.36	648.65	653.15
6750.0	9.72	691.51	696.01
7000.0	10.08	735.75	740.25
7250.0	10.44	781.37	785.87
7500.0	10.80	828.35	832.85
7750.0	11.16	876.70	881.20
8000.0	11.52	926.40	930.90
8250.0	11.88	977.45	981.95
8500.0	12.24	1029.84	1034.34
8750.0	12.60	1083.57	1088.07
9000.0	12.96	1138.63	1143.13
9250.0	13.32	1195.02	1199.52
9500.0	13.68	1252.74	1257.24
9750.0	14.04	1311.76	1316.26
10000.0	14.40	1372.10	1376.60
10250.0	14.76	1433.75	1438.25
10500.0	15.12	1496.70	1501.20
10750.0	15.48	1560.94	1565.44
11000.0	15.84	1626.48	1630.98
11250.0	16.20	1693.31	1697.81
11500.0	16.56	1761.43	1765.93
11750.0	16.92	1830.83	1835.33
12000.0	17.28	1901.50	1906.00
12250.0	17.64	1973.45	1977.95
12500.0	18.00	2046.67	2051.17
12750.0	18.36	2121.15	2125.65
13000.0	18.72	2196.90	2201.40
13250.0	19.08	2273.90	2278.40
13500.0	19.44	2352.16	2356.66
13750.0	19.80	2431.68	2436.18
14000.0	20.16	2512.44	2516.94
14250.0	20.52	2594.45	2598.95
14500.0	20.88	2677.70	2682.20
14750.0	21.24	2762.20	2766.70
15000.0	21.60	2847.93	2852.43
15250.0	21.96	2934.89	2939.39
15500.0	22.32	3023.08	3027.58
15750.0	22.68	3112.51	3117.01
16000.0	23.04	3203.15	3207.65

MIN Static Head = 58.13
MAX Static Head = 62.63

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To A Modified High Point

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FM System Curve – 24"

Diameter = 24 in
Area = 3.141593 ft^2
RH=D/4= 0.5
C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To A Modified High Point

13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve – 24" (24" Parallel FM Portion)

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	316	100	0.0000	0.0000	3.8	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	316	100	0.0000	0.0034	3.8	0.002	0.0053
500.0	0.72	1.11	24.00	0.35	0.00	316	100	0.0000	0.0123	3.8	0.007	0.0198
750.0	1.08	1.67	24.00	0.53	0.00	316	100	0.0001	0.0261	3.8	0.017	0.0428
1000.0	1.44	2.23	24.00	0.71	0.01	316	100	0.0001	0.0445	3.8	0.030	0.0742
1250.0	1.80	2.79	24.00	0.89	0.01	316	100	0.0002	0.0673	3.8	0.046	0.1137
1500.0	2.16	3.34	24.00	1.06	0.02	316	100	0.0003	0.0943	3.8	0.067	0.1611
1750.0	2.52	3.90	24.00	1.24	0.02	316	100	0.0004	0.1255	3.8	0.091	0.2164
2000.0	2.88	4.46	24.00	1.42	0.03	316	100	0.0005	0.1607	3.8	0.119	0.2794
2250.0	3.24	5.01	24.00	1.60	0.04	316	100	0.0006	0.1999	3.8	0.150	0.3501
2500.0	3.60	5.57	24.00	1.77	0.05	316	100	0.0008	0.2429	3.8	0.186	0.4284
2750.0	3.96	6.13	24.00	1.95	0.06	316	100	0.0009	0.2898	3.8	0.224	0.5143
3000.0	4.32	6.68	24.00	2.13	0.07	316	100	0.0011	0.3405	3.8	0.267	0.6077
3250.0	4.68	7.24	24.00	2.31	0.08	316	100	0.0012	0.3949	3.8	0.314	0.7084
3500.0	5.04	7.80	24.00	2.48	0.10	316	100	0.0014	0.4530	3.8	0.364	0.8166
3750.0	5.40	8.36	24.00	2.66	0.11	316	100	0.0016	0.5148	3.8	0.417	0.9322
4000.0	5.76	8.91	24.00	2.84	0.12	316	100	0.0018	0.5801	3.8	0.475	1.0550
4250.0	6.12	9.47	24.00	3.01	0.14	316	100	0.0021	0.6491	3.8	0.536	1.1852
4500.0	6.48	10.03	24.00	3.19	0.16	316	100	0.0023	0.7215	3.8	0.601	1.3226
4750.0	6.84	10.58	24.00	3.37	0.18	316	100	0.0025	0.7975	3.8	0.670	1.4672
5000.0	7.20	11.14	24.00	3.55	0.20	316	100	0.0028	0.8770	3.8	0.742	1.6191
5250.0	7.56	11.70	24.00	3.72	0.22	316	100	0.0030	0.9599	3.8	0.818	1.7781
5500.0	7.92	12.25	24.00	3.90	0.24	316	100	0.0033	1.0463	3.8	0.898	1.9442
5750.0	8.28	12.81	24.00	4.08	0.26	316	100	0.0036	1.1361	3.8	0.981	2.1175
6000.0	8.64	13.37	24.00	4.26	0.28	316	100	0.0039	1.2293	3.8	1.069	2.2978
6250.0	9.00	13.93	24.00	4.43	0.31	316	100	0.0042	1.3258	3.8	1.159	2.4853
6500.0	9.36	14.48	24.00	4.61	0.33	316	100	0.0045	1.4257	3.8	1.254	2.6798
6750.0	9.72	15.04	24.00	4.79	0.36	316	100	0.0048	1.5289	3.8	1.352	2.8813
7000.0	10.08	15.60	24.00	4.96	0.38	316	100	0.0052	1.6354	3.8	1.454	3.0898
7250.0	10.44	16.15	24.00	5.14	0.41	316	100	0.0055	1.7452	3.8	1.560	3.3054
7500.0	10.80	16.71	24.00	5.32	0.44	316	100	0.0059	1.8583	3.8	1.670	3.5279
7750.0	11.16	17.27	24.00	5.50	0.47	316	100	0.0062	1.9747	3.8	1.783	3.7575
8000.0	11.52	17.83	24.00	5.67	0.50	316	100	0.0066	2.0943	3.8	1.900	3.9939
8250.0	11.88	18.38	24.00	5.85	0.53	316	100	0.0070	2.2171	3.8	2.020	4.2373
8500.0	12.24	18.94	24.00	6.03	0.56	316	100	0.0074	2.3431	3.8	2.145	4.4876
8750.0	12.60	19.50	24.00	6.21	0.60	316	100	0.0078	2.4723	3.8	2.273	4.7449
9000.0	12.96	20.05	24.00	6.38	0.63	316	100	0.0082	2.6048	3.8	2.404	5.0090
9250.0	13.32	20.61	24.00	6.56	0.67	316	100	0.0087	2.7403	3.8	2.540	5.2800
9500.0	13.68	21.17	24.00	6.74	0.70	316	100	0.0091	2.8791	3.8	2.679	5.5579
9750.0	14.04	21.72	24.00	6.92	0.74	316	100	0.0096	3.0210	3.8	2.822	5.8426
10000.0	14.40	22.28	24.00	7.09	0.78	316	100	0.0100	3.1660	3.8	2.968	6.1342
10250.0	14.76	22.84	24.00	7.27	0.82	316	100	0.0105	3.3141	3.8	3.118	6.4326
10500.0	15.12	23.40	24.00	7.45	0.86	316	100	0.0110	3.4654	3.8	3.272	6.7378

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To A Modified High Point

10750.0	15.48	23.95	24.00	7.62	0.90	316	100	0.0115	3.6197	3.8	3.430	7.0499
11000.0	15.84	24.51	24.00	7.80	0.95	316	100	0.0120	3.7772	3.8	3.592	7.3687
11250.0	16.20	25.07	24.00	7.98	0.99	316	100	0.0125	3.9377	3.8	3.757	7.6943
11500.0	16.56	25.62	24.00	8.16	1.03	316	100	0.0130	4.1013	3.8	3.925	8.0267
11750.0	16.92	26.18	24.00	8.33	1.08	316	100	0.0135	4.2680	3.8	4.098	8.3659
12000.0	17.28	26.74	24.00	8.51	1.12	316	100	0.0140	4.4377	3.8	4.274	8.7119
12250.0	17.64	27.30	24.00	8.69	1.17	316	100	0.0146	4.6104	3.8	4.454	9.0645
12500.0	18.00	27.85	24.00	8.87	1.22	316	100	0.0151	4.7862	3.8	4.638	9.4240
12750.0	18.36	28.41	24.00	9.04	1.27	316	100	0.0157	4.9650	3.8	4.825	9.7901
13000.0	18.72	28.97	24.00	9.22	1.32	316	100	0.0163	5.1468	3.8	5.016	10.1630
13250.0	19.08	29.52	24.00	9.40	1.37	316	100	0.0169	5.3316	3.8	5.211	10.5426
13500.0	19.44	30.08	24.00	9.57	1.42	316	100	0.0175	5.5194	3.8	5.410	10.9289
13750.0	19.80	30.64	24.00	9.75	1.48	316	100	0.0181	5.7101	3.8	5.612	11.3219
14000.0	20.16	31.19	24.00	9.93	1.53	316	100	0.0187	5.9039	3.8	5.818	11.7216
14250.0	20.52	31.75	24.00	10.11	1.59	316	100	0.0193	6.1006	3.8	6.027	12.1279
14500.0	20.88	32.31	24.00	10.28	1.64	316	100	0.0199	6.3003	3.8	6.241	12.5410
14750.0	21.24	32.87	24.00	10.46	1.70	316	100	0.0206	6.5030	3.8	6.458	12.9607
15000.0	21.60	33.42	24.00	10.64	1.76	316	100	0.0212	6.7086	3.8	6.678	13.3870
15250.0	21.96	33.98	24.00	10.82	1.82	316	100	0.0219	6.9171	3.8	6.903	13.8200
15500.0	22.32	34.54	24.00	10.99	1.88	316	100	0.0226	7.1286	3.8	7.131	14.2597
15750.0	22.68	35.09	24.00	11.17	1.94	316	100	0.0232	7.3430	3.8	7.363	14.7060
16000.0	23.04	35.65	24.00	11.35	2.00	316	100	0.0239	7.5603	3.8	7.599	15.1589

FM System Curve – 14" (14" Parallel FM Portion)

Diameter = 14 in

Area = 1.069014 ft^2

RH=D/4= 0.291667

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	14.00	0.00	0.00	68.50	100	0.0000	0.0000	1.72	0.000	0.0000
250.0	0.36	0.56	14.00	0.52	0.00	68.50	100	0.0001	0.0102	1.72	0.007	0.0175
500.0	0.72	1.11	14.00	1.04	0.02	68.50	100	0.0005	0.0369	1.72	0.029	0.0659
750.0	1.08	1.67	14.00	1.56	0.04	68.50	100	0.0011	0.0782	1.72	0.065	0.1435
1000.0	1.44	2.23	14.00	2.08	0.07	68.50	100	0.0019	0.1333	1.72	0.116	0.2493
1250.0	1.80	2.79	14.00	2.61	0.11	68.50	100	0.0029	0.2014	1.72	0.181	0.3827
1500.0	2.16	3.34	14.00	3.13	0.15	68.50	100	0.0041	0.2824	1.72	0.261	0.5434
1750.0	2.52	3.90	14.00	3.65	0.21	68.50	100	0.0055	0.3756	1.72	0.355	0.7310
2000.0	2.88	4.46	14.00	4.17	0.27	68.50	100	0.0070	0.4810	1.72	0.464	0.9452
2250.0	3.24	5.01	14.00	4.69	0.34	68.50	100	0.0087	0.5983	1.72	0.587	1.1857
2500.0	3.60	5.57	14.00	5.21	0.42	68.50	100	0.0106	0.7272	1.72	0.725	1.4524
2750.0	3.96	6.13	14.00	5.73	0.51	68.50	100	0.0127	0.8676	1.72	0.877	1.7451
3000.0	4.32	6.68	14.00	6.25	0.61	68.50	100	0.0149	1.0193	1.72	1.044	2.0636
3250.0	4.68	7.24	14.00	6.77	0.71	68.50	100	0.0173	1.1822	1.72	1.226	2.4077
3500.0	5.04	7.80	14.00	7.30	0.83	68.50	100	0.0198	1.3561	1.72	1.421	2.7775
3750.0	5.40	8.36	14.00	7.82	0.95	68.50	100	0.0225	1.5409	1.72	1.632	3.1726
4000.0	5.76	8.91	14.00	8.34	1.08	68.50	100	0.0254	1.7366	1.72	1.856	3.5930
4250.0	6.12	9.47	14.00	8.86	1.22	68.50	100	0.0284	1.9429	1.72	2.096	4.0387
4500.0	6.48	10.03	14.00	9.38	1.37	68.50	100	0.0315	2.1599	1.72	2.350	4.5095
4750.0	6.84	10.58	14.00	9.90	1.52	68.50	100	0.0349	2.3873	1.72	2.618	5.0053
5000.0	7.20	11.14	14.00	10.42	1.69	68.50	100	0.0383	2.6252	1.72	2.901	5.5260
5250.0	7.56	11.70	14.00	10.94	1.86	68.50	100	0.0419	2.8735	1.72	3.198	6.0716
5500.0	7.92	12.25	14.00	11.46	2.04	68.50	100	0.0457	3.1320	1.72	3.510	6.6420
5750.0	8.28	12.81	14.00	11.98	2.23	68.50	100	0.0496	3.4008	1.72	3.836	7.2370
6000.0	8.64	13.37	14.00	12.51	2.43	68.50	100	0.0537	3.6797	1.72	4.177	7.8568
6250.0	9.00	13.93	14.00	13.03	2.64	68.50	100	0.0579	3.9687	1.72	4.532	8.5011
6500.0	9.36	14.48	14.00	13.55	2.85	68.50	100	0.0623	4.2677	1.72	4.902	9.1699
6750.0	9.72	15.04	14.00	14.07	3.07	68.50	100	0.0668	4.5766	1.72	5.287	9.8633
7000.0	10.08	15.60	14.00	14.59	3.31	68.50	100	0.0715	4.8955	1.72	5.685	10.5810
7250.0	10.44	16.15	14.00	15.11	3.55	68.50	100	0.0763	5.2242	1.72	6.099	11.3231
7500.0	10.80	16.71	14.00	15.63	3.79	68.50	100	0.0812	5.5628	1.72	6.527	12.0894

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To A Modified High Point

7750.0	11.16	17.27	14.00	16.15	4.05	68.50	100	0.0863	5.9110	1.72	6.969	12.8801
8000.0	11.52	17.83	14.00	16.67	4.32	68.50	100	0.0915	6.2690	1.72	7.426	13.6949
8250.0	11.88	18.38	14.00	17.20	4.59	68.50	100	0.0969	6.6367	1.72	7.897	14.5339
8500.0	12.24	18.94	14.00	17.72	4.87	68.50	100	0.1024	7.0139	1.72	8.383	15.3971
8750.0	12.60	19.50	14.00	18.24	5.16	68.50	100	0.1080	7.4007	1.72	8.884	16.2843
9000.0	12.96	20.05	14.00	18.76	5.46	68.50	100	0.1138	7.7971	1.72	9.398	17.1955
9250.0	13.32	20.61	14.00	19.28	5.77	68.50	100	0.1198	8.2030	1.72	9.928	18.1308
9500.0	13.68	21.17	14.00	19.80	6.09	68.50	100	0.1258	8.6183	1.72	10.472	19.0900
9750.0	14.04	21.72	14.00	20.32	6.41	68.50	100	0.1320	9.0430	1.72	11.030	20.0731
10000.0	14.40	22.28	14.00	20.84	6.75	68.50	100	0.1384	9.4771	1.72	11.603	21.0801
10250.0	14.76	22.84	14.00	21.36	7.09	68.50	100	0.1448	9.9206	1.72	12.190	22.1110
10500.0	15.12	23.40	14.00	21.89	7.44	68.50	100	0.1514	10.3734	1.72	12.792	23.1657
10750.0	15.48	23.95	14.00	22.41	7.80	68.50	100	0.1582	10.8354	1.72	13.409	24.2441
11000.0	15.84	24.51	14.00	22.93	8.16	68.50	100	0.1651	11.3067	1.72	14.040	25.3463
11250.0	16.20	25.07	14.00	23.45	8.54	68.50	100	0.1721	11.7872	1.72	14.685	26.4722
11500.0	16.56	25.62	14.00	23.97	8.92	68.50	100	0.1792	12.2769	1.72	15.345	27.6219
11750.0	16.92	26.18	14.00	24.49	9.31	68.50	100	0.1865	12.7758	1.72	16.019	28.7951
12000.0	17.28	26.74	14.00	25.01	9.71	68.50	100	0.1939	13.2837	1.72	16.708	29.9920
12250.0	17.64	27.30	14.00	25.53	10.12	68.50	100	0.2015	13.8008	1.72	17.412	31.2126
12500.0	18.00	27.85	14.00	26.05	10.54	68.50	100	0.2092	14.3270	1.72	18.130	32.4566
12750.0	18.36	28.41	14.00	26.58	10.97	68.50	100	0.2170	14.8621	1.72	18.862	33.7243
13000.0	18.72	28.97	14.00	27.10	11.40	68.50	100	0.2249	15.4063	1.72	19.609	35.0154
13250.0	19.08	29.52	14.00	27.62	11.84	68.50	100	0.2330	15.9595	1.72	20.371	36.3300
13500.0	19.44	30.08	14.00	28.14	12.29	68.50	100	0.2412	16.5217	1.72	21.146	37.6682
13750.0	19.80	30.64	14.00	28.66	12.75	68.50	100	0.2495	17.0928	1.72	21.937	39.0297
14000.0	20.16	31.19	14.00	29.18	13.22	68.50	100	0.2580	17.6728	1.72	22.742	40.4147
14250.0	20.52	31.75	14.00	29.70	13.70	68.50	100	0.2666	18.2617	1.72	23.561	41.8230
14500.0	20.88	32.31	14.00	30.22	14.18	68.50	100	0.2753	18.8595	1.72	24.395	43.2548
14750.0	21.24	32.87	14.00	30.74	14.68	68.50	100	0.2842	19.4661	1.72	25.244	44.7099
15000.0	21.60	33.42	14.00	31.26	15.18	68.50	100	0.2932	20.0816	1.72	26.107	46.1883
15250.0	21.96	33.98	14.00	31.79	15.69	68.50	100	0.3023	20.7058	1.72	26.984	47.6900
15500.0	22.32	34.54	14.00	32.31	16.21	68.50	100	0.3115	21.3388	1.72	27.876	49.2150
15750.0	22.68	35.09	14.00	32.83	16.73	68.50	100	0.3209	21.9806	1.72	28.783	50.7633
16000.0	23.04	35.65	14.00	33.35	17.27	68.50	100	0.3304	22.6312	1.72	29.704	52.3348

FM System Curve – 13.5" (14" Parallel FM Portion)

Diameter = 13.5 in

Area = 0.99402 ft^2

RH=D/4= 0.28125

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	13.50	0.00	0.00	10640.5	120	0.0000	0.0000	3.1	0.000	0.0000
250.0	0.36	0.56	13.50	0.56	0.00	10640.5	120	0.0001	1.3528	3.1	0.015	1.3679
500.0	0.72	1.11	13.50	1.12	0.02	10640.5	120	0.0005	4.8835	3.1	0.060	4.9439
750.0	1.08	1.67	13.50	1.68	0.04	10640.5	120	0.0010	10.3478	3.1	0.136	10.4839
1000.0	1.44	2.23	13.50	2.24	0.08	10640.5	120	0.0017	17.6293	3.1	0.242	17.8711
1250.0	1.80	2.79	13.50	2.80	0.12	10640.5	120	0.0025	26.6509	3.1	0.378	27.0288
1500.0	2.16	3.34	13.50	3.36	0.18	10640.5	120	0.0035	37.3556	3.1	0.544	37.8998
1750.0	2.52	3.90	13.50	3.92	0.24	10640.5	120	0.0047	49.6982	3.1	0.741	50.4390
2000.0	2.88	4.46	13.50	4.48	0.31	10640.5	120	0.0060	63.6417	3.1	0.967	64.6092
2250.0	3.24	5.01	13.50	5.04	0.39	10640.5	120	0.0074	79.1547	3.1	1.224	80.3791
2500.0	3.60	5.57	13.50	5.60	0.49	10640.5	120	0.0090	96.2098	3.1	1.512	97.7215
2750.0	3.96	6.13	13.50	6.16	0.59	10640.5	120	0.0108	114.7833	3.1	1.829	116.6124
3000.0	4.32	6.68	13.50	6.72	0.70	10640.5	120	0.0127	134.8538	3.1	2.177	137.0306
3250.0	4.68	7.24	13.50	7.29	0.82	10640.5	120	0.0147	156.4021	3.1	2.555	158.9568
3500.0	5.04	7.80	13.50	7.85	0.96	10640.5	120	0.0169	179.4108	3.1	2.963	182.3737
3750.0	5.40	8.36	13.50	8.41	1.10	10640.5	120	0.0192	203.8640	3.1	3.401	207.2652
4000.0	5.76	8.91	13.50	8.97	1.25	10640.5	120	0.0216	229.7469	3.1	3.870	233.6168
4250.0	6.12	9.47	13.50	9.53	1.41	10640.5	120	0.0242	257.0460	3.1	4.369	261.4148
4500.0	6.48	10.03	13.50	10.09	1.58	10640.5	120	0.0269	285.7486	3.1	4.898	290.6465

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To A Modified High Point

4750.0	6.84	10.58	13.50	10.65	1.76	10640.5	120	0.0297	315.8429	3.1	5.457	321.3001
5000.0	7.20	11.14	13.50	11.21	1.95	10640.5	120	0.0326	347.3178	3.1	6.047	353.3645
5250.0	7.56	11.70	13.50	11.77	2.15	10640.5	120	0.0357	380.1628	3.1	6.667	386.8293
5500.0	7.92	12.25	13.50	12.33	2.36	10640.5	120	0.0389	414.3680	3.1	7.317	421.6846
5750.0	8.28	12.81	13.50	12.89	2.58	10640.5	120	0.0423	449.9242	3.1	7.997	457.9210
6000.0	8.64	13.37	13.50	13.45	2.81	10640.5	120	0.0458	486.8225	3.1	8.707	495.5298
6250.0	9.00	13.93	13.50	14.01	3.05	10640.5	120	0.0493	525.0544	3.1	9.448	534.5025
6500.0	9.36	14.48	13.50	14.57	3.30	10640.5	120	0.0531	564.6120	3.1	10.219	574.8309
6750.0	9.72	15.04	13.50	15.13	3.55	10640.5	120	0.0569	605.4874	3.1	11.020	616.5076
7000.0	10.08	15.60	13.50	15.69	3.82	10640.5	120	0.0609	647.6735	3.1	11.852	659.5251
7250.0	10.44	16.15	13.50	16.25	4.10	10640.5	120	0.0650	691.1631	3.1	12.713	703.8763
7500.0	10.80	16.71	13.50	16.81	4.39	10640.5	120	0.0692	735.9495	3.1	13.605	749.5546
7750.0	11.16	17.27	13.50	17.37	4.69	10640.5	120	0.0735	782.0262	3.1	14.527	796.5535
8000.0	11.52	17.83	13.50	17.93	4.99	10640.5	120	0.0779	829.3870	3.1	15.480	844.8666
8250.0	11.88	18.38	13.50	18.49	5.31	10640.5	120	0.0825	878.0258	3.1	16.462	894.4880
8500.0	12.24	18.94	13.50	19.05	5.64	10640.5	120	0.0872	927.9368	3.1	17.475	945.4118
8750.0	12.60	19.50	13.50	19.61	5.97	10640.5	120	0.0920	979.1145	3.1	18.518	997.6326
9000.0	12.96	20.05	13.50	20.17	6.32	10640.5	120	0.0969	1031.5533	3.1	19.591	1051.1447
9250.0	13.32	20.61	13.50	20.73	6.68	10640.5	120	0.1020	1085.2481	3.1	20.695	1105.9430
9500.0	13.68	21.17	13.50	21.29	7.04	10640.5	120	0.1072	1140.1938	3.1	21.829	1162.0225
9750.0	14.04	21.72	13.50	21.86	7.42	10640.5	120	0.1124	1196.3854	3.1	22.993	1219.3781
10000.0	14.40	22.28	13.50	22.42	7.80	10640.5	120	0.1178	1253.8181	3.1	24.187	1278.0050
10250.0	14.76	22.84	13.50	22.98	8.20	10640.5	120	0.1233	1312.4874	3.1	25.411	1337.8988
10500.0	15.12	23.40	13.50	23.54	8.60	10640.5	120	0.1290	1372.3887	3.1	26.666	1399.0548
10750.0	15.48	23.95	13.50	24.10	9.02	10640.5	120	0.1347	1433.5176	3.1	27.951	1461.4686
11000.0	15.84	24.51	13.50	24.66	9.44	10640.5	120	0.1406	1495.8698	3.1	29.266	1525.1360
11250.0	16.20	25.07	13.50	25.22	9.87	10640.5	120	0.1466	1559.4413	3.1	30.612	1590.0528
11500.0	16.56	25.62	13.50	25.78	10.32	10640.5	120	0.1526	1624.2278	3.1	31.987	1656.2150
11750.0	16.92	26.18	13.50	26.34	10.77	10640.5	120	0.1588	1690.2256	3.1	33.393	1723.6187
12000.0	17.28	26.74	13.50	26.90	11.24	10640.5	120	0.1652	1757.4307	3.1	34.829	1792.2599
12250.0	17.64	27.30	13.50	27.46	11.71	10640.5	120	0.1716	1825.8394	3.1	36.295	1862.1349
12500.0	18.00	27.85	13.50	28.02	12.19	10640.5	120	0.1781	1895.4481	3.1	37.792	1933.2401
12750.0	18.36	28.41	13.50	28.58	12.68	10640.5	120	0.1848	1966.2531	3.1	39.319	2005.5719
13000.0	18.72	28.97	13.50	29.14	13.19	10640.5	120	0.1916	2038.2509	3.1	40.876	2079.1267
13250.0	19.08	29.52	13.50	29.70	13.70	10640.5	120	0.1984	2111.4381	3.1	42.463	2153.9012
13500.0	19.44	30.08	13.50	30.26	14.22	10640.5	120	0.2054	2185.8114	3.1	44.081	2229.8920
13750.0	19.80	30.64	13.50	30.82	14.75	10640.5	120	0.2125	2261.3675	3.1	45.728	2307.0959
14000.0	20.16	31.19	13.50	31.38	15.29	10640.5	120	0.2197	2338.1032	3.1	47.406	2385.5095
14250.0	20.52	31.75	13.50	31.94	15.84	10640.5	120	0.2271	2416.0153	3.1	49.115	2465.1298
14500.0	20.88	32.31	13.50	32.50	16.40	10640.5	120	0.2345	2495.1008	3.1	50.853	2545.9537
14750.0	21.24	32.87	13.50	33.06	16.97	10640.5	120	0.2420	2575.3566	3.1	52.622	2627.9782
15000.0	21.60	33.42	13.50	33.62	17.56	10640.5	120	0.2497	2656.7798	3.1	54.421	2711.2003
15250.0	21.96	33.98	13.50	34.18	18.15	10640.5	120	0.2574	2739.3675	3.1	56.250	2795.6172
15500.0	22.32	34.54	13.50	34.74	18.74	10640.5	120	0.2653	2823.1168	3.1	58.109	2881.2259
15750.0	22.68	35.09	13.50	35.30	19.35	10640.5	120	0.2733	2908.0250	3.1	59.999	2968.0237
16000.0	23.04	35.65	13.50	35.87	19.97	10640.5	120	0.2814	2994.0893	3.1	61.918	3056.0078

FM System Curve – 23.85" (28" Parallel FM Portion)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.456875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	619.99	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	619.99	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	619.99	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	619.99	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	619.99	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	619.99	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	619.99	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	619.99	120	0.0003	0.1811	2.7	0.066	0.2473

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To A Modified High Point

2000.0	2.88	4.46	23.85	1.44	0.03	619.99	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	619.99	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	619.99	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	619.99	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	619.99	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	619.99	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	619.99	120	0.0011	0.6538	2.7	0.265	0.9187
3750.0	5.40	8.36	23.85	2.69	0.11	619.99	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	619.99	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	619.99	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	619.99	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	619.99	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	619.99	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	619.99	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	619.99	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	619.99	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	619.99	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	619.99	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	619.99	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	619.99	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	619.99	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	619.99	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	619.99	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	619.99	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	619.99	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	619.99	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	619.99	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	619.99	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	619.99	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	619.99	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	619.99	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	619.99	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	619.99	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	619.99	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	619.99	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	619.99	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	619.99	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	619.99	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	619.99	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	619.99	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	619.99	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	619.99	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	619.99	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	619.99	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	619.99	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	619.99	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	619.99	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	619.99	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	619.99	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	619.99	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	619.99	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	619.99	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	619.99	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	619.99	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	619.99	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	619.99	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	619.99	120	0.0176	10.9108	2.7	5.536	16.4469

FM System Curve – 25.14" (28" DIP))

Diameter =	25.14	in
Area =	3.4471	ft^2
RH=D/4=	0.5238	
C=	100	

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To A Modified High Point

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.14	0.00	0.00	625	100	0.0000	0.0000	0.6	0.000	0.0000
250.0	0.36	0.56	25.14	0.16	0.00	625	100	0.0000	0.0054	0.6	0.000	0.0056
500.0	0.72	1.11	25.14	0.32	0.00	625	100	0.0000	0.0195	0.6	0.001	0.0204
750.0	1.08	1.67	25.14	0.48	0.00	625	100	0.0001	0.0412	0.6	0.002	0.0434
1000.0	1.44	2.23	25.14	0.65	0.01	625	100	0.0001	0.0702	0.6	0.004	0.0741
1250.0	1.80	2.79	25.14	0.81	0.01	625	100	0.0002	0.1062	0.6	0.006	0.1123
1500.0	2.16	3.34	25.14	0.97	0.01	625	100	0.0002	0.1488	0.6	0.009	0.1576
1750.0	2.52	3.90	25.14	1.13	0.02	625	100	0.0003	0.1980	0.6	0.012	0.2099
2000.0	2.88	4.46	25.14	1.29	0.03	625	100	0.0004	0.2535	0.6	0.016	0.2691
2250.0	3.24	5.01	25.14	1.45	0.03	625	100	0.0005	0.3153	0.6	0.020	0.3350
2500.0	3.60	5.57	25.14	1.62	0.04	625	100	0.0006	0.3833	0.6	0.024	0.4076
2750.0	3.96	6.13	25.14	1.78	0.05	625	100	0.0007	0.4573	0.6	0.029	0.4867
3000.0	4.32	6.68	25.14	1.94	0.06	625	100	0.0009	0.5372	0.6	0.035	0.5723
3250.0	4.68	7.24	25.14	2.10	0.07	625	100	0.0010	0.6231	0.6	0.041	0.6642
3500.0	5.04	7.80	25.14	2.26	0.08	625	100	0.0011	0.7147	0.6	0.048	0.7624
3750.0	5.40	8.36	25.14	2.42	0.09	625	100	0.0013	0.8122	0.6	0.055	0.8669
4000.0	5.76	8.91	25.14	2.59	0.10	625	100	0.0015	0.9153	0.6	0.062	0.9776
4250.0	6.12	9.47	25.14	2.75	0.12	625	100	0.0016	1.0240	0.6	0.070	1.0943
4500.0	6.48	10.03	25.14	2.91	0.13	625	100	0.0018	1.1384	0.6	0.079	1.2172
4750.0	6.84	10.58	25.14	3.07	0.15	625	100	0.0020	1.2583	0.6	0.088	1.3461
5000.0	7.20	11.14	25.14	3.23	0.16	625	100	0.0022	1.3837	0.6	0.097	1.4810
5250.0	7.56	11.70	25.14	3.39	0.18	625	100	0.0024	1.5145	0.6	0.107	1.6218
5500.0	7.92	12.25	25.14	3.56	0.20	625	100	0.0026	1.6508	0.6	0.118	1.7685
5750.0	8.28	12.81	25.14	3.72	0.21	625	100	0.0029	1.7924	0.6	0.129	1.9211
6000.0	8.64	13.37	25.14	3.88	0.23	625	100	0.0031	1.9394	0.6	0.140	2.0796
6250.0	9.00	13.93	25.14	4.04	0.25	625	100	0.0033	2.0917	0.6	0.152	2.2438
6500.0	9.36	14.48	25.14	4.20	0.27	625	100	0.0036	2.2493	0.6	0.164	2.4138
6750.0	9.72	15.04	25.14	4.36	0.30	625	100	0.0039	2.4122	0.6	0.177	2.5895
7000.0	10.08	15.60	25.14	4.52	0.32	625	100	0.0041	2.5802	0.6	0.191	2.7710
7250.0	10.44	16.15	25.14	4.69	0.34	625	100	0.0044	2.7535	0.6	0.205	2.9581
7500.0	10.80	16.71	25.14	4.85	0.36	625	100	0.0047	2.9319	0.6	0.219	3.1509
7750.0	11.16	17.27	25.14	5.01	0.39	625	100	0.0050	3.1155	0.6	0.234	3.3493
8000.0	11.52	17.83	25.14	5.17	0.42	625	100	0.0053	3.3042	0.6	0.249	3.5533
8250.0	11.88	18.38	25.14	5.33	0.44	625	100	0.0056	3.4979	0.6	0.265	3.7629
8500.0	12.24	18.94	25.14	5.49	0.47	625	100	0.0059	3.6968	0.6	0.281	3.9780
8750.0	12.60	19.50	25.14	5.66	0.50	625	100	0.0062	3.9006	0.6	0.298	4.1987
9000.0	12.96	20.05	25.14	5.82	0.53	625	100	0.0066	4.1096	0.6	0.315	4.4249
9250.0	13.32	20.61	25.14	5.98	0.56	625	100	0.0069	4.3235	0.6	0.333	4.6565
9500.0	13.68	21.17	25.14	6.14	0.59	625	100	0.0073	4.5424	0.6	0.351	4.8937
9750.0	14.04	21.72	25.14	6.30	0.62	625	100	0.0076	4.7662	0.6	0.370	5.1363
10000.0	14.40	22.28	25.14	6.46	0.65	625	100	0.0080	4.9950	0.6	0.389	5.3843
10250.0	14.76	22.84	25.14	6.63	0.68	625	100	0.0084	5.2288	0.6	0.409	5.6377
10500.0	15.12	23.40	25.14	6.79	0.72	625	100	0.0087	5.4674	0.6	0.429	5.8966
10750.0	15.48	23.95	25.14	6.95	0.75	625	100	0.0091	5.7109	0.6	0.450	6.1608
11000.0	15.84	24.51	25.14	7.11	0.79	625	100	0.0095	5.9593	0.6	0.471	6.4303
11250.0	16.20	25.07	25.14	7.27	0.82	625	100	0.0099	6.2126	0.6	0.493	6.7052
11500.0	16.56	25.62	25.14	7.43	0.86	625	100	0.0104	6.4707	0.6	0.515	6.9855
11750.0	16.92	26.18	25.14	7.59	0.90	625	100	0.0108	6.7336	0.6	0.537	7.2710
12000.0	17.28	26.74	25.14	7.76	0.93	625	100	0.0112	7.0013	0.6	0.561	7.5619
12250.0	17.64	27.30	25.14	7.92	0.97	625	100	0.0116	7.2739	0.6	0.584	7.8580
12500.0	18.00	27.85	25.14	8.08	1.01	625	100	0.0121	7.5512	0.6	0.608	8.1594
12750.0	18.36	28.41	25.14	8.24	1.05	625	100	0.0125	7.8333	0.6	0.633	8.4661
13000.0	18.72	28.97	25.14	8.40	1.10	625	100	0.0130	8.1201	0.6	0.658	8.7779
13250.0	19.08	29.52	25.14	8.56	1.14	625	100	0.0135	8.4117	0.6	0.683	9.0951
13500.0	19.44	30.08	25.14	8.73	1.18	625	100	0.0139	8.7079	0.6	0.709	9.4174
13750.0	19.80	30.64	25.14	8.89	1.23	625	100	0.0144	9.0089	0.6	0.736	9.7449
14000.0	20.16	31.19	25.14	9.05	1.27	625	100	0.0149	9.3147	0.6	0.763	10.0776
14250.0	20.52	31.75	25.14	9.21	1.32	625	100	0.0154	9.6250	0.6	0.790	10.4155
14500.0	20.88	32.31	25.14	9.37	1.36	625	100	0.0159	9.9401	0.6	0.818	10.7585
14750.0	21.24	32.87	25.14	9.53	1.41	625	100	0.0164	10.2598	0.6	0.847	11.1067
15000.0	21.60	33.42	25.14	9.70	1.46	625	100	0.0169	10.5842	0.6	0.876	11.4601
15250.0	21.96	33.98	25.14	9.86	1.51	625	100	0.0175	10.9132	0.6	0.905	11.8185

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To A Modified High Point

15500.0	22.32	34.54	25.14	10.02	1.56	625	100	0.0180	11.2469	0.6	0.935	12.1821
15750.0	22.68	35.09	25.14	10.18	1.61	625	100	0.0185	11.5851	0.6	0.966	12.5508
16000.0	23.04	35.65	25.14	10.34	1.66	625	100	0.0191	11.9280	0.6	0.997	12.9245

FM System Curve – 25.3" (30" DIP))

Diameter = 25.3 in
Area = 3.4911 ft^2
RH=D/4= 0.5271
C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.30	0.00	0.00	2455	120	0.0000	0.0000	2.75	0.000	0.0000
250.0	0.36	0.56	25.30	0.16	0.00	2455	120	0.0000	0.0146	2.75	0.001	0.0157
500.0	0.72	1.11	25.30	0.32	0.00	2455	120	0.0000	0.0529	2.75	0.004	0.0572
750.0	1.08	1.67	25.30	0.48	0.00	2455	120	0.0000	0.1120	2.75	0.010	0.1218
1000.0	1.44	2.23	25.30	0.64	0.01	2455	120	0.0001	0.1908	2.75	0.017	0.2082
1250.0	1.80	2.79	25.30	0.80	0.01	2455	120	0.0001	0.2885	2.75	0.027	0.3157
1500.0	2.16	3.34	25.30	0.96	0.01	2455	120	0.0002	0.4044	2.75	0.039	0.4435
1750.0	2.52	3.90	25.30	1.12	0.02	2455	120	0.0002	0.5380	2.75	0.053	0.5912
2000.0	2.88	4.46	25.30	1.28	0.03	2455	120	0.0003	0.6889	2.75	0.070	0.7585
2250.0	3.24	5.01	25.30	1.44	0.03	2455	120	0.0003	0.8568	2.75	0.088	0.9449
2500.0	3.60	5.57	25.30	1.60	0.04	2455	120	0.0004	1.0414	2.75	0.109	1.1501
2750.0	3.96	6.13	25.30	1.76	0.05	2455	120	0.0005	1.2425	2.75	0.132	1.3740
3000.0	4.32	6.68	25.30	1.91	0.06	2455	120	0.0006	1.4597	2.75	0.157	1.6163
3250.0	4.68	7.24	25.30	2.07	0.07	2455	120	0.0007	1.6930	2.75	0.184	1.8767
3500.0	5.04	7.80	25.30	2.23	0.08	2455	120	0.0008	1.9420	2.75	0.213	2.1551
3750.0	5.40	8.36	25.30	2.39	0.09	2455	120	0.0009	2.2067	2.75	0.245	2.4513
4000.0	5.76	8.91	25.30	2.55	0.10	2455	120	0.0010	2.4869	2.75	0.278	2.7652
4250.0	6.12	9.47	25.30	2.71	0.11	2455	120	0.0011	2.7824	2.75	0.314	3.0966
4500.0	6.48	10.03	25.30	2.87	0.13	2455	120	0.0013	3.0931	2.75	0.352	3.4453
4750.0	6.84	10.58	25.30	3.03	0.14	2455	120	0.0014	3.4189	2.75	0.392	3.8113
5000.0	7.20	11.14	25.30	3.19	0.16	2455	120	0.0015	3.7596	2.75	0.435	4.1944
5250.0	7.56	11.70	25.30	3.35	0.17	2455	120	0.0017	4.1151	2.75	0.479	4.5945
5500.0	7.92	12.25	25.30	3.51	0.19	2455	120	0.0018	4.4854	2.75	0.526	5.0115
5750.0	8.28	12.81	25.30	3.67	0.21	2455	120	0.0020	4.8702	2.75	0.575	5.4453
6000.0	8.64	13.37	25.30	3.83	0.23	2455	120	0.0021	5.2696	2.75	0.626	5.8958
6250.0	9.00	13.93	25.30	3.99	0.25	2455	120	0.0023	5.6835	2.75	0.679	6.3629
6500.0	9.36	14.48	25.30	4.15	0.27	2455	120	0.0025	6.1117	2.75	0.735	6.8466
6750.0	9.72	15.04	25.30	4.31	0.29	2455	120	0.0027	6.5541	2.75	0.793	7.3467
7000.0	10.08	15.60	25.30	4.47	0.31	2455	120	0.0029	7.0108	2.75	0.852	7.8631
7250.0	10.44	16.15	25.30	4.63	0.33	2455	120	0.0030	7.4815	2.75	0.914	8.3958
7500.0	10.80	16.71	25.30	4.79	0.36	2455	120	0.0032	7.9663	2.75	0.978	8.9448
7750.0	11.16	17.27	25.30	4.95	0.38	2455	120	0.0034	8.4651	2.75	1.045	9.5098
8000.0	11.52	17.83	25.30	5.11	0.40	2455	120	0.0037	8.9778	2.75	1.113	10.0910
8250.0	11.88	18.38	25.30	5.27	0.43	2455	120	0.0039	9.5043	2.75	1.184	10.6881
8500.0	12.24	18.94	25.30	5.42	0.46	2455	120	0.0041	10.0445	2.75	1.257	11.3012
8750.0	12.60	19.50	25.30	5.58	0.48	2455	120	0.0043	10.5985	2.75	1.332	11.9302
9000.0	12.96	20.05	25.30	5.74	0.51	2455	120	0.0045	11.1661	2.75	1.409	12.5751
9250.0	13.32	20.61	25.30	5.90	0.54	2455	120	0.0048	11.7473	2.75	1.488	13.2356
9500.0	13.68	21.17	25.30	6.06	0.57	2455	120	0.0050	12.3421	2.75	1.570	13.9119
9750.0	14.04	21.72	25.30	6.22	0.60	2455	120	0.0053	12.9504	2.75	1.654	14.6039
10000.0	14.40	22.28	25.30	6.38	0.63	2455	120	0.0055	13.5720	2.75	1.739	15.3115
10250.0	14.76	22.84	25.30	6.54	0.66	2455	120	0.0058	14.2071	2.75	1.827	16.0346
10500.0	15.12	23.40	25.30	6.70	0.70	2455	120	0.0061	14.8555	2.75	1.918	16.7732
10750.0	15.48	23.95	25.30	6.86	0.73	2455	120	0.0063	15.5172	2.75	2.010	17.5273
11000.0	15.84	24.51	25.30	7.02	0.77	2455	120	0.0066	16.1921	2.75	2.105	18.2968
11250.0	16.20	25.07	25.30	7.18	0.80	2455	120	0.0069	16.8803	2.75	2.201	19.0817
11500.0	16.56	25.62	25.30	7.34	0.84	2455	120	0.0072	17.5816	2.75	2.300	19.8819
11750.0	16.92	26.18	25.30	7.50	0.87	2455	120	0.0075	18.2960	2.75	2.401	20.6975
12000.0	17.28	26.74	25.30	7.66	0.91	2455	120	0.0077	19.0234	2.75	2.505	21.5282

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To A Modified High Point

12250.0	17.64	27.30	25.30	7.82	0.95	2455	120	0.0081	19.7639	2.75	2.610	22.3741
12500.0	18.00	27.85	25.30	7.98	0.99	2455	120	0.0084	20.5174	2.75	2.718	23.2353
12750.0	18.36	28.41	25.30	8.14	1.03	2455	120	0.0087	21.2838	2.75	2.828	24.1115
13000.0	18.72	28.97	25.30	8.30	1.07	2455	120	0.0090	22.0632	2.75	2.940	25.0028
13250.0	19.08	29.52	25.30	8.46	1.11	2455	120	0.0093	22.8554	2.75	3.054	25.9092
13500.0	19.44	30.08	25.30	8.62	1.15	2455	120	0.0096	23.6605	2.75	3.170	26.8306
13750.0	19.80	30.64	25.30	8.78	1.20	2455	120	0.0100	24.4783	2.75	3.289	27.7669
14000.0	20.16	31.19	25.30	8.94	1.24	2455	120	0.0103	25.3090	2.75	3.409	28.7182
14250.0	20.52	31.75	25.30	9.09	1.28	2455	120	0.0107	26.1523	2.75	3.532	29.6844
14500.0	20.88	32.31	25.30	9.25	1.33	2455	120	0.0110	27.0084	2.75	3.657	30.6655
14750.0	21.24	32.87	25.30	9.41	1.38	2455	120	0.0114	27.8771	2.75	3.784	31.6615
15000.0	21.60	33.42	25.30	9.57	1.42	2455	120	0.0117	28.7585	2.75	3.914	32.6722
15250.0	21.96	33.98	25.30	9.73	1.47	2455	120	0.0121	29.6525	2.75	4.045	33.6977
15500.0	22.32	34.54	25.30	9.89	1.52	2455	120	0.0124	30.5590	2.75	4.179	34.7380
15750.0	22.68	35.09	25.30	10.05	1.57	2455	120	0.0128	31.4781	2.75	4.315	35.7930
16000.0	23.04	35.65	25.30	10.21	1.62	2455	120	0.0132	32.4097	2.75	4.453	36.8626

FM System Curve – 24"

Diameter =	24	in
Area =	3.1416	ft^2
RH=D/4=	0.5	
C=	100	

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	1794.00	100	0.0000	0.0000	2.03	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	1794.00	100	0.0000	0.0194	2.03	0.001	0.0204
500.0	0.72	1.11	24.00	0.35	0.00	1794.00	100	0.0000	0.0700	2.03	0.004	0.0740
750.0	1.08	1.67	24.00	0.53	0.00	1794.00	100	0.0001	0.1483	2.03	0.009	0.1573
1000.0	1.44	2.23	24.00	0.71	0.01	1794.00	100	0.0001	0.2527	2.03	0.016	0.2686
1250.0	1.80	2.79	24.00	0.89	0.01	1794.00	100	0.0002	0.3821	2.03	0.025	0.4068
1500.0	2.16	3.34	24.00	1.06	0.02	1794.00	100	0.0003	0.5355	2.03	0.036	0.5712
1750.0	2.52	3.90	24.00	1.24	0.02	1794.00	100	0.0004	0.7124	2.03	0.049	0.7610
2000.0	2.88	4.46	24.00	1.42	0.03	1794.00	100	0.0005	0.9123	2.03	0.063	0.9758
2250.0	3.24	5.01	24.00	1.60	0.04	1794.00	100	0.0006	1.1347	2.03	0.080	1.2150
2500.0	3.60	5.57	24.00	1.77	0.05	1794.00	100	0.0008	1.3792	2.03	0.099	1.4783
2750.0	3.96	6.13	24.00	1.95	0.06	1794.00	100	0.0009	1.6455	2.03	0.120	1.7654
3000.0	4.32	6.68	24.00	2.13	0.07	1794.00	100	0.0011	1.9332	2.03	0.143	2.0759
3250.0	4.68	7.24	24.00	2.31	0.08	1794.00	100	0.0012	2.2421	2.03	0.167	2.4096
3500.0	5.04	7.80	24.00	2.48	0.10	1794.00	100	0.0014	2.5719	2.03	0.194	2.7662
3750.0	5.40	8.36	24.00	2.66	0.11	1794.00	100	0.0016	2.9225	2.03	0.223	3.1455
4000.0	5.76	8.91	24.00	2.84	0.12	1794.00	100	0.0018	3.2935	2.03	0.254	3.5472
4250.0	6.12	9.47	24.00	3.01	0.14	1794.00	100	0.0021	3.6849	2.03	0.286	3.9713
4500.0	6.48	10.03	24.00	3.19	0.16	1794.00	100	0.0023	4.0963	2.03	0.321	4.4174
4750.0	6.84	10.58	24.00	3.37	0.18	1794.00	100	0.0025	4.5277	2.03	0.358	4.8855
5000.0	7.20	11.14	24.00	3.55	0.20	1794.00	100	0.0028	4.9790	2.03	0.396	5.3754
5250.0	7.56	11.70	24.00	3.72	0.22	1794.00	100	0.0030	5.4498	2.03	0.437	5.8868
5500.0	7.92	12.25	24.00	3.90	0.24	1794.00	100	0.0033	5.9401	2.03	0.480	6.4198
5750.0	8.28	12.81	24.00	4.08	0.26	1794.00	100	0.0036	6.4499	2.03	0.524	6.9741
6000.0	8.64	13.37	24.00	4.26	0.28	1794.00	100	0.0039	6.9788	2.03	0.571	7.5496
6250.0	9.00	13.93	24.00	4.43	0.31	1794.00	100	0.0042	7.5269	2.03	0.619	8.1463
6500.0	9.36	14.48	24.00	4.61	0.33	1794.00	100	0.0045	8.0940	2.03	0.670	8.7639
6750.0	9.72	15.04	24.00	4.79	0.36	1794.00	100	0.0048	8.6799	2.03	0.722	9.4024
7000.0	10.08	15.60	24.00	4.96	0.38	1794.00	100	0.0052	9.2847	2.03	0.777	10.0616
7250.0	10.44	16.15	24.00	5.14	0.41	1794.00	100	0.0055	9.9081	2.03	0.833	10.7416
7500.0	10.80	16.71	24.00	5.32	0.44	1794.00	100	0.0059	10.5502	2.03	0.892	11.4421
7750.0	11.16	17.27	24.00	5.50	0.47	1794.00	100	0.0062	11.2107	2.03	0.952	12.1631
8000.0	11.52	17.83	24.00	5.67	0.50	1794.00	100	0.0066	11.8896	2.03	1.015	12.9044
8250.0	11.88	18.38	24.00	5.85	0.53	1794.00	100	0.0070	12.5869	2.03	1.079	13.6661
8500.0	12.24	18.94	24.00	6.03	0.56	1794.00	100	0.0074	13.3024	2.03	1.146	14.4480
8750.0	12.60	19.50	24.00	6.21	0.60	1794.00	100	0.0078	14.0360	2.03	1.214	15.2500

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To A Modified High Point

9000.0	12.96	20.05	24.00	6.38	0.63	1794.00	100	0.0082	14.7878	2.03	1.284	16.0721
9250.0	13.32	20.61	24.00	6.56	0.67	1794.00	100	0.0087	15.5575	2.03	1.357	16.9142
9500.0	13.68	21.17	24.00	6.74	0.70	1794.00	100	0.0091	16.3452	2.03	1.431	17.7762
9750.0	14.04	21.72	24.00	6.92	0.74	1794.00	100	0.0096	17.1507	2.03	1.507	18.6581
10000.0	14.40	22.28	24.00	7.09	0.78	1794.00	100	0.0100	17.9740	2.03	1.586	19.5597
10250.0	14.76	22.84	24.00	7.27	0.82	1794.00	100	0.0105	18.8151	2.03	1.666	20.4810
10500.0	15.12	23.40	24.00	7.45	0.86	1794.00	100	0.0110	19.6738	2.03	1.748	21.4220
10750.0	15.48	23.95	24.00	7.62	0.90	1794.00	100	0.0115	20.5501	2.03	1.832	22.3825
11000.0	15.84	24.51	24.00	7.80	0.95	1794.00	100	0.0120	21.4439	2.03	1.919	23.3626
11250.0	16.20	25.07	24.00	7.98	0.99	1794.00	100	0.0125	22.3553	2.03	2.007	24.3621
11500.0	16.56	25.62	24.00	8.16	1.03	1794.00	100	0.0130	23.2840	2.03	2.097	25.3810
11750.0	16.92	26.18	24.00	8.33	1.08	1794.00	100	0.0135	24.2301	2.03	2.189	26.4193
12000.0	17.28	26.74	24.00	8.51	1.12	1794.00	100	0.0140	25.1935	2.03	2.283	27.4769
12250.0	17.64	27.30	24.00	8.69	1.17	1794.00	100	0.0146	26.1742	2.03	2.379	28.5537
12500.0	18.00	27.85	24.00	8.87	1.22	1794.00	100	0.0151	27.1721	2.03	2.478	29.6496
12750.0	18.36	28.41	24.00	9.04	1.27	1794.00	100	0.0157	28.1871	2.03	2.578	30.7647
13000.0	18.72	28.97	24.00	9.22	1.32	1794.00	100	0.0163	29.2192	2.03	2.680	31.8989
13250.0	19.08	29.52	24.00	9.40	1.37	1794.00	100	0.0169	30.2684	2.03	2.784	33.0522
13500.0	19.44	30.08	24.00	9.57	1.42	1794.00	100	0.0175	31.3346	2.03	2.890	34.2244
13750.0	19.80	30.64	24.00	9.75	1.48	1794.00	100	0.0181	32.4177	2.03	2.998	35.4155
14000.0	20.16	31.19	24.00	9.93	1.53	1794.00	100	0.0187	33.5177	2.03	3.108	36.6256
14250.0	20.52	31.75	24.00	10.11	1.59	1794.00	100	0.0193	34.6346	2.03	3.220	37.8545
14500.0	20.88	32.31	24.00	10.28	1.64	1794.00	100	0.0199	35.7684	2.03	3.334	39.1022
14750.0	21.24	32.87	24.00	10.46	1.70	1794.00	100	0.0206	36.9189	2.03	3.450	40.3686
15000.0	21.60	33.42	24.00	10.64	1.76	1794.00	100	0.0212	38.0861	2.03	3.568	41.6538
15250.0	21.96	33.98	24.00	10.82	1.82	1794.00	100	0.0219	39.2700	2.03	3.688	42.9576
15500.0	22.32	34.54	24.00	10.99	1.88	1794.00	100	0.0226	40.4706	2.03	3.810	44.2801
15750.0	22.68	35.09	24.00	11.17	1.94	1794.00	100	0.0232	41.6878	2.03	3.933	45.6212
16000.0	23.04	35.65	24.00	11.35	2.00	1794.00	100	0.0239	42.9216	2.03	4.059	46.9808

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To A Modified High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	1.44
500.0	0.72	5.21
750.0	1.08	11.06
1000.0	1.44	18.85
1250.0	1.80	28.53
1500.0	2.16	40.01
1750.0	2.52	53.26
2000.0	2.88	68.24
2250.0	3.24	84.92
2500.0	3.60	103.26
2750.0	3.96	123.24
3000.0	4.32	144.84
3250.0	4.68	168.05
3500.0	5.04	192.83
3750.0	5.40	219.18
4000.0	5.76	247.07
4250.0	6.12	276.51
4500.0	6.48	307.46
4750.0	6.84	339.93
5000.0	7.20	373.89
5250.0	7.56	409.34
5500.0	7.92	446.26
5750.0	8.28	484.66
6000.0	8.64	524.51
6250.0	9.00	565.81
6500.0	9.36	608.55
6750.0	9.72	652.72
7000.0	10.08	698.32
7250.0	10.44	745.33
7500.0	10.80	793.76
7750.0	11.16	843.59
8000.0	11.52	894.82
8250.0	11.88	947.43
8500.0	12.24	1001.44
8750.0	12.60	1056.82
9000.0	12.96	1113.58
9250.0	13.32	1171.70
9500.0	13.68	1231.19
9750.0	14.04	1292.03
10000.0	14.40	1354.23
10250.0	14.76	1417.77
10500.0	15.12	1482.66
10750.0	15.48	1548.88
11000.0	15.84	1616.44
11250.0	16.20	1685.33
11500.0	16.56	1755.55
11750.0	16.92	1827.08
12000.0	17.28	1899.94
12250.0	17.64	1974.10
12500.0	18.00	2049.58
12750.0	18.36	2126.36
13000.0	18.72	2204.45
13250.0	19.08	2283.83
13500.0	19.44	2364.51
13750.0	19.80	2446.48
14000.0	20.16	2529.73
14250.0	20.52	2614.28
14500.0	20.88	2700.10
14750.0	21.24	2787.20
15000.0	21.60	2875.58
15250.0	21.96	2965.23
15500.0	22.32	3056.15
15750.0	22.68	3148.34
16000.0	23.04	3241.79

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	32.88	37.38
250.0	0.36	34.32	38.82
500.0	0.72	38.09	42.59
750.0	1.08	43.94	48.44
1000.0	1.44	51.73	56.23
1250.0	1.80	61.41	65.91
1500.0	2.16	72.89	77.39
1750.0	2.52	86.14	90.64
2000.0	2.88	101.12	105.62
2250.0	3.24	117.80	122.30
2500.0	3.60	136.14	140.64
2750.0	3.96	156.12	160.62
3000.0	4.32	177.72	182.22
3250.0	4.68	200.93	205.43
3500.0	5.04	225.71	230.21
3750.0	5.40	252.06	256.56
4000.0	5.76	279.95	284.45
4250.0	6.12	309.39	313.89
4500.0	6.48	340.34	344.84
4750.0	6.84	372.81	377.31
5000.0	7.20	406.77	411.27
5250.0	7.56	442.22	446.72
5500.0	7.92	479.14	483.64
5750.0	8.28	517.54	522.04
6000.0	8.64	557.39	561.89
6250.0	9.00	598.69	603.19
6500.0	9.36	641.43	645.93
6750.0	9.72	685.60	690.10
7000.0	10.08	731.20	735.70
7250.0	10.44	778.21	782.71
7500.0	10.80	826.64	831.14
7750.0	11.16	876.47	880.97
8000.0	11.52	927.70	932.20
8250.0	11.88	980.31	984.81
8500.0	12.24	1034.32	1038.82
8750.0	12.60	1089.70	1094.20
9000.0	12.96	1146.46	1150.96
9250.0	13.32	1204.58	1209.08
9500.0	13.68	1264.07	1268.57
9750.0	14.04	1324.91	1329.41
10000.0	14.40	1387.11	1391.61
10250.0	14.76	1450.65	1455.15
10500.0	15.12	1515.54	1520.04
10750.0	15.48	1581.76	1586.26
11000.0	15.84	1649.32	1653.82
11250.0	16.20	1718.21	1722.71
11500.0	16.56	1788.43	1792.93
11750.0	16.92	1859.96	1864.46
12000.0	17.28	1932.82	1937.32
12250.0	17.64	2006.98	2011.48
12500.0	18.00	2082.46	2086.96
12750.0	18.36	2159.24	2163.74
13000.0	18.72	2237.33	2241.83
13250.0	19.08	2316.71	2321.21
13500.0	19.44	2397.39	2401.89
13750.0	19.80	2479.36	2483.86
14000.0	20.16	2562.61	2567.11
14250.0	20.52	2647.16	2651.66
14500.0	20.88	2732.98	2737.48
14750.0	21.24	2820.08	2824.58
15000.0	21.60	2908.46	2912.96
15250.0	21.96	2998.11	3002.61
15500.0	22.32	3089.03	3093.53
15750.0	22.68	3181.22	3185.72
16000.0	23.04	3274.67	3279.17

MIN Static Head = 32.88
MAX Static Head = 37.38

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To B Modified High Point

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FM System Curve – 24"

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To B Modified High Point

13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve – 24" (24" Parallel FM Portion)

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	316	100	0.0000	0.0000	3.8	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	316	100	0.0000	0.0034	3.8	0.002	0.0053
500.0	0.72	1.11	24.00	0.35	0.00	316	100	0.0000	0.0123	3.8	0.007	0.0198
750.0	1.08	1.67	24.00	0.53	0.00	316	100	0.0001	0.0261	3.8	0.017	0.0428
1000.0	1.44	2.23	24.00	0.71	0.01	316	100	0.0001	0.0445	3.8	0.030	0.0742
1250.0	1.80	2.79	24.00	0.89	0.01	316	100	0.0002	0.0673	3.8	0.046	0.1137
1500.0	2.16	3.34	24.00	1.06	0.02	316	100	0.0003	0.0943	3.8	0.067	0.1611
1750.0	2.52	3.90	24.00	1.24	0.02	316	100	0.0004	0.1255	3.8	0.091	0.2164
2000.0	2.88	4.46	24.00	1.42	0.03	316	100	0.0005	0.1607	3.8	0.119	0.2794
2250.0	3.24	5.01	24.00	1.60	0.04	316	100	0.0006	0.1999	3.8	0.150	0.3501
2500.0	3.60	5.57	24.00	1.77	0.05	316	100	0.0008	0.2429	3.8	0.186	0.4284
2750.0	3.96	6.13	24.00	1.95	0.06	316	100	0.0009	0.2898	3.8	0.224	0.5143
3000.0	4.32	6.68	24.00	2.13	0.07	316	100	0.0011	0.3405	3.8	0.267	0.6077
3250.0	4.68	7.24	24.00	2.31	0.08	316	100	0.0012	0.3949	3.8	0.314	0.7084
3500.0	5.04	7.80	24.00	2.48	0.10	316	100	0.0014	0.4530	3.8	0.364	0.8166
3750.0	5.40	8.36	24.00	2.66	0.11	316	100	0.0016	0.5148	3.8	0.417	0.9322
4000.0	5.76	8.91	24.00	2.84	0.12	316	100	0.0018	0.5801	3.8	0.475	1.0550
4250.0	6.12	9.47	24.00	3.01	0.14	316	100	0.0021	0.6491	3.8	0.536	1.1852
4500.0	6.48	10.03	24.00	3.19	0.16	316	100	0.0023	0.7215	3.8	0.601	1.3226
4750.0	6.84	10.58	24.00	3.37	0.18	316	100	0.0025	0.7975	3.8	0.670	1.4672
5000.0	7.20	11.14	24.00	3.55	0.20	316	100	0.0028	0.8770	3.8	0.742	1.6191
5250.0	7.56	11.70	24.00	3.72	0.22	316	100	0.0030	0.9599	3.8	0.818	1.7781
5500.0	7.92	12.25	24.00	3.90	0.24	316	100	0.0033	1.0463	3.8	0.898	1.9442
5750.0	8.28	12.81	24.00	4.08	0.26	316	100	0.0036	1.1361	3.8	0.981	2.1175
6000.0	8.64	13.37	24.00	4.26	0.28	316	100	0.0039	1.2293	3.8	1.069	2.2978
6250.0	9.00	13.93	24.00	4.43	0.31	316	100	0.0042	1.3258	3.8	1.159	2.4853
6500.0	9.36	14.48	24.00	4.61	0.33	316	100	0.0045	1.4257	3.8	1.254	2.6798
6750.0	9.72	15.04	24.00	4.79	0.36	316	100	0.0048	1.5289	3.8	1.352	2.8813
7000.0	10.08	15.60	24.00	4.96	0.38	316	100	0.0052	1.6354	3.8	1.454	3.0898
7250.0	10.44	16.15	24.00	5.14	0.41	316	100	0.0055	1.7452	3.8	1.560	3.3054
7500.0	10.80	16.71	24.00	5.32	0.44	316	100	0.0059	1.8583	3.8	1.670	3.5279
7750.0	11.16	17.27	24.00	5.50	0.47	316	100	0.0062	1.9747	3.8	1.783	3.7575
8000.0	11.52	17.83	24.00	5.67	0.50	316	100	0.0066	2.0943	3.8	1.900	3.9939
8250.0	11.88	18.38	24.00	5.85	0.53	316	100	0.0070	2.2171	3.8	2.020	4.2373
8500.0	12.24	18.94	24.00	6.03	0.56	316	100	0.0074	2.3431	3.8	2.145	4.4876
8750.0	12.60	19.50	24.00	6.21	0.60	316	100	0.0078	2.4723	3.8	2.273	4.7449
9000.0	12.96	20.05	24.00	6.38	0.63	316	100	0.0082	2.6048	3.8	2.404	5.0090
9250.0	13.32	20.61	24.00	6.56	0.67	316	100	0.0087	2.7403	3.8	2.540	5.2800
9500.0	13.68	21.17	24.00	6.74	0.70	316	100	0.0091	2.8791	3.8	2.679	5.5579
9750.0	14.04	21.72	24.00	6.92	0.74	316	100	0.0096	3.0210	3.8	2.822	5.8426
10000.0	14.40	22.28	24.00	7.09	0.78	316	100	0.0100	3.1660	3.8	2.968	6.1342
10250.0	14.76	22.84	24.00	7.27	0.82	316	100	0.0105	3.3141	3.8	3.118	6.4326
10500.0	15.12	23.40	24.00	7.45	0.86	316	100	0.0110	3.4654	3.8	3.272	6.7378

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To B Modified High Point

10750.0	15.48	23.95	24.00	7.62	0.90	316	100	0.0115	3.6197	3.8	3.430	7.0499
11000.0	15.84	24.51	24.00	7.80	0.95	316	100	0.0120	3.7772	3.8	3.592	7.3687
11250.0	16.20	25.07	24.00	7.98	0.99	316	100	0.0125	3.9377	3.8	3.757	7.6943
11500.0	16.56	25.62	24.00	8.16	1.03	316	100	0.0130	4.1013	3.8	3.925	8.0267
11750.0	16.92	26.18	24.00	8.33	1.08	316	100	0.0135	4.2680	3.8	4.098	8.3659
12000.0	17.28	26.74	24.00	8.51	1.12	316	100	0.0140	4.4377	3.8	4.274	8.7119
12250.0	17.64	27.30	24.00	8.69	1.17	316	100	0.0146	4.6104	3.8	4.454	9.0645
12500.0	18.00	27.85	24.00	8.87	1.22	316	100	0.0151	4.7862	3.8	4.638	9.4240
12750.0	18.36	28.41	24.00	9.04	1.27	316	100	0.0157	4.9650	3.8	4.825	9.7901
13000.0	18.72	28.97	24.00	9.22	1.32	316	100	0.0163	5.1468	3.8	5.016	10.1630
13250.0	19.08	29.52	24.00	9.40	1.37	316	100	0.0169	5.3316	3.8	5.211	10.5426
13500.0	19.44	30.08	24.00	9.57	1.42	316	100	0.0175	5.5194	3.8	5.410	10.9289
13750.0	19.80	30.64	24.00	9.75	1.48	316	100	0.0181	5.7101	3.8	5.612	11.3219
14000.0	20.16	31.19	24.00	9.93	1.53	316	100	0.0187	5.9039	3.8	5.818	11.7216
14250.0	20.52	31.75	24.00	10.11	1.59	316	100	0.0193	6.1006	3.8	6.027	12.1279
14500.0	20.88	32.31	24.00	10.28	1.64	316	100	0.0199	6.3003	3.8	6.241	12.5410
14750.0	21.24	32.87	24.00	10.46	1.70	316	100	0.0206	6.5030	3.8	6.458	12.9607
15000.0	21.60	33.42	24.00	10.64	1.76	316	100	0.0212	6.7086	3.8	6.678	13.3870
15250.0	21.96	33.98	24.00	10.82	1.82	316	100	0.0219	6.9171	3.8	6.903	13.8200
15500.0	22.32	34.54	24.00	10.99	1.88	316	100	0.0226	7.1286	3.8	7.131	14.2597
15750.0	22.68	35.09	24.00	11.17	1.94	316	100	0.0232	7.3430	3.8	7.363	14.7060
16000.0	23.04	35.65	24.00	11.35	2.00	316	100	0.0239	7.5603	3.8	7.599	15.1589

FM System Curve – 14" (14" Parallel FM Portion)

Diameter = 14 in

Area = 1.069014 ft^2

RH=D/4= 0.291667

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	14.00	0.00	0.00	68.50	100	0.0000	0.0000	1.72	0.000	0.0000
250.0	0.36	0.56	14.00	0.52	0.00	68.50	100	0.0001	0.0102	1.72	0.007	0.0175
500.0	0.72	1.11	14.00	1.04	0.02	68.50	100	0.0005	0.0369	1.72	0.029	0.0659
750.0	1.08	1.67	14.00	1.56	0.04	68.50	100	0.0011	0.0782	1.72	0.065	0.1435
1000.0	1.44	2.23	14.00	2.08	0.07	68.50	100	0.0019	0.1333	1.72	0.116	0.2493
1250.0	1.80	2.79	14.00	2.61	0.11	68.50	100	0.0029	0.2014	1.72	0.181	0.3827
1500.0	2.16	3.34	14.00	3.13	0.15	68.50	100	0.0041	0.2824	1.72	0.261	0.5434
1750.0	2.52	3.90	14.00	3.65	0.21	68.50	100	0.0055	0.3756	1.72	0.355	0.7310
2000.0	2.88	4.46	14.00	4.17	0.27	68.50	100	0.0070	0.4810	1.72	0.464	0.9452
2250.0	3.24	5.01	14.00	4.69	0.34	68.50	100	0.0087	0.5983	1.72	0.587	1.1857
2500.0	3.60	5.57	14.00	5.21	0.42	68.50	100	0.0106	0.7272	1.72	0.725	1.4524
2750.0	3.96	6.13	14.00	5.73	0.51	68.50	100	0.0127	0.8676	1.72	0.877	1.7451
3000.0	4.32	6.68	14.00	6.25	0.61	68.50	100	0.0149	1.0193	1.72	1.044	2.0636
3250.0	4.68	7.24	14.00	6.77	0.71	68.50	100	0.0173	1.1822	1.72	1.226	2.4077
3500.0	5.04	7.80	14.00	7.30	0.83	68.50	100	0.0198	1.3561	1.72	1.421	2.7775
3750.0	5.40	8.36	14.00	7.82	0.95	68.50	100	0.0225	1.5409	1.72	1.632	3.1726
4000.0	5.76	8.91	14.00	8.34	1.08	68.50	100	0.0254	1.7366	1.72	1.856	3.5930
4250.0	6.12	9.47	14.00	8.86	1.22	68.50	100	0.0284	1.9429	1.72	2.096	4.0387
4500.0	6.48	10.03	14.00	9.38	1.37	68.50	100	0.0315	2.1599	1.72	2.350	4.5095
4750.0	6.84	10.58	14.00	9.90	1.52	68.50	100	0.0349	2.3873	1.72	2.618	5.0053
5000.0	7.20	11.14	14.00	10.42	1.69	68.50	100	0.0383	2.6252	1.72	2.901	5.5260
5250.0	7.56	11.70	14.00	10.94	1.86	68.50	100	0.0419	2.8735	1.72	3.198	6.0716
5500.0	7.92	12.25	14.00	11.46	2.04	68.50	100	0.0457	3.1320	1.72	3.510	6.6420
5750.0	8.28	12.81	14.00	11.98	2.23	68.50	100	0.0496	3.4008	1.72	3.836	7.2370
6000.0	8.64	13.37	14.00	12.51	2.43	68.50	100	0.0537	3.6797	1.72	4.177	7.8568
6250.0	9.00	13.93	14.00	13.03	2.64	68.50	100	0.0579	3.9687	1.72	4.532	8.5011
6500.0	9.36	14.48	14.00	13.55	2.85	68.50	100	0.0623	4.2677	1.72	4.902	9.1699
6750.0	9.72	15.04	14.00	14.07	3.07	68.50	100	0.0668	4.5766	1.72	5.287	9.8633
7000.0	10.08	15.60	14.00	14.59	3.31	68.50	100	0.0715	4.8955	1.72	5.685	10.5810
7250.0	10.44	16.15	14.00	15.11	3.55	68.50	100	0.0763	5.2242	1.72	6.099	11.3231
7500.0	10.80	16.71	14.00	15.63	3.79	68.50	100	0.0812	5.5628	1.72	6.527	12.0894

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To B Modified High Point

7750.0	11.16	17.27	14.00	16.15	4.05	68.50	100	0.0863	5.9110	1.72	6.969	12.8801
8000.0	11.52	17.83	14.00	16.67	4.32	68.50	100	0.0915	6.2690	1.72	7.426	13.6949
8250.0	11.88	18.38	14.00	17.20	4.59	68.50	100	0.0969	6.6367	1.72	7.897	14.5339
8500.0	12.24	18.94	14.00	17.72	4.87	68.50	100	0.1024	7.0139	1.72	8.383	15.3971
8750.0	12.60	19.50	14.00	18.24	5.16	68.50	100	0.1080	7.4007	1.72	8.884	16.2843
9000.0	12.96	20.05	14.00	18.76	5.46	68.50	100	0.1138	7.7971	1.72	9.398	17.1955
9250.0	13.32	20.61	14.00	19.28	5.77	68.50	100	0.1198	8.2030	1.72	9.928	18.1308
9500.0	13.68	21.17	14.00	19.80	6.09	68.50	100	0.1258	8.6183	1.72	10.472	19.0900
9750.0	14.04	21.72	14.00	20.32	6.41	68.50	100	0.1320	9.0430	1.72	11.030	20.0731
10000.0	14.40	22.28	14.00	20.84	6.75	68.50	100	0.1384	9.4771	1.72	11.603	21.0801
10250.0	14.76	22.84	14.00	21.36	7.09	68.50	100	0.1448	9.9206	1.72	12.190	22.1110
10500.0	15.12	23.40	14.00	21.89	7.44	68.50	100	0.1514	10.3734	1.72	12.792	23.1657
10750.0	15.48	23.95	14.00	22.41	7.80	68.50	100	0.1582	10.8354	1.72	13.409	24.2441
11000.0	15.84	24.51	14.00	22.93	8.16	68.50	100	0.1651	11.3067	1.72	14.040	25.3463
11250.0	16.20	25.07	14.00	23.45	8.54	68.50	100	0.1721	11.7872	1.72	14.685	26.4722
11500.0	16.56	25.62	14.00	23.97	8.92	68.50	100	0.1792	12.2769	1.72	15.345	27.6219
11750.0	16.92	26.18	14.00	24.49	9.31	68.50	100	0.1865	12.7758	1.72	16.019	28.7951
12000.0	17.28	26.74	14.00	25.01	9.71	68.50	100	0.1939	13.2837	1.72	16.708	29.9920
12250.0	17.64	27.30	14.00	25.53	10.12	68.50	100	0.2015	13.8008	1.72	17.412	31.2126
12500.0	18.00	27.85	14.00	26.05	10.54	68.50	100	0.2092	14.3270	1.72	18.130	32.4566
12750.0	18.36	28.41	14.00	26.58	10.97	68.50	100	0.2170	14.8621	1.72	18.862	33.7243
13000.0	18.72	28.97	14.00	27.10	11.40	68.50	100	0.2249	15.4063	1.72	19.609	35.0154
13250.0	19.08	29.52	14.00	27.62	11.84	68.50	100	0.2330	15.9595	1.72	20.371	36.3300
13500.0	19.44	30.08	14.00	28.14	12.29	68.50	100	0.2412	16.5217	1.72	21.146	37.6682
13750.0	19.80	30.64	14.00	28.66	12.75	68.50	100	0.2495	17.0928	1.72	21.937	39.0297
14000.0	20.16	31.19	14.00	29.18	13.22	68.50	100	0.2580	17.6728	1.72	22.742	40.4147
14250.0	20.52	31.75	14.00	29.70	13.70	68.50	100	0.2666	18.2617	1.72	23.561	41.8230
14500.0	20.88	32.31	14.00	30.22	14.18	68.50	100	0.2753	18.8595	1.72	24.395	43.2548
14750.0	21.24	32.87	14.00	30.74	14.68	68.50	100	0.2842	19.4661	1.72	25.244	44.7099
15000.0	21.60	33.42	14.00	31.26	15.18	68.50	100	0.2932	20.0816	1.72	26.107	46.1883
15250.0	21.96	33.98	14.00	31.79	15.69	68.50	100	0.3023	20.7058	1.72	26.984	47.6900
15500.0	22.32	34.54	14.00	32.31	16.21	68.50	100	0.3115	21.3388	1.72	27.876	49.2150
15750.0	22.68	35.09	14.00	32.83	16.73	68.50	100	0.3209	21.9806	1.72	28.783	50.7633
16000.0	23.04	35.65	14.00	33.35	17.27	68.50	100	0.3304	22.6312	1.72	29.704	52.3348

FM System Curve – 13.5" (14" Parallel FM Portion)

Diameter = 13.5 in

Area = 0.99402 ft^2

RH=D/4= 0.28125

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	13.50	0.00	0.00	10640.5	120	0.0000	0.0000	3.1	0.000	0.0000
250.0	0.36	0.56	13.50	0.56	0.00	10640.5	120	0.0001	1.3528	3.1	0.015	1.3679
500.0	0.72	1.11	13.50	1.12	0.02	10640.5	120	0.0005	4.8835	3.1	0.060	4.9439
750.0	1.08	1.67	13.50	1.68	0.04	10640.5	120	0.0010	10.3478	3.1	0.136	10.4839
1000.0	1.44	2.23	13.50	2.24	0.08	10640.5	120	0.0017	17.6293	3.1	0.242	17.8711
1250.0	1.80	2.79	13.50	2.80	0.12	10640.5	120	0.0025	26.6509	3.1	0.378	27.0288
1500.0	2.16	3.34	13.50	3.36	0.18	10640.5	120	0.0035	37.3556	3.1	0.544	37.8998
1750.0	2.52	3.90	13.50	3.92	0.24	10640.5	120	0.0047	49.6982	3.1	0.741	50.4390
2000.0	2.88	4.46	13.50	4.48	0.31	10640.5	120	0.0060	63.6417	3.1	0.967	64.6092
2250.0	3.24	5.01	13.50	5.04	0.39	10640.5	120	0.0074	79.1547	3.1	1.224	80.3791
2500.0	3.60	5.57	13.50	5.60	0.49	10640.5	120	0.0090	96.2098	3.1	1.512	97.7215
2750.0	3.96	6.13	13.50	6.16	0.59	10640.5	120	0.0108	114.7833	3.1	1.829	116.6124
3000.0	4.32	6.68	13.50	6.72	0.70	10640.5	120	0.0127	134.8538	3.1	2.177	137.0306
3250.0	4.68	7.24	13.50	7.29	0.82	10640.5	120	0.0147	156.4021	3.1	2.555	158.9568
3500.0	5.04	7.80	13.50	7.85	0.96	10640.5	120	0.0169	179.4108	3.1	2.963	182.3737
3750.0	5.40	8.36	13.50	8.41	1.10	10640.5	120	0.0192	203.8640	3.1	3.401	207.2652
4000.0	5.76	8.91	13.50	8.97	1.25	10640.5	120	0.0216	229.7469	3.1	3.870	233.6168
4250.0	6.12	9.47	13.50	9.53	1.41	10640.5	120	0.0242	257.0460	3.1	4.369	261.4148
4500.0	6.48	10.03	13.50	10.09	1.58	10640.5	120	0.0269	285.7486	3.1	4.898	290.6465

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To B Modified High Point

4750.0	6.84	10.58	13.50	10.65	1.76	10640.5	120	0.0297	315.8429	3.1	5.457	321.3001
5000.0	7.20	11.14	13.50	11.21	1.95	10640.5	120	0.0326	347.3178	3.1	6.047	353.3645
5250.0	7.56	11.70	13.50	11.77	2.15	10640.5	120	0.0357	380.1628	3.1	6.667	386.8293
5500.0	7.92	12.25	13.50	12.33	2.36	10640.5	120	0.0389	414.3680	3.1	7.317	421.6846
5750.0	8.28	12.81	13.50	12.89	2.58	10640.5	120	0.0423	449.9242	3.1	7.997	457.9210
6000.0	8.64	13.37	13.50	13.45	2.81	10640.5	120	0.0458	486.8225	3.1	8.707	495.5298
6250.0	9.00	13.93	13.50	14.01	3.05	10640.5	120	0.0493	525.0544	3.1	9.448	534.5025
6500.0	9.36	14.48	13.50	14.57	3.30	10640.5	120	0.0531	564.6120	3.1	10.219	574.8309
6750.0	9.72	15.04	13.50	15.13	3.55	10640.5	120	0.0569	605.4874	3.1	11.020	616.5076
7000.0	10.08	15.60	13.50	15.69	3.82	10640.5	120	0.0609	647.6735	3.1	11.852	659.5251
7250.0	10.44	16.15	13.50	16.25	4.10	10640.5	120	0.0650	691.1631	3.1	12.713	703.8763
7500.0	10.80	16.71	13.50	16.81	4.39	10640.5	120	0.0692	735.9495	3.1	13.605	749.5546
7750.0	11.16	17.27	13.50	17.37	4.69	10640.5	120	0.0735	782.0262	3.1	14.527	796.5535
8000.0	11.52	17.83	13.50	17.93	4.99	10640.5	120	0.0779	829.3870	3.1	15.480	844.8666
8250.0	11.88	18.38	13.50	18.49	5.31	10640.5	120	0.0825	878.0258	3.1	16.462	894.4880
8500.0	12.24	18.94	13.50	19.05	5.64	10640.5	120	0.0872	927.9368	3.1	17.475	945.4118
8750.0	12.60	19.50	13.50	19.61	5.97	10640.5	120	0.0920	979.1145	3.1	18.518	997.6326
9000.0	12.96	20.05	13.50	20.17	6.32	10640.5	120	0.0969	1031.5533	3.1	19.591	1051.1447
9250.0	13.32	20.61	13.50	20.73	6.68	10640.5	120	0.1020	1085.2481	3.1	20.695	1105.9430
9500.0	13.68	21.17	13.50	21.29	7.04	10640.5	120	0.1072	1140.1938	3.1	21.829	1162.0225
9750.0	14.04	21.72	13.50	21.86	7.42	10640.5	120	0.1124	1196.3854	3.1	22.993	1219.3781
10000.0	14.40	22.28	13.50	22.42	7.80	10640.5	120	0.1178	1253.8181	3.1	24.187	1278.0050
10250.0	14.76	22.84	13.50	22.98	8.20	10640.5	120	0.1233	1312.4874	3.1	25.411	1337.8988
10500.0	15.12	23.40	13.50	23.54	8.60	10640.5	120	0.1290	1372.3887	3.1	26.666	1399.0548
10750.0	15.48	23.95	13.50	24.10	9.02	10640.5	120	0.1347	1433.5176	3.1	27.951	1461.4686
11000.0	15.84	24.51	13.50	24.66	9.44	10640.5	120	0.1406	1495.8698	3.1	29.266	1525.1360
11250.0	16.20	25.07	13.50	25.22	9.87	10640.5	120	0.1466	1559.4413	3.1	30.612	1590.0528
11500.0	16.56	25.62	13.50	25.78	10.32	10640.5	120	0.1526	1624.2278	3.1	31.987	1656.2150
11750.0	16.92	26.18	13.50	26.34	10.77	10640.5	120	0.1588	1690.2256	3.1	33.393	1723.6187
12000.0	17.28	26.74	13.50	26.90	11.24	10640.5	120	0.1652	1757.4307	3.1	34.829	1792.2599
12250.0	17.64	27.30	13.50	27.46	11.71	10640.5	120	0.1716	1825.8394	3.1	36.295	1862.1349
12500.0	18.00	27.85	13.50	28.02	12.19	10640.5	120	0.1781	1895.4481	3.1	37.792	1933.2401
12750.0	18.36	28.41	13.50	28.58	12.68	10640.5	120	0.1848	1966.2531	3.1	39.319	2005.5719
13000.0	18.72	28.97	13.50	29.14	13.19	10640.5	120	0.1916	2038.2509	3.1	40.876	2079.1267
13250.0	19.08	29.52	13.50	29.70	13.70	10640.5	120	0.1984	2111.4381	3.1	42.463	2153.9012
13500.0	19.44	30.08	13.50	30.26	14.22	10640.5	120	0.2054	2185.8114	3.1	44.081	2229.8920
13750.0	19.80	30.64	13.50	30.82	14.75	10640.5	120	0.2125	2261.3675	3.1	45.728	2307.0959
14000.0	20.16	31.19	13.50	31.38	15.29	10640.5	120	0.2197	2338.1032	3.1	47.406	2385.5095
14250.0	20.52	31.75	13.50	31.94	15.84	10640.5	120	0.2271	2416.0153	3.1	49.115	2465.1298
14500.0	20.88	32.31	13.50	32.50	16.40	10640.5	120	0.2345	2495.1008	3.1	50.853	2545.9537
14750.0	21.24	32.87	13.50	33.06	16.97	10640.5	120	0.2420	2575.3566	3.1	52.622	2627.9782
15000.0	21.60	33.42	13.50	33.62	17.56	10640.5	120	0.2497	2656.7798	3.1	54.421	2711.2003
15250.0	21.96	33.98	13.50	34.18	18.15	10640.5	120	0.2574	2739.3675	3.1	56.250	2795.6172
15500.0	22.32	34.54	13.50	34.74	18.74	10640.5	120	0.2653	2823.1168	3.1	58.109	2881.2259
15750.0	22.68	35.09	13.50	35.30	19.35	10640.5	120	0.2733	2908.0250	3.1	59.999	2968.0237
16000.0	23.04	35.65	13.50	35.87	19.97	10640.5	120	0.2814	2994.0893	3.1	61.918	3056.0078

FM System Curve – 23.85" (28" Parallel FM Portion)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.456875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	619.99	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	619.99	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	619.99	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	619.99	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	619.99	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	619.99	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	619.99	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	619.99	120	0.0003	0.1811	2.7	0.066	0.2473

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To B Modified High Point

2000.0	2.88	4.46	23.85	1.44	0.03	619.99	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	619.99	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	619.99	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	619.99	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	619.99	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	619.99	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	619.99	120	0.0011	0.6538	2.7	0.265	0.9187
3750.0	5.40	8.36	23.85	2.69	0.11	619.99	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	619.99	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	619.99	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	619.99	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	619.99	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	619.99	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	619.99	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	619.99	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	619.99	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	619.99	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	619.99	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	619.99	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	619.99	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	619.99	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	619.99	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	619.99	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	619.99	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	619.99	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	619.99	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	619.99	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	619.99	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	619.99	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	619.99	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	619.99	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	619.99	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	619.99	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	619.99	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	619.99	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	619.99	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	619.99	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	619.99	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	619.99	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	619.99	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	619.99	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	619.99	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	619.99	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	619.99	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	619.99	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	619.99	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	619.99	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	619.99	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	619.99	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	619.99	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	619.99	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	619.99	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	619.99	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	619.99	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	619.99	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	619.99	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	619.99	120	0.0176	10.9108	2.7	5.536	16.4469

FM System Curve – 25.14" (28" DIP))

Diameter =	25.14	in
Area =	3.4471	ft^2
RH=D/4=	0.5238	
C=	100	

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To B Modified High Point

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.14	0.00	0.00	625	100	0.0000	0.0000	0.6	0.000	0.0000
250.0	0.36	0.56	25.14	0.16	0.00	625	100	0.0000	0.0054	0.6	0.000	0.0056
500.0	0.72	1.11	25.14	0.32	0.00	625	100	0.0000	0.0195	0.6	0.001	0.0204
750.0	1.08	1.67	25.14	0.48	0.00	625	100	0.0001	0.0412	0.6	0.002	0.0434
1000.0	1.44	2.23	25.14	0.65	0.01	625	100	0.0001	0.0702	0.6	0.004	0.0741
1250.0	1.80	2.79	25.14	0.81	0.01	625	100	0.0002	0.1062	0.6	0.006	0.1123
1500.0	2.16	3.34	25.14	0.97	0.01	625	100	0.0002	0.1488	0.6	0.009	0.1576
1750.0	2.52	3.90	25.14	1.13	0.02	625	100	0.0003	0.1980	0.6	0.012	0.2099
2000.0	2.88	4.46	25.14	1.29	0.03	625	100	0.0004	0.2535	0.6	0.016	0.2691
2250.0	3.24	5.01	25.14	1.45	0.03	625	100	0.0005	0.3153	0.6	0.020	0.3350
2500.0	3.60	5.57	25.14	1.62	0.04	625	100	0.0006	0.3833	0.6	0.024	0.4076
2750.0	3.96	6.13	25.14	1.78	0.05	625	100	0.0007	0.4573	0.6	0.029	0.4867
3000.0	4.32	6.68	25.14	1.94	0.06	625	100	0.0009	0.5372	0.6	0.035	0.5723
3250.0	4.68	7.24	25.14	2.10	0.07	625	100	0.0010	0.6231	0.6	0.041	0.6642
3500.0	5.04	7.80	25.14	2.26	0.08	625	100	0.0011	0.7147	0.6	0.048	0.7624
3750.0	5.40	8.36	25.14	2.42	0.09	625	100	0.0013	0.8122	0.6	0.055	0.8669
4000.0	5.76	8.91	25.14	2.59	0.10	625	100	0.0015	0.9153	0.6	0.062	0.9776
4250.0	6.12	9.47	25.14	2.75	0.12	625	100	0.0016	1.0240	0.6	0.070	1.0943
4500.0	6.48	10.03	25.14	2.91	0.13	625	100	0.0018	1.1384	0.6	0.079	1.2172
4750.0	6.84	10.58	25.14	3.07	0.15	625	100	0.0020	1.2583	0.6	0.088	1.3461
5000.0	7.20	11.14	25.14	3.23	0.16	625	100	0.0022	1.3837	0.6	0.097	1.4810
5250.0	7.56	11.70	25.14	3.39	0.18	625	100	0.0024	1.5145	0.6	0.107	1.6218
5500.0	7.92	12.25	25.14	3.56	0.20	625	100	0.0026	1.6508	0.6	0.118	1.7685
5750.0	8.28	12.81	25.14	3.72	0.21	625	100	0.0029	1.7924	0.6	0.129	1.9211
6000.0	8.64	13.37	25.14	3.88	0.23	625	100	0.0031	1.9394	0.6	0.140	2.0796
6250.0	9.00	13.93	25.14	4.04	0.25	625	100	0.0033	2.0917	0.6	0.152	2.2438
6500.0	9.36	14.48	25.14	4.20	0.27	625	100	0.0036	2.2493	0.6	0.164	2.4138
6750.0	9.72	15.04	25.14	4.36	0.30	625	100	0.0039	2.4122	0.6	0.177	2.5895
7000.0	10.08	15.60	25.14	4.52	0.32	625	100	0.0041	2.5802	0.6	0.191	2.7710
7250.0	10.44	16.15	25.14	4.69	0.34	625	100	0.0044	2.7535	0.6	0.205	2.9581
7500.0	10.80	16.71	25.14	4.85	0.36	625	100	0.0047	2.9319	0.6	0.219	3.1509
7750.0	11.16	17.27	25.14	5.01	0.39	625	100	0.0050	3.1155	0.6	0.234	3.3493
8000.0	11.52	17.83	25.14	5.17	0.42	625	100	0.0053	3.3042	0.6	0.249	3.5533
8250.0	11.88	18.38	25.14	5.33	0.44	625	100	0.0056	3.4979	0.6	0.265	3.7629
8500.0	12.24	18.94	25.14	5.49	0.47	625	100	0.0059	3.6968	0.6	0.281	3.9780
8750.0	12.60	19.50	25.14	5.66	0.50	625	100	0.0062	3.9006	0.6	0.298	4.1987
9000.0	12.96	20.05	25.14	5.82	0.53	625	100	0.0066	4.1096	0.6	0.315	4.4249
9250.0	13.32	20.61	25.14	5.98	0.56	625	100	0.0069	4.3235	0.6	0.333	4.6565
9500.0	13.68	21.17	25.14	6.14	0.59	625	100	0.0073	4.5424	0.6	0.351	4.8937
9750.0	14.04	21.72	25.14	6.30	0.62	625	100	0.0076	4.7662	0.6	0.370	5.1363
10000.0	14.40	22.28	25.14	6.46	0.65	625	100	0.0080	4.9950	0.6	0.389	5.3843
10250.0	14.76	22.84	25.14	6.63	0.68	625	100	0.0084	5.2288	0.6	0.409	5.6377
10500.0	15.12	23.40	25.14	6.79	0.72	625	100	0.0087	5.4674	0.6	0.429	5.8966
10750.0	15.48	23.95	25.14	6.95	0.75	625	100	0.0091	5.7109	0.6	0.450	6.1608
11000.0	15.84	24.51	25.14	7.11	0.79	625	100	0.0095	5.9593	0.6	0.471	6.4303
11250.0	16.20	25.07	25.14	7.27	0.82	625	100	0.0099	6.2126	0.6	0.493	6.7052
11500.0	16.56	25.62	25.14	7.43	0.86	625	100	0.0104	6.4707	0.6	0.515	6.9855
11750.0	16.92	26.18	25.14	7.59	0.90	625	100	0.0108	6.7336	0.6	0.537	7.2710
12000.0	17.28	26.74	25.14	7.76	0.93	625	100	0.0112	7.0013	0.6	0.561	7.5619
12250.0	17.64	27.30	25.14	7.92	0.97	625	100	0.0116	7.2739	0.6	0.584	7.8580
12500.0	18.00	27.85	25.14	8.08	1.01	625	100	0.0121	7.5512	0.6	0.608	8.1594
12750.0	18.36	28.41	25.14	8.24	1.05	625	100	0.0125	7.8333	0.6	0.633	8.4661
13000.0	18.72	28.97	25.14	8.40	1.10	625	100	0.0130	8.1201	0.6	0.658	8.7779
13250.0	19.08	29.52	25.14	8.56	1.14	625	100	0.0135	8.4117	0.6	0.683	9.0951
13500.0	19.44	30.08	25.14	8.73	1.18	625	100	0.0139	8.7079	0.6	0.709	9.4174
13750.0	19.80	30.64	25.14	8.89	1.23	625	100	0.0144	9.0089	0.6	0.736	9.7449
14000.0	20.16	31.19	25.14	9.05	1.27	625	100	0.0149	9.3147	0.6	0.763	10.0776
14250.0	20.52	31.75	25.14	9.21	1.32	625	100	0.0154	9.6250	0.6	0.790	10.4155
14500.0	20.88	32.31	25.14	9.37	1.36	625	100	0.0159	9.9401	0.6	0.818	10.7585
14750.0	21.24	32.87	25.14	9.53	1.41	625	100	0.0164	10.2598	0.6	0.847	11.1067
15000.0	21.60	33.42	25.14	9.70	1.46	625	100	0.0169	10.5842	0.6	0.876	11.4601
15250.0	21.96	33.98	25.14	9.86	1.51	625	100	0.0175	10.9132	0.6	0.905	11.8185

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To B Modified High Point

15500.0	22.32	34.54	25.14	10.02	1.56	625	100	0.0180	11.2469	0.6	0.935	12.1821
15750.0	22.68	35.09	25.14	10.18	1.61	625	100	0.0185	11.5851	0.6	0.966	12.5508
16000.0	23.04	35.65	25.14	10.34	1.66	625	100	0.0191	11.9280	0.6	0.997	12.9245

FM System Curve – 25.3" (30" DIP))

Diameter = 25.3 in
Area = 3.4911 ft^2
RH=D/4= 0.5271
C= 120

Q (gpm)	Q (mgd)	Q (cfs)	Pipe Dia. (in)	V (fps)	V^2/2g (ft)	L (ft)	C	S	Friction Losses S x L (ft)	K	Minor Losses K x (v^2/2g) (ft)	Total Losses (ft)
0.0	0.00	0.00	25.30	0.00	0.00	2455	120	0.0000	0.0000	2.75	0.000	0.0000
250.0	0.36	0.56	25.30	0.16	0.00	2455	120	0.0000	0.0146	2.75	0.001	0.0157
500.0	0.72	1.11	25.30	0.32	0.00	2455	120	0.0000	0.0529	2.75	0.004	0.0572
750.0	1.08	1.67	25.30	0.48	0.00	2455	120	0.0000	0.1120	2.75	0.010	0.1218
1000.0	1.44	2.23	25.30	0.64	0.01	2455	120	0.0001	0.1908	2.75	0.017	0.2082
1250.0	1.80	2.79	25.30	0.80	0.01	2455	120	0.0001	0.2885	2.75	0.027	0.3157
1500.0	2.16	3.34	25.30	0.96	0.01	2455	120	0.0002	0.4044	2.75	0.039	0.4435
1750.0	2.52	3.90	25.30	1.12	0.02	2455	120	0.0002	0.5380	2.75	0.053	0.5912
2000.0	2.88	4.46	25.30	1.28	0.03	2455	120	0.0003	0.6889	2.75	0.070	0.7585
2250.0	3.24	5.01	25.30	1.44	0.03	2455	120	0.0003	0.8568	2.75	0.088	0.9449
2500.0	3.60	5.57	25.30	1.60	0.04	2455	120	0.0004	1.0414	2.75	0.109	1.1501
2750.0	3.96	6.13	25.30	1.76	0.05	2455	120	0.0005	1.2425	2.75	0.132	1.3740
3000.0	4.32	6.68	25.30	1.91	0.06	2455	120	0.0006	1.4597	2.75	0.157	1.6163
3250.0	4.68	7.24	25.30	2.07	0.07	2455	120	0.0007	1.6930	2.75	0.184	1.8767
3500.0	5.04	7.80	25.30	2.23	0.08	2455	120	0.0008	1.9420	2.75	0.213	2.1551
3750.0	5.40	8.36	25.30	2.39	0.09	2455	120	0.0009	2.2067	2.75	0.245	2.4513
4000.0	5.76	8.91	25.30	2.55	0.10	2455	120	0.0010	2.4869	2.75	0.278	2.7652
4250.0	6.12	9.47	25.30	2.71	0.11	2455	120	0.0011	2.7824	2.75	0.314	3.0966
4500.0	6.48	10.03	25.30	2.87	0.13	2455	120	0.0013	3.0931	2.75	0.352	3.4453
4750.0	6.84	10.58	25.30	3.03	0.14	2455	120	0.0014	3.4189	2.75	0.392	3.8113
5000.0	7.20	11.14	25.30	3.19	0.16	2455	120	0.0015	3.7596	2.75	0.435	4.1944
5250.0	7.56	11.70	25.30	3.35	0.17	2455	120	0.0017	4.1151	2.75	0.479	4.5945
5500.0	7.92	12.25	25.30	3.51	0.19	2455	120	0.0018	4.4854	2.75	0.526	5.0115
5750.0	8.28	12.81	25.30	3.67	0.21	2455	120	0.0020	4.8702	2.75	0.575	5.4453
6000.0	8.64	13.37	25.30	3.83	0.23	2455	120	0.0021	5.2696	2.75	0.626	5.8958
6250.0	9.00	13.93	25.30	3.99	0.25	2455	120	0.0023	5.6835	2.75	0.679	6.3629
6500.0	9.36	14.48	25.30	4.15	0.27	2455	120	0.0025	6.1117	2.75	0.735	6.8466
6750.0	9.72	15.04	25.30	4.31	0.29	2455	120	0.0027	6.5541	2.75	0.793	7.3467
7000.0	10.08	15.60	25.30	4.47	0.31	2455	120	0.0029	7.0108	2.75	0.852	7.8631
7250.0	10.44	16.15	25.30	4.63	0.33	2455	120	0.0030	7.4815	2.75	0.914	8.3958
7500.0	10.80	16.71	25.30	4.79	0.36	2455	120	0.0032	7.9663	2.75	0.978	8.9448
7750.0	11.16	17.27	25.30	4.95	0.38	2455	120	0.0034	8.4651	2.75	1.045	9.5098
8000.0	11.52	17.83	25.30	5.11	0.40	2455	120	0.0037	8.9778	2.75	1.113	10.0910
8250.0	11.88	18.38	25.30	5.27	0.43	2455	120	0.0039	9.5043	2.75	1.184	10.6881
8500.0	12.24	18.94	25.30	5.42	0.46	2455	120	0.0041	10.0445	2.75	1.257	11.3012
8750.0	12.60	19.50	25.30	5.58	0.48	2455	120	0.0043	10.5985	2.75	1.332	11.9302
9000.0	12.96	20.05	25.30	5.74	0.51	2455	120	0.0045	11.1661	2.75	1.409	12.5751
9250.0	13.32	20.61	25.30	5.90	0.54	2455	120	0.0048	11.7473	2.75	1.488	13.2356
9500.0	13.68	21.17	25.30	6.06	0.57	2455	120	0.0050	12.3421	2.75	1.570	13.9119
9750.0	14.04	21.72	25.30	6.22	0.60	2455	120	0.0053	12.9504	2.75	1.654	14.6039
10000.0	14.40	22.28	25.30	6.38	0.63	2455	120	0.0055	13.5720	2.75	1.739	15.3115
10250.0	14.76	22.84	25.30	6.54	0.66	2455	120	0.0058	14.2071	2.75	1.827	16.0346
10500.0	15.12	23.40	25.30	6.70	0.70	2455	120	0.0061	14.8555	2.75	1.918	16.7732
10750.0	15.48	23.95	25.30	6.86	0.73	2455	120	0.0063	15.5172	2.75	2.010	17.5273
11000.0	15.84	24.51	25.30	7.02	0.77	2455	120	0.0066	16.1921	2.75	2.105	18.2968
11250.0	16.20	25.07	25.30	7.18	0.80	2455	120	0.0069	16.8803	2.75	2.201	19.0817
11500.0	16.56	25.62	25.30	7.34	0.84	2455	120	0.0072	17.5816	2.75	2.300	19.8819
11750.0	16.92	26.18	25.30	7.50	0.87	2455	120	0.0075	18.2960	2.75	2.401	20.6975
12000.0	17.28	26.74	25.30	7.66	0.91	2455	120	0.0077	19.0234	2.75	2.505	21.5282

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To B Modified High Point

12250.0	17.64	27.30	25.30	7.82	0.95	2455	120	0.0081	19.7639	2.75	2.610	22.3741
12500.0	18.00	27.85	25.30	7.98	0.99	2455	120	0.0084	20.5174	2.75	2.718	23.2353
12750.0	18.36	28.41	25.30	8.14	1.03	2455	120	0.0087	21.2838	2.75	2.828	24.1115
13000.0	18.72	28.97	25.30	8.30	1.07	2455	120	0.0090	22.0632	2.75	2.940	25.0028
13250.0	19.08	29.52	25.30	8.46	1.11	2455	120	0.0093	22.8554	2.75	3.054	25.9092
13500.0	19.44	30.08	25.30	8.62	1.15	2455	120	0.0096	23.6605	2.75	3.170	26.8306
13750.0	19.80	30.64	25.30	8.78	1.20	2455	120	0.0100	24.4783	2.75	3.289	27.7669
14000.0	20.16	31.19	25.30	8.94	1.24	2455	120	0.0103	25.3090	2.75	3.409	28.7182
14250.0	20.52	31.75	25.30	9.09	1.28	2455	120	0.0107	26.1523	2.75	3.532	29.6844
14500.0	20.88	32.31	25.30	9.25	1.33	2455	120	0.0110	27.0084	2.75	3.657	30.6655
14750.0	21.24	32.87	25.30	9.41	1.38	2455	120	0.0114	27.8771	2.75	3.784	31.6615
15000.0	21.60	33.42	25.30	9.57	1.42	2455	120	0.0117	28.7585	2.75	3.914	32.6722
15250.0	21.96	33.98	25.30	9.73	1.47	2455	120	0.0121	29.6525	2.75	4.045	33.6977
15500.0	22.32	34.54	25.30	9.89	1.52	2455	120	0.0124	30.5590	2.75	4.179	34.7380
15750.0	22.68	35.09	25.30	10.05	1.57	2455	120	0.0128	31.4781	2.75	4.315	35.7930
16000.0	23.04	35.65	25.30	10.21	1.62	2455	120	0.0132	32.4097	2.75	4.453	36.8626

FM System Curve – 24”

Diameter =	24	in
Area =	3.1416	ft^2
RH=D/4=	0.5	
C=	100	

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	5273	100	0.0000	0.0000	4.66	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	5273	100	0.0000	0.0570	4.66	0.002	0.0593
500.0	0.72	1.11	24.00	0.35	0.00	5273	100	0.0000	0.2058	4.66	0.009	0.2149
750.0	1.08	1.67	24.00	0.53	0.00	5273	100	0.0001	0.4360	4.66	0.020	0.4565
1000.0	1.44	2.23	24.00	0.71	0.01	5273	100	0.0001	0.7428	4.66	0.036	0.7792
1250.0	1.80	2.79	24.00	0.89	0.01	5273	100	0.0002	1.1229	4.66	0.057	1.1798
1500.0	2.16	3.34	24.00	1.06	0.02	5273	100	0.0003	1.5740	4.66	0.082	1.6559
1750.0	2.52	3.90	24.00	1.24	0.02	5273	100	0.0004	2.0941	4.66	0.111	2.2055
2000.0	2.88	4.46	24.00	1.42	0.03	5273	100	0.0005	2.6816	4.66	0.146	2.8272
2250.0	3.24	5.01	24.00	1.60	0.04	5273	100	0.0006	3.3352	4.66	0.184	3.5195
2500.0	3.60	5.57	24.00	1.77	0.05	5273	100	0.0008	4.0538	4.66	0.227	4.2813
2750.0	3.96	6.13	24.00	1.95	0.06	5273	100	0.0009	4.8364	4.66	0.275	5.1117
3000.0	4.32	6.68	24.00	2.13	0.07	5273	100	0.0011	5.6821	4.66	0.328	6.0097
3250.0	4.68	7.24	24.00	2.31	0.08	5273	100	0.0012	6.5901	4.66	0.384	6.9745
3500.0	5.04	7.80	24.00	2.48	0.10	5273	100	0.0014	7.5595	4.66	0.446	8.0054
3750.0	5.40	8.36	24.00	2.66	0.11	5273	100	0.0016	8.5899	4.66	0.512	9.1017
4000.0	5.76	8.91	24.00	2.84	0.12	5273	100	0.0018	9.6805	4.66	0.582	10.2628
4250.0	6.12	9.47	24.00	3.01	0.14	5273	100	0.0021	10.8307	4.66	0.657	11.4882
4500.0	6.48	10.03	24.00	3.19	0.16	5273	100	0.0023	12.0401	4.66	0.737	12.7772
4750.0	6.84	10.58	24.00	3.37	0.18	5273	100	0.0025	13.3081	4.66	0.821	14.1294
5000.0	7.20	11.14	24.00	3.55	0.20	5273	100	0.0028	14.6343	4.66	0.910	15.5443
5250.0	7.56	11.70	24.00	3.72	0.22	5273	100	0.0030	16.0183	4.66	1.003	17.0215
5500.0	7.92	12.25	24.00	3.90	0.24	5273	100	0.0033	17.4595	4.66	1.101	18.5606
5750.0	8.28	12.81	24.00	4.08	0.26	5273	100	0.0036	18.9577	4.66	1.203	20.1612
6000.0	8.64	13.37	24.00	4.26	0.28	5273	100	0.0039	20.5124	4.66	1.310	21.8228
6250.0	9.00	13.93	24.00	4.43	0.31	5273	100	0.0042	22.1233	4.66	1.422	23.5452
6500.0	9.36	14.48	24.00	4.61	0.33	5273	100	0.0045	23.7901	4.66	1.538	25.3280
6750.0	9.72	15.04	24.00	4.79	0.36	5273	100	0.0048	25.5124	4.66	1.658	27.1709
7000.0	10.08	15.60	24.00	4.96	0.38	5273	100	0.0052	27.2899	4.66	1.784	29.0735
7250.0	10.44	16.15	24.00	5.14	0.41	5273	100	0.0055	29.1224	4.66	1.913	31.0356
7500.0	10.80	16.71	24.00	5.32	0.44	5273	100	0.0059	31.0095	4.66	2.047	33.0569
7750.0	11.16	17.27	24.00	5.50	0.47	5273	100	0.0062	32.9509	4.66	2.186	35.1372
8000.0	11.52	17.83	24.00	5.67	0.50	5273	100	0.0066	34.9465	4.66	2.330	37.2760
8250.0	11.88	18.38	24.00	5.85	0.53	5273	100	0.0070	36.9959	4.66	2.477	39.4733
8500.0	12.24	18.94	24.00	6.03	0.56	5273	100	0.0074	39.0989	4.66	2.630	41.7288
8750.0	12.60	19.50	24.00	6.21	0.60	5273	100	0.0078	41.2553	4.66	2.787	44.0421

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To B Modified High Point

9000.0	12.96	20.05	24.00	6.38	0.63	5273	100	0.0082	43.4648	4.66	2.948	46.4132
9250.0	13.32	20.61	24.00	6.56	0.67	5273	100	0.0087	45.7273	4.66	3.114	48.8417
9500.0	13.68	21.17	24.00	6.74	0.70	5273	100	0.0091	48.0424	4.66	3.285	51.3275
9750.0	14.04	21.72	24.00	6.92	0.74	5273	100	0.0096	50.4101	4.66	3.460	53.8703
10000.0	14.40	22.28	24.00	7.09	0.78	5273	100	0.0100	52.8300	4.66	3.640	56.4700
10250.0	14.76	22.84	24.00	7.27	0.82	5273	100	0.0105	55.3021	4.66	3.824	59.1263
10500.0	15.12	23.40	24.00	7.45	0.86	5273	100	0.0110	57.8260	4.66	4.013	61.8391
10750.0	15.48	23.95	24.00	7.62	0.90	5273	100	0.0115	60.4017	4.66	4.206	64.6081
11000.0	15.84	24.51	24.00	7.80	0.95	5273	100	0.0120	63.0289	4.66	4.404	67.4333
11250.0	16.20	25.07	24.00	7.98	0.99	5273	100	0.0125	65.7075	4.66	4.607	70.3143
11500.0	16.56	25.62	24.00	8.16	1.03	5273	100	0.0130	68.4373	4.66	4.814	73.2512
11750.0	16.92	26.18	24.00	8.33	1.08	5273	100	0.0135	71.2182	4.66	5.025	76.2436
12000.0	17.28	26.74	24.00	8.51	1.12	5273	100	0.0140	74.0499	4.66	5.242	79.2914
12250.0	17.64	27.30	24.00	8.69	1.17	5273	100	0.0146	76.9323	4.66	5.462	82.3945
12500.0	18.00	27.85	24.00	8.87	1.22	5273	100	0.0151	79.8653	4.66	5.687	85.5527
12750.0	18.36	28.41	24.00	9.04	1.27	5273	100	0.0157	82.8487	4.66	5.917	88.7659
13000.0	18.72	28.97	24.00	9.22	1.32	5273	100	0.0163	85.8823	4.66	6.152	92.0338
13250.0	19.08	29.52	24.00	9.40	1.37	5273	100	0.0169	88.9661	4.66	6.390	95.3565
13500.0	19.44	30.08	24.00	9.57	1.42	5273	100	0.0175	92.0998	4.66	6.634	98.7336
13750.0	19.80	30.64	24.00	9.75	1.48	5273	100	0.0181	95.2834	4.66	6.882	102.1652
14000.0	20.16	31.19	24.00	9.93	1.53	5273	100	0.0187	98.5167	4.66	7.134	105.6510
14250.0	20.52	31.75	24.00	10.11	1.59	5273	100	0.0193	101.7996	4.66	7.391	109.1909
14500.0	20.88	32.31	24.00	10.28	1.64	5273	100	0.0199	105.1318	4.66	7.653	112.7848
14750.0	21.24	32.87	24.00	10.46	1.70	5273	100	0.0206	108.5135	4.66	7.919	116.4326
15000.0	21.60	33.42	24.00	10.64	1.76	5273	100	0.0212	111.9442	4.66	8.190	120.1341
15250.0	21.96	33.98	24.00	10.82	1.82	5273	100	0.0219	115.4241	4.66	8.465	123.8892
15500.0	22.32	34.54	24.00	10.99	1.88	5273	100	0.0226	118.9529	4.66	8.745	127.6979
15750.0	22.68	35.09	24.00	11.17	1.94	5273	100	0.0232	122.5305	4.66	9.029	131.5599
16000.0	23.04	35.65	24.00	11.35	2.00	5273	100	0.0239	126.1569	4.66	9.318	135.4751

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To B Modified High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	1.48
500.0	0.72	5.35
750.0	1.08	11.35
1000.0	1.44	19.36
1250.0	1.80	29.30
1500.0	2.16	41.10
1750.0	2.52	54.71
2000.0	2.88	70.09
2250.0	3.24	87.22
2500.0	3.60	106.06
2750.0	3.96	126.59
3000.0	4.32	148.78
3250.0	4.68	172.61
3500.0	5.04	198.07
3750.0	5.40	225.13
4000.0	5.76	253.79
4250.0	6.12	284.02
4500.0	6.48	315.82
4750.0	6.84	349.17
5000.0	7.20	384.06
5250.0	7.56	420.47
5500.0	7.92	458.40
5750.0	8.28	497.84
6000.0	8.64	538.78
6250.0	9.00	581.20
6500.0	9.36	625.11
6750.0	9.72	670.49
7000.0	10.08	717.33
7250.0	10.44	765.63
7500.0	10.80	815.37
7750.0	11.16	866.56
8000.0	11.52	919.19
8250.0	11.88	973.24
8500.0	12.24	1028.72
8750.0	12.60	1085.61
9000.0	12.96	1143.92
9250.0	13.32	1203.63
9500.0	13.68	1264.74
9750.0	14.04	1327.24
10000.0	14.40	1391.14
10250.0	14.76	1456.42
10500.0	15.12	1523.08
10750.0	15.48	1591.11
11000.0	15.84	1660.52
11250.0	16.20	1731.29
11500.0	16.56	1803.42
11750.0	16.92	1876.91
12000.0	17.28	1951.75
12250.0	17.64	2027.94
12500.0	18.00	2105.48
12750.0	18.36	2184.36
13000.0	18.72	2264.58
13250.0	19.08	2346.13
13500.0	19.44	2429.02
13750.0	19.80	2513.22
14000.0	20.16	2598.76
14250.0	20.52	2685.61
14500.0	20.88	2773.78
14750.0	21.24	2863.27
15000.0	21.60	2954.06
15250.0	21.96	3046.16
15500.0	22.32	3139.57
15750.0	22.68	3234.28
16000.0	23.04	3330.29

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	31.35	35.85
250.0	0.36	32.83	37.33
500.0	0.72	36.70	41.20
750.0	1.08	42.70	47.20
1000.0	1.44	50.71	55.21
1250.0	1.80	60.65	65.15
1500.0	2.16	72.45	76.95
1750.0	2.52	86.06	90.56
2000.0	2.88	101.44	105.94
2250.0	3.24	118.57	123.07
2500.0	3.60	137.41	141.91
2750.0	3.96	157.94	162.44
3000.0	4.32	180.13	184.63
3250.0	4.68	203.96	208.46
3500.0	5.04	229.42	233.92
3750.0	5.40	256.48	260.98
4000.0	5.76	285.14	289.64
4250.0	6.12	315.37	319.87
4500.0	6.48	347.17	351.67
4750.0	6.84	380.52	385.02
5000.0	7.20	415.41	419.91
5250.0	7.56	451.82	456.32
5500.0	7.92	489.75	494.25
5750.0	8.28	529.19	533.69
6000.0	8.64	570.13	574.63
6250.0	9.00	612.55	617.05
6500.0	9.36	656.46	660.96
6750.0	9.72	701.84	706.34
7000.0	10.08	748.68	753.18
7250.0	10.44	796.98	801.48
7500.0	10.80	846.72	851.22
7750.0	11.16	897.91	902.41
8000.0	11.52	950.54	955.04
8250.0	11.88	1004.59	1009.09
8500.0	12.24	1060.07	1064.57
8750.0	12.60	1116.96	1121.46
9000.0	12.96	1175.27	1179.77
9250.0	13.32	1234.98	1239.48
9500.0	13.68	1296.09	1300.59
9750.0	14.04	1358.59	1363.09
10000.0	14.40	1422.49	1426.99
10250.0	14.76	1487.77	1492.27
10500.0	15.12	1554.43	1558.93
10750.0	15.48	1622.46	1626.96
11000.0	15.84	1691.87	1696.37
11250.0	16.20	1762.64	1767.14
11500.0	16.56	1834.77	1839.27
11750.0	16.92	1908.26	1912.76
12000.0	17.28	1983.10	1987.60
12250.0	17.64	2059.29	2063.79
12500.0	18.00	2136.83	2141.33
12750.0	18.36	2215.71	2220.21
13000.0	18.72	2295.93	2300.43
13250.0	19.08	2377.48	2381.98
13500.0	19.44	2460.37	2464.87
13750.0	19.80	2544.57	2549.07
14000.0	20.16	2630.11	2634.61
14250.0	20.52	2716.96	2721.46
14500.0	20.88	2805.13	2809.63
14750.0	21.24	2894.62	2899.12
15000.0	21.60	2985.41	2989.91
15250.0	21.96	3077.51	3082.01
15500.0	22.32	3170.92	3175.42
15750.0	22.68	3265.63	3270.13
16000.0	23.04	3361.64	3366.14

MIN Static Head = 31.35
MAX Static Head = 35.85

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To C Modified High Point

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FM System Curve – 24"

Diameter = 24 in
Area = 3.141593 ft^2
RH=D/4= 0.5
C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To C Modified High Point

13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve – 24" (24" Parallel FM Portion)

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	316	100	0.0000	0.0000	3.8	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	316	100	0.0000	0.0034	3.8	0.002	0.0053
500.0	0.72	1.11	24.00	0.35	0.00	316	100	0.0000	0.0123	3.8	0.007	0.0198
750.0	1.08	1.67	24.00	0.53	0.00	316	100	0.0001	0.0261	3.8	0.017	0.0428
1000.0	1.44	2.23	24.00	0.71	0.01	316	100	0.0001	0.0445	3.8	0.030	0.0742
1250.0	1.80	2.79	24.00	0.89	0.01	316	100	0.0002	0.0673	3.8	0.046	0.1137
1500.0	2.16	3.34	24.00	1.06	0.02	316	100	0.0003	0.0943	3.8	0.067	0.1611
1750.0	2.52	3.90	24.00	1.24	0.02	316	100	0.0004	0.1255	3.8	0.091	0.2164
2000.0	2.88	4.46	24.00	1.42	0.03	316	100	0.0005	0.1607	3.8	0.119	0.2794
2250.0	3.24	5.01	24.00	1.60	0.04	316	100	0.0006	0.1999	3.8	0.150	0.3501
2500.0	3.60	5.57	24.00	1.77	0.05	316	100	0.0008	0.2429	3.8	0.186	0.4284
2750.0	3.96	6.13	24.00	1.95	0.06	316	100	0.0009	0.2898	3.8	0.224	0.5143
3000.0	4.32	6.68	24.00	2.13	0.07	316	100	0.0011	0.3405	3.8	0.267	0.6077
3250.0	4.68	7.24	24.00	2.31	0.08	316	100	0.0012	0.3949	3.8	0.314	0.7084
3500.0	5.04	7.80	24.00	2.48	0.10	316	100	0.0014	0.4530	3.8	0.364	0.8166
3750.0	5.40	8.36	24.00	2.66	0.11	316	100	0.0016	0.5148	3.8	0.417	0.9322
4000.0	5.76	8.91	24.00	2.84	0.12	316	100	0.0018	0.5801	3.8	0.475	1.0550
4250.0	6.12	9.47	24.00	3.01	0.14	316	100	0.0021	0.6491	3.8	0.536	1.1852
4500.0	6.48	10.03	24.00	3.19	0.16	316	100	0.0023	0.7215	3.8	0.601	1.3226
4750.0	6.84	10.58	24.00	3.37	0.18	316	100	0.0025	0.7975	3.8	0.670	1.4672
5000.0	7.20	11.14	24.00	3.55	0.20	316	100	0.0028	0.8770	3.8	0.742	1.6191
5250.0	7.56	11.70	24.00	3.72	0.22	316	100	0.0030	0.9599	3.8	0.818	1.7781
5500.0	7.92	12.25	24.00	3.90	0.24	316	100	0.0033	1.0463	3.8	0.898	1.9442
5750.0	8.28	12.81	24.00	4.08	0.26	316	100	0.0036	1.1361	3.8	0.981	2.1175
6000.0	8.64	13.37	24.00	4.26	0.28	316	100	0.0039	1.2293	3.8	1.069	2.2978
6250.0	9.00	13.93	24.00	4.43	0.31	316	100	0.0042	1.3258	3.8	1.159	2.4853
6500.0	9.36	14.48	24.00	4.61	0.33	316	100	0.0045	1.4257	3.8	1.254	2.6798
6750.0	9.72	15.04	24.00	4.79	0.36	316	100	0.0048	1.5289	3.8	1.352	2.8813
7000.0	10.08	15.60	24.00	4.96	0.38	316	100	0.0052	1.6354	3.8	1.454	3.0898
7250.0	10.44	16.15	24.00	5.14	0.41	316	100	0.0055	1.7452	3.8	1.560	3.3054
7500.0	10.80	16.71	24.00	5.32	0.44	316	100	0.0059	1.8583	3.8	1.670	3.5279
7750.0	11.16	17.27	24.00	5.50	0.47	316	100	0.0062	1.9747	3.8	1.783	3.7575
8000.0	11.52	17.83	24.00	5.67	0.50	316	100	0.0066	2.0943	3.8	1.900	3.9939
8250.0	11.88	18.38	24.00	5.85	0.53	316	100	0.0070	2.2171	3.8	2.020	4.2373
8500.0	12.24	18.94	24.00	6.03	0.56	316	100	0.0074	2.3431	3.8	2.145	4.4876
8750.0	12.60	19.50	24.00	6.21	0.60	316	100	0.0078	2.4723	3.8	2.273	4.7449
9000.0	12.96	20.05	24.00	6.38	0.63	316	100	0.0082	2.6048	3.8	2.404	5.0090
9250.0	13.32	20.61	24.00	6.56	0.67	316	100	0.0087	2.7403	3.8	2.540	5.2800
9500.0	13.68	21.17	24.00	6.74	0.70	316	100	0.0091	2.8791	3.8	2.679	5.5579
9750.0	14.04	21.72	24.00	6.92	0.74	316	100	0.0096	3.0210	3.8	2.822	5.8426
10000.0	14.40	22.28	24.00	7.09	0.78	316	100	0.0100	3.1660	3.8	2.968	6.1342
10250.0	14.76	22.84	24.00	7.27	0.82	316	100	0.0105	3.3141	3.8	3.118	6.4326
10500.0	15.12	23.40	24.00	7.45	0.86	316	100	0.0110	3.4654	3.8	3.272	6.7378

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To C Modified High Point

10750.0	15.48	23.95	24.00	7.62	0.90	316	100	0.0115	3.6197	3.8	3.430	7.0499
11000.0	15.84	24.51	24.00	7.80	0.95	316	100	0.0120	3.7772	3.8	3.592	7.3687
11250.0	16.20	25.07	24.00	7.98	0.99	316	100	0.0125	3.9377	3.8	3.757	7.6943
11500.0	16.56	25.62	24.00	8.16	1.03	316	100	0.0130	4.1013	3.8	3.925	8.0267
11750.0	16.92	26.18	24.00	8.33	1.08	316	100	0.0135	4.2680	3.8	4.098	8.3659
12000.0	17.28	26.74	24.00	8.51	1.12	316	100	0.0140	4.4377	3.8	4.274	8.7119
12250.0	17.64	27.30	24.00	8.69	1.17	316	100	0.0146	4.6104	3.8	4.454	9.0645
12500.0	18.00	27.85	24.00	8.87	1.22	316	100	0.0151	4.7862	3.8	4.638	9.4240
12750.0	18.36	28.41	24.00	9.04	1.27	316	100	0.0157	4.9650	3.8	4.825	9.7901
13000.0	18.72	28.97	24.00	9.22	1.32	316	100	0.0163	5.1468	3.8	5.016	10.1630
13250.0	19.08	29.52	24.00	9.40	1.37	316	100	0.0169	5.3316	3.8	5.211	10.5426
13500.0	19.44	30.08	24.00	9.57	1.42	316	100	0.0175	5.5194	3.8	5.410	10.9289
13750.0	19.80	30.64	24.00	9.75	1.48	316	100	0.0181	5.7101	3.8	5.612	11.3219
14000.0	20.16	31.19	24.00	9.93	1.53	316	100	0.0187	5.9039	3.8	5.818	11.7216
14250.0	20.52	31.75	24.00	10.11	1.59	316	100	0.0193	6.1006	3.8	6.027	12.1279
14500.0	20.88	32.31	24.00	10.28	1.64	316	100	0.0199	6.3003	3.8	6.241	12.5410
14750.0	21.24	32.87	24.00	10.46	1.70	316	100	0.0206	6.5030	3.8	6.458	12.9607
15000.0	21.60	33.42	24.00	10.64	1.76	316	100	0.0212	6.7086	3.8	6.678	13.3870
15250.0	21.96	33.98	24.00	10.82	1.82	316	100	0.0219	6.9171	3.8	6.903	13.8200
15500.0	22.32	34.54	24.00	10.99	1.88	316	100	0.0226	7.1286	3.8	7.131	14.2597
15750.0	22.68	35.09	24.00	11.17	1.94	316	100	0.0232	7.3430	3.8	7.363	14.7060
16000.0	23.04	35.65	24.00	11.35	2.00	316	100	0.0239	7.5603	3.8	7.599	15.1589

FM System Curve – 14" (14" Parallel FM Portion)

Diameter = 14 in
Area = 1.069014 ft^2
RH=D/4= 0.291667
C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	14.00	0.00	0.00	68.50	100	0.0000	0.0000	1.72	0.000	0.0000
250.0	0.36	0.56	14.00	0.52	0.00	68.50	100	0.0001	0.0102	1.72	0.007	0.0175
500.0	0.72	1.11	14.00	1.04	0.02	68.50	100	0.0005	0.0369	1.72	0.029	0.0659
750.0	1.08	1.67	14.00	1.56	0.04	68.50	100	0.0011	0.0782	1.72	0.065	0.1435
1000.0	1.44	2.23	14.00	2.08	0.07	68.50	100	0.0019	0.1333	1.72	0.116	0.2493
1250.0	1.80	2.79	14.00	2.61	0.11	68.50	100	0.0029	0.2014	1.72	0.181	0.3827
1500.0	2.16	3.34	14.00	3.13	0.15	68.50	100	0.0041	0.2824	1.72	0.261	0.5434
1750.0	2.52	3.90	14.00	3.65	0.21	68.50	100	0.0055	0.3756	1.72	0.355	0.7310
2000.0	2.88	4.46	14.00	4.17	0.27	68.50	100	0.0070	0.4810	1.72	0.464	0.9452
2250.0	3.24	5.01	14.00	4.69	0.34	68.50	100	0.0087	0.5983	1.72	0.587	1.1857
2500.0	3.60	5.57	14.00	5.21	0.42	68.50	100	0.0106	0.7272	1.72	0.725	1.4524
2750.0	3.96	6.13	14.00	5.73	0.51	68.50	100	0.0127	0.8676	1.72	0.877	1.7451
3000.0	4.32	6.68	14.00	6.25	0.61	68.50	100	0.0149	1.0193	1.72	1.044	2.0636
3250.0	4.68	7.24	14.00	6.77	0.71	68.50	100	0.0173	1.1822	1.72	1.226	2.4077
3500.0	5.04	7.80	14.00	7.30	0.83	68.50	100	0.0198	1.3561	1.72	1.421	2.7775
3750.0	5.40	8.36	14.00	7.82	0.95	68.50	100	0.0225	1.5409	1.72	1.632	3.1726
4000.0	5.76	8.91	14.00	8.34	1.08	68.50	100	0.0254	1.7366	1.72	1.856	3.5930
4250.0	6.12	9.47	14.00	8.86	1.22	68.50	100	0.0284	1.9429	1.72	2.096	4.0387
4500.0	6.48	10.03	14.00	9.38	1.37	68.50	100	0.0315	2.1599	1.72	2.350	4.5095
4750.0	6.84	10.58	14.00	9.90	1.52	68.50	100	0.0349	2.3873	1.72	2.618	5.0053
5000.0	7.20	11.14	14.00	10.42	1.69	68.50	100	0.0383	2.6252	1.72	2.901	5.5260
5250.0	7.56	11.70	14.00	10.94	1.86	68.50	100	0.0419	2.8735	1.72	3.198	6.0716
5500.0	7.92	12.25	14.00	11.46	2.04	68.50	100	0.0457	3.1320	1.72	3.510	6.6420
5750.0	8.28	12.81	14.00	11.98	2.23	68.50	100	0.0496	3.4008	1.72	3.836	7.2370
6000.0	8.64	13.37	14.00	12.51	2.43	68.50	100	0.0537	3.6797	1.72	4.177	7.8568
6250.0	9.00	13.93	14.00	13.03	2.64	68.50	100	0.0579	3.9687	1.72	4.532	8.5011
6500.0	9.36	14.48	14.00	13.55	2.85	68.50	100	0.0623	4.2677	1.72	4.902	9.1699
6750.0	9.72	15.04	14.00	14.07	3.07	68.50	100	0.0668	4.5766	1.72	5.287	9.8633
7000.0	10.08	15.60	14.00	14.59	3.31	68.50	100	0.0715	4.8955	1.72	5.685	10.5810
7250.0	10.44	16.15	14.00	15.11	3.55	68.50	100	0.0763	5.2242	1.72	6.099	11.3231
7500.0	10.80	16.71	14.00	15.63	3.79	68.50	100	0.0812	5.5628	1.72	6.527	12.0894

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To C Modified High Point

7750.0	11.16	17.27	14.00	16.15	4.05	68.50	100	0.0863	5.9110	1.72	6.969	12.8801
8000.0	11.52	17.83	14.00	16.67	4.32	68.50	100	0.0915	6.2690	1.72	7.426	13.6949
8250.0	11.88	18.38	14.00	17.20	4.59	68.50	100	0.0969	6.6367	1.72	7.897	14.5339
8500.0	12.24	18.94	14.00	17.72	4.87	68.50	100	0.1024	7.0139	1.72	8.383	15.3971
8750.0	12.60	19.50	14.00	18.24	5.16	68.50	100	0.1080	7.4007	1.72	8.884	16.2843
9000.0	12.96	20.05	14.00	18.76	5.46	68.50	100	0.1138	7.7971	1.72	9.398	17.1955
9250.0	13.32	20.61	14.00	19.28	5.77	68.50	100	0.1198	8.2030	1.72	9.928	18.1308
9500.0	13.68	21.17	14.00	19.80	6.09	68.50	100	0.1258	8.6183	1.72	10.472	19.0900
9750.0	14.04	21.72	14.00	20.32	6.41	68.50	100	0.1320	9.0430	1.72	11.030	20.0731
10000.0	14.40	22.28	14.00	20.84	6.75	68.50	100	0.1384	9.4771	1.72	11.603	21.0801
10250.0	14.76	22.84	14.00	21.36	7.09	68.50	100	0.1448	9.9206	1.72	12.190	22.1110
10500.0	15.12	23.40	14.00	21.89	7.44	68.50	100	0.1514	10.3734	1.72	12.792	23.1657
10750.0	15.48	23.95	14.00	22.41	7.80	68.50	100	0.1582	10.8354	1.72	13.409	24.2441
11000.0	15.84	24.51	14.00	22.93	8.16	68.50	100	0.1651	11.3067	1.72	14.040	25.3463
11250.0	16.20	25.07	14.00	23.45	8.54	68.50	100	0.1721	11.7872	1.72	14.685	26.4722
11500.0	16.56	25.62	14.00	23.97	8.92	68.50	100	0.1792	12.2769	1.72	15.345	27.6219
11750.0	16.92	26.18	14.00	24.49	9.31	68.50	100	0.1865	12.7758	1.72	16.019	28.7951
12000.0	17.28	26.74	14.00	25.01	9.71	68.50	100	0.1939	13.2837	1.72	16.708	29.9920
12250.0	17.64	27.30	14.00	25.53	10.12	68.50	100	0.2015	13.8008	1.72	17.412	31.2126
12500.0	18.00	27.85	14.00	26.05	10.54	68.50	100	0.2092	14.3270	1.72	18.130	32.4566
12750.0	18.36	28.41	14.00	26.58	10.97	68.50	100	0.2170	14.8621	1.72	18.862	33.7243
13000.0	18.72	28.97	14.00	27.10	11.40	68.50	100	0.2249	15.4063	1.72	19.609	35.0154
13250.0	19.08	29.52	14.00	27.62	11.84	68.50	100	0.2330	15.9595	1.72	20.371	36.3300
13500.0	19.44	30.08	14.00	28.14	12.29	68.50	100	0.2412	16.5217	1.72	21.146	37.6682
13750.0	19.80	30.64	14.00	28.66	12.75	68.50	100	0.2495	17.0928	1.72	21.937	39.0297
14000.0	20.16	31.19	14.00	29.18	13.22	68.50	100	0.2580	17.6728	1.72	22.742	40.4147
14250.0	20.52	31.75	14.00	29.70	13.70	68.50	100	0.2666	18.2617	1.72	23.561	41.8230
14500.0	20.88	32.31	14.00	30.22	14.18	68.50	100	0.2753	18.8595	1.72	24.395	43.2548
14750.0	21.24	32.87	14.00	30.74	14.68	68.50	100	0.2842	19.4661	1.72	25.244	44.7099
15000.0	21.60	33.42	14.00	31.26	15.18	68.50	100	0.2932	20.0816	1.72	26.107	46.1883
15250.0	21.96	33.98	14.00	31.79	15.69	68.50	100	0.3023	20.7058	1.72	26.984	47.6900
15500.0	22.32	34.54	14.00	32.31	16.21	68.50	100	0.3115	21.3388	1.72	27.876	49.2150
15750.0	22.68	35.09	14.00	32.83	16.73	68.50	100	0.3209	21.9806	1.72	28.783	50.7633
16000.0	23.04	35.65	14.00	33.35	17.27	68.50	100	0.3304	22.6312	1.72	29.704	52.3348

FM System Curve – 13.5" (14" Parallel FM Portion)

Diameter = 13.5 in

Area = 0.99402 ft^2

RH=D/4= 0.28125

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	13.50	0.00	0.00	10640.5	120	0.0000	0.0000	3.1	0.000	0.0000
250.0	0.36	0.56	13.50	0.56	0.00	10640.5	120	0.0001	1.3528	3.1	0.015	1.3679
500.0	0.72	1.11	13.50	1.12	0.02	10640.5	120	0.0005	4.8835	3.1	0.060	4.9439
750.0	1.08	1.67	13.50	1.68	0.04	10640.5	120	0.0010	10.3478	3.1	0.136	10.4839
1000.0	1.44	2.23	13.50	2.24	0.08	10640.5	120	0.0017	17.6293	3.1	0.242	17.8711
1250.0	1.80	2.79	13.50	2.80	0.12	10640.5	120	0.0025	26.6509	3.1	0.378	27.0288
1500.0	2.16	3.34	13.50	3.36	0.18	10640.5	120	0.0035	37.3556	3.1	0.544	37.8998
1750.0	2.52	3.90	13.50	3.92	0.24	10640.5	120	0.0047	49.6982	3.1	0.741	50.4390
2000.0	2.88	4.46	13.50	4.48	0.31	10640.5	120	0.0060	63.6417	3.1	0.967	64.6092
2250.0	3.24	5.01	13.50	5.04	0.39	10640.5	120	0.0074	79.1547	3.1	1.224	80.3791
2500.0	3.60	5.57	13.50	5.60	0.49	10640.5	120	0.0090	96.2098	3.1	1.512	97.7215
2750.0	3.96	6.13	13.50	6.16	0.59	10640.5	120	0.0108	114.7833	3.1	1.829	116.6124
3000.0	4.32	6.68	13.50	6.72	0.70	10640.5	120	0.0127	134.8538	3.1	2.177	137.0306
3250.0	4.68	7.24	13.50	7.29	0.82	10640.5	120	0.0147	156.4021	3.1	2.555	158.9568
3500.0	5.04	7.80	13.50	7.85	0.96	10640.5	120	0.0169	179.4108	3.1	2.963	182.3737
3750.0	5.40	8.36	13.50	8.41	1.10	10640.5	120	0.0192	203.8640	3.1	3.401	207.2652
4000.0	5.76	8.91	13.50	8.97	1.25	10640.5	120	0.0216	229.7469	3.1	3.870	233.6168
4250.0	6.12	9.47	13.50	9.53	1.41	10640.5	120	0.0242	257.0460	3.1	4.369	261.4148
4500.0	6.48	10.03	13.50	10.09	1.58	10640.5	120	0.0269	285.7486	3.1	4.898	290.6465

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To C Modified High Point

4750.0	6.84	10.58	13.50	10.65	1.76	10640.5	120	0.0297	315.8429	3.1	5.457	321.3001
5000.0	7.20	11.14	13.50	11.21	1.95	10640.5	120	0.0326	347.3178	3.1	6.047	353.3645
5250.0	7.56	11.70	13.50	11.77	2.15	10640.5	120	0.0357	380.1628	3.1	6.667	386.8293
5500.0	7.92	12.25	13.50	12.33	2.36	10640.5	120	0.0389	414.3680	3.1	7.317	421.6846
5750.0	8.28	12.81	13.50	12.89	2.58	10640.5	120	0.0423	449.9242	3.1	7.997	457.9210
6000.0	8.64	13.37	13.50	13.45	2.81	10640.5	120	0.0458	486.8225	3.1	8.707	495.5298
6250.0	9.00	13.93	13.50	14.01	3.05	10640.5	120	0.0493	525.0544	3.1	9.448	534.5025
6500.0	9.36	14.48	13.50	14.57	3.30	10640.5	120	0.0531	564.6120	3.1	10.219	574.8309
6750.0	9.72	15.04	13.50	15.13	3.55	10640.5	120	0.0569	605.4874	3.1	11.020	616.5076
7000.0	10.08	15.60	13.50	15.69	3.82	10640.5	120	0.0609	647.6735	3.1	11.852	659.5251
7250.0	10.44	16.15	13.50	16.25	4.10	10640.5	120	0.0650	691.1631	3.1	12.713	703.8763
7500.0	10.80	16.71	13.50	16.81	4.39	10640.5	120	0.0692	735.9495	3.1	13.605	749.5546
7750.0	11.16	17.27	13.50	17.37	4.69	10640.5	120	0.0735	782.0262	3.1	14.527	796.5535
8000.0	11.52	17.83	13.50	17.93	4.99	10640.5	120	0.0779	829.3870	3.1	15.480	844.8666
8250.0	11.88	18.38	13.50	18.49	5.31	10640.5	120	0.0825	878.0258	3.1	16.462	894.4880
8500.0	12.24	18.94	13.50	19.05	5.64	10640.5	120	0.0872	927.9368	3.1	17.475	945.4118
8750.0	12.60	19.50	13.50	19.61	5.97	10640.5	120	0.0920	979.1145	3.1	18.518	997.6326
9000.0	12.96	20.05	13.50	20.17	6.32	10640.5	120	0.0969	1031.5533	3.1	19.591	1051.1447
9250.0	13.32	20.61	13.50	20.73	6.68	10640.5	120	0.1020	1085.2481	3.1	20.695	1105.9430
9500.0	13.68	21.17	13.50	21.29	7.04	10640.5	120	0.1072	1140.1938	3.1	21.829	1162.0225
9750.0	14.04	21.72	13.50	21.86	7.42	10640.5	120	0.1124	1196.3854	3.1	22.993	1219.3781
10000.0	14.40	22.28	13.50	22.42	7.80	10640.5	120	0.1178	1253.8181	3.1	24.187	1278.0050
10250.0	14.76	22.84	13.50	22.98	8.20	10640.5	120	0.1233	1312.4874	3.1	25.411	1337.8988
10500.0	15.12	23.40	13.50	23.54	8.60	10640.5	120	0.1290	1372.3887	3.1	26.666	1399.0548
10750.0	15.48	23.95	13.50	24.10	9.02	10640.5	120	0.1347	1433.5176	3.1	27.951	1461.4686
11000.0	15.84	24.51	13.50	24.66	9.44	10640.5	120	0.1406	1495.8698	3.1	29.266	1525.1360
11250.0	16.20	25.07	13.50	25.22	9.87	10640.5	120	0.1466	1559.4413	3.1	30.612	1590.0528
11500.0	16.56	25.62	13.50	25.78	10.32	10640.5	120	0.1526	1624.2278	3.1	31.987	1656.2150
11750.0	16.92	26.18	13.50	26.34	10.77	10640.5	120	0.1588	1690.2256	3.1	33.393	1723.6187
12000.0	17.28	26.74	13.50	26.90	11.24	10640.5	120	0.1652	1757.4307	3.1	34.829	1792.2599
12250.0	17.64	27.30	13.50	27.46	11.71	10640.5	120	0.1716	1825.8394	3.1	36.295	1862.1349
12500.0	18.00	27.85	13.50	28.02	12.19	10640.5	120	0.1781	1895.4481	3.1	37.792	1933.2401
12750.0	18.36	28.41	13.50	28.58	12.68	10640.5	120	0.1848	1966.2531	3.1	39.319	2005.5719
13000.0	18.72	28.97	13.50	29.14	13.19	10640.5	120	0.1916	2038.2509	3.1	40.876	2079.1267
13250.0	19.08	29.52	13.50	29.70	13.70	10640.5	120	0.1984	2111.4381	3.1	42.463	2153.9012
13500.0	19.44	30.08	13.50	30.26	14.22	10640.5	120	0.2054	2185.8114	3.1	44.081	2229.8920
13750.0	19.80	30.64	13.50	30.82	14.75	10640.5	120	0.2125	2261.3675	3.1	45.728	2307.0959
14000.0	20.16	31.19	13.50	31.38	15.29	10640.5	120	0.2197	2338.1032	3.1	47.406	2385.5095
14250.0	20.52	31.75	13.50	31.94	15.84	10640.5	120	0.2271	2416.0153	3.1	49.115	2465.1298
14500.0	20.88	32.31	13.50	32.50	16.40	10640.5	120	0.2345	2495.1008	3.1	50.853	2545.9537
14750.0	21.24	32.87	13.50	33.06	16.97	10640.5	120	0.2420	2575.3566	3.1	52.622	2627.9782
15000.0	21.60	33.42	13.50	33.62	17.56	10640.5	120	0.2497	2656.7798	3.1	54.421	2711.2003
15250.0	21.96	33.98	13.50	34.18	18.15	10640.5	120	0.2574	2739.3675	3.1	56.250	2795.6172
15500.0	22.32	34.54	13.50	34.74	18.74	10640.5	120	0.2653	2823.1168	3.1	58.109	2881.2259
15750.0	22.68	35.09	13.50	35.30	19.35	10640.5	120	0.2733	2908.0250	3.1	59.999	2968.0237
16000.0	23.04	35.65	13.50	35.87	19.97	10640.5	120	0.2814	2994.0893	3.1	61.918	3056.0078

FM System Curve – 23.85" (28" Parallel FM Portion)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.456875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	619.99	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	619.99	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	619.99	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	619.99	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	619.99	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	619.99	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	619.99	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	619.99	120	0.0003	0.1811	2.7	0.066	0.2473

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To C Modified High Point

2000.0	2.88	4.46	23.85	1.44	0.03	619.99	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	619.99	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	619.99	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	619.99	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	619.99	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	619.99	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	619.99	120	0.0011	0.6538	2.7	0.265	0.9187
3750.0	5.40	8.36	23.85	2.69	0.11	619.99	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	619.99	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	619.99	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	619.99	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	619.99	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	619.99	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	619.99	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	619.99	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	619.99	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	619.99	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	619.99	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	619.99	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	619.99	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	619.99	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	619.99	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	619.99	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	619.99	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	619.99	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	619.99	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	619.99	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	619.99	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	619.99	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	619.99	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	619.99	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	619.99	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	619.99	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	619.99	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	619.99	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	619.99	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	619.99	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	619.99	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	619.99	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	619.99	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	619.99	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	619.99	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	619.99	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	619.99	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	619.99	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	619.99	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	619.99	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	619.99	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	619.99	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	619.99	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	619.99	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	619.99	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	619.99	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	619.99	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	619.99	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	619.99	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	619.99	120	0.0176	10.9108	2.7	5.536	16.4469

FM System Curve – 25.14" (28" DIP))

Diameter =	25.14	in
Area =	3.4471	ft^2
RH=D/4=	0.5238	
C=	100	

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To C Modified High Point

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.14	0.00	0.00	625	100	0.0000	0.0000	0.6	0.000	0.0000
250.0	0.36	0.56	25.14	0.16	0.00	625	100	0.0000	0.0054	0.6	0.000	0.0056
500.0	0.72	1.11	25.14	0.32	0.00	625	100	0.0000	0.0195	0.6	0.001	0.0204
750.0	1.08	1.67	25.14	0.48	0.00	625	100	0.0001	0.0412	0.6	0.002	0.0434
1000.0	1.44	2.23	25.14	0.65	0.01	625	100	0.0001	0.0702	0.6	0.004	0.0741
1250.0	1.80	2.79	25.14	0.81	0.01	625	100	0.0002	0.1062	0.6	0.006	0.1123
1500.0	2.16	3.34	25.14	0.97	0.01	625	100	0.0002	0.1488	0.6	0.009	0.1576
1750.0	2.52	3.90	25.14	1.13	0.02	625	100	0.0003	0.1980	0.6	0.012	0.2099
2000.0	2.88	4.46	25.14	1.29	0.03	625	100	0.0004	0.2535	0.6	0.016	0.2691
2250.0	3.24	5.01	25.14	1.45	0.03	625	100	0.0005	0.3153	0.6	0.020	0.3350
2500.0	3.60	5.57	25.14	1.62	0.04	625	100	0.0006	0.3833	0.6	0.024	0.4076
2750.0	3.96	6.13	25.14	1.78	0.05	625	100	0.0007	0.4573	0.6	0.029	0.4867
3000.0	4.32	6.68	25.14	1.94	0.06	625	100	0.0009	0.5372	0.6	0.035	0.5723
3250.0	4.68	7.24	25.14	2.10	0.07	625	100	0.0010	0.6231	0.6	0.041	0.6642
3500.0	5.04	7.80	25.14	2.26	0.08	625	100	0.0011	0.7147	0.6	0.048	0.7624
3750.0	5.40	8.36	25.14	2.42	0.09	625	100	0.0013	0.8122	0.6	0.055	0.8669
4000.0	5.76	8.91	25.14	2.59	0.10	625	100	0.0015	0.9153	0.6	0.062	0.9776
4250.0	6.12	9.47	25.14	2.75	0.12	625	100	0.0016	1.0240	0.6	0.070	1.0943
4500.0	6.48	10.03	25.14	2.91	0.13	625	100	0.0018	1.1384	0.6	0.079	1.2172
4750.0	6.84	10.58	25.14	3.07	0.15	625	100	0.0020	1.2583	0.6	0.088	1.3461
5000.0	7.20	11.14	25.14	3.23	0.16	625	100	0.0022	1.3837	0.6	0.097	1.4810
5250.0	7.56	11.70	25.14	3.39	0.18	625	100	0.0024	1.5145	0.6	0.107	1.6218
5500.0	7.92	12.25	25.14	3.56	0.20	625	100	0.0026	1.6508	0.6	0.118	1.7685
5750.0	8.28	12.81	25.14	3.72	0.21	625	100	0.0029	1.7924	0.6	0.129	1.9211
6000.0	8.64	13.37	25.14	3.88	0.23	625	100	0.0031	1.9394	0.6	0.140	2.0796
6250.0	9.00	13.93	25.14	4.04	0.25	625	100	0.0033	2.0917	0.6	0.152	2.2438
6500.0	9.36	14.48	25.14	4.20	0.27	625	100	0.0036	2.2493	0.6	0.164	2.4138
6750.0	9.72	15.04	25.14	4.36	0.30	625	100	0.0039	2.4122	0.6	0.177	2.5895
7000.0	10.08	15.60	25.14	4.52	0.32	625	100	0.0041	2.5802	0.6	0.191	2.7710
7250.0	10.44	16.15	25.14	4.69	0.34	625	100	0.0044	2.7535	0.6	0.205	2.9581
7500.0	10.80	16.71	25.14	4.85	0.36	625	100	0.0047	2.9319	0.6	0.219	3.1509
7750.0	11.16	17.27	25.14	5.01	0.39	625	100	0.0050	3.1155	0.6	0.234	3.3493
8000.0	11.52	17.83	25.14	5.17	0.42	625	100	0.0053	3.3042	0.6	0.249	3.5533
8250.0	11.88	18.38	25.14	5.33	0.44	625	100	0.0056	3.4979	0.6	0.265	3.7629
8500.0	12.24	18.94	25.14	5.49	0.47	625	100	0.0059	3.6968	0.6	0.281	3.9780
8750.0	12.60	19.50	25.14	5.66	0.50	625	100	0.0062	3.9006	0.6	0.298	4.1987
9000.0	12.96	20.05	25.14	5.82	0.53	625	100	0.0066	4.1096	0.6	0.315	4.4249
9250.0	13.32	20.61	25.14	5.98	0.56	625	100	0.0069	4.3235	0.6	0.333	4.6565
9500.0	13.68	21.17	25.14	6.14	0.59	625	100	0.0073	4.5424	0.6	0.351	4.8937
9750.0	14.04	21.72	25.14	6.30	0.62	625	100	0.0076	4.7662	0.6	0.370	5.1363
10000.0	14.40	22.28	25.14	6.46	0.65	625	100	0.0080	4.9950	0.6	0.389	5.3843
10250.0	14.76	22.84	25.14	6.63	0.68	625	100	0.0084	5.2288	0.6	0.409	5.6377
10500.0	15.12	23.40	25.14	6.79	0.72	625	100	0.0087	5.4674	0.6	0.429	5.8966
10750.0	15.48	23.95	25.14	6.95	0.75	625	100	0.0091	5.7109	0.6	0.450	6.1608
11000.0	15.84	24.51	25.14	7.11	0.79	625	100	0.0095	5.9593	0.6	0.471	6.4303
11250.0	16.20	25.07	25.14	7.27	0.82	625	100	0.0099	6.2126	0.6	0.493	6.7052
11500.0	16.56	25.62	25.14	7.43	0.86	625	100	0.0104	6.4707	0.6	0.515	6.9855
11750.0	16.92	26.18	25.14	7.59	0.90	625	100	0.0108	6.7336	0.6	0.537	7.2710
12000.0	17.28	26.74	25.14	7.76	0.93	625	100	0.0112	7.0013	0.6	0.561	7.5619
12250.0	17.64	27.30	25.14	7.92	0.97	625	100	0.0116	7.2739	0.6	0.584	7.8580
12500.0	18.00	27.85	25.14	8.08	1.01	625	100	0.0121	7.5512	0.6	0.608	8.1594
12750.0	18.36	28.41	25.14	8.24	1.05	625	100	0.0125	7.8333	0.6	0.633	8.4661
13000.0	18.72	28.97	25.14	8.40	1.10	625	100	0.0130	8.1201	0.6	0.658	8.7779
13250.0	19.08	29.52	25.14	8.56	1.14	625	100	0.0135	8.4117	0.6	0.683	9.0951
13500.0	19.44	30.08	25.14	8.73	1.18	625	100	0.0139	8.7079	0.6	0.709	9.4174
13750.0	19.80	30.64	25.14	8.89	1.23	625	100	0.0144	9.0089	0.6	0.736	9.7449
14000.0	20.16	31.19	25.14	9.05	1.27	625	100	0.0149	9.3147	0.6	0.763	10.0776
14250.0	20.52	31.75	25.14	9.21	1.32	625	100	0.0154	9.6250	0.6	0.790	10.4155
14500.0	20.88	32.31	25.14	9.37	1.36	625	100	0.0159	9.9401	0.6	0.818	10.7585
14750.0	21.24	32.87	25.14	9.53	1.41	625	100	0.0164	10.2598	0.6	0.847	11.1067
15000.0	21.60	33.42	25.14	9.70	1.46	625	100	0.0169	10.5842	0.6	0.876	11.4601
15250.0	21.96	33.98	25.14	9.86	1.51	625	100	0.0175	10.9132	0.6	0.905	11.8185

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To C Modified High Point

15500.0	22.32	34.54	25.14	10.02	1.56	625	100	0.0180	11.2469	0.6	0.935	12.1821
15750.0	22.68	35.09	25.14	10.18	1.61	625	100	0.0185	11.5851	0.6	0.966	12.5508
16000.0	23.04	35.65	25.14	10.34	1.66	625	100	0.0191	11.9280	0.6	0.997	12.9245

FM System Curve – 25.3" (30" HDPE)

Diameter = 25.3 in
Area = 3.4911 ft^2
RH=D/4= 0.5271
C= 120

Q (gpm)	Q (mgd)	Q (cfs)	Pipe Dia. (in)	V (fps)	V^2/2g (ft)	L (ft)	C	S	Friction Losses S x L (ft)	K	Minor Losses K x (v^2/2g) (ft)	Total Losses (ft)
0.0	0.00	0.00	25.30	0.00	0.00	2455	120	0.0000	0.0000	2.75	0.000	0.0000
250.0	0.36	0.56	25.30	0.16	0.00	2455	120	0.0000	0.0146	2.75	0.001	0.0157
500.0	0.72	1.11	25.30	0.32	0.00	2455	120	0.0000	0.0529	2.75	0.004	0.0572
750.0	1.08	1.67	25.30	0.48	0.00	2455	120	0.0000	0.1120	2.75	0.010	0.1218
1000.0	1.44	2.23	25.30	0.64	0.01	2455	120	0.0001	0.1908	2.75	0.017	0.2082
1250.0	1.80	2.79	25.30	0.80	0.01	2455	120	0.0001	0.2885	2.75	0.027	0.3157
1500.0	2.16	3.34	25.30	0.96	0.01	2455	120	0.0002	0.4044	2.75	0.039	0.4435
1750.0	2.52	3.90	25.30	1.12	0.02	2455	120	0.0002	0.5380	2.75	0.053	0.5912
2000.0	2.88	4.46	25.30	1.28	0.03	2455	120	0.0003	0.6889	2.75	0.070	0.7585
2250.0	3.24	5.01	25.30	1.44	0.03	2455	120	0.0003	0.8568	2.75	0.088	0.9449
2500.0	3.60	5.57	25.30	1.60	0.04	2455	120	0.0004	1.0414	2.75	0.109	1.1501
2750.0	3.96	6.13	25.30	1.76	0.05	2455	120	0.0005	1.2425	2.75	0.132	1.3740
3000.0	4.32	6.68	25.30	1.91	0.06	2455	120	0.0006	1.4597	2.75	0.157	1.6163
3250.0	4.68	7.24	25.30	2.07	0.07	2455	120	0.0007	1.6930	2.75	0.184	1.8767
3500.0	5.04	7.80	25.30	2.23	0.08	2455	120	0.0008	1.9420	2.75	0.213	2.1551
3750.0	5.40	8.36	25.30	2.39	0.09	2455	120	0.0009	2.2067	2.75	0.245	2.4513
4000.0	5.76	8.91	25.30	2.55	0.10	2455	120	0.0010	2.4869	2.75	0.278	2.7652
4250.0	6.12	9.47	25.30	2.71	0.11	2455	120	0.0011	2.7824	2.75	0.314	3.0966
4500.0	6.48	10.03	25.30	2.87	0.13	2455	120	0.0013	3.0931	2.75	0.352	3.4453
4750.0	6.84	10.58	25.30	3.03	0.14	2455	120	0.0014	3.4189	2.75	0.392	3.8113
5000.0	7.20	11.14	25.30	3.19	0.16	2455	120	0.0015	3.7596	2.75	0.435	4.1944
5250.0	7.56	11.70	25.30	3.35	0.17	2455	120	0.0017	4.1151	2.75	0.479	4.5945
5500.0	7.92	12.25	25.30	3.51	0.19	2455	120	0.0018	4.4854	2.75	0.526	5.0115
5750.0	8.28	12.81	25.30	3.67	0.21	2455	120	0.0020	4.8702	2.75	0.575	5.4453
6000.0	8.64	13.37	25.30	3.83	0.23	2455	120	0.0021	5.2696	2.75	0.626	5.8958
6250.0	9.00	13.93	25.30	3.99	0.25	2455	120	0.0023	5.6835	2.75	0.679	6.3629
6500.0	9.36	14.48	25.30	4.15	0.27	2455	120	0.0025	6.1117	2.75	0.735	6.8466
6750.0	9.72	15.04	25.30	4.31	0.29	2455	120	0.0027	6.5541	2.75	0.793	7.3467
7000.0	10.08	15.60	25.30	4.47	0.31	2455	120	0.0029	7.0108	2.75	0.852	7.8631
7250.0	10.44	16.15	25.30	4.63	0.33	2455	120	0.0030	7.4815	2.75	0.914	8.3958
7500.0	10.80	16.71	25.30	4.79	0.36	2455	120	0.0032	7.9663	2.75	0.978	8.9448
7750.0	11.16	17.27	25.30	4.95	0.38	2455	120	0.0034	8.4651	2.75	1.045	9.5098
8000.0	11.52	17.83	25.30	5.11	0.40	2455	120	0.0037	8.9778	2.75	1.113	10.0910
8250.0	11.88	18.38	25.30	5.27	0.43	2455	120	0.0039	9.5043	2.75	1.184	10.6881
8500.0	12.24	18.94	25.30	5.42	0.46	2455	120	0.0041	10.0445	2.75	1.257	11.3012
8750.0	12.60	19.50	25.30	5.58	0.48	2455	120	0.0043	10.5985	2.75	1.332	11.9302
9000.0	12.96	20.05	25.30	5.74	0.51	2455	120	0.0045	11.1661	2.75	1.409	12.5751
9250.0	13.32	20.61	25.30	5.90	0.54	2455	120	0.0048	11.7473	2.75	1.488	13.2356
9500.0	13.68	21.17	25.30	6.06	0.57	2455	120	0.0050	12.3421	2.75	1.570	13.9119
9750.0	14.04	21.72	25.30	6.22	0.60	2455	120	0.0053	12.9504	2.75	1.654	14.6039
10000.0	14.40	22.28	25.30	6.38	0.63	2455	120	0.0055	13.5720	2.75	1.739	15.3115
10250.0	14.76	22.84	25.30	6.54	0.66	2455	120	0.0058	14.2071	2.75	1.827	16.0346
10500.0	15.12	23.40	25.30	6.70	0.70	2455	120	0.0061	14.8555	2.75	1.918	16.7732
10750.0	15.48	23.95	25.30	6.86	0.73	2455	120	0.0063	15.5172	2.75	2.010	17.5273
11000.0	15.84	24.51	25.30	7.02	0.77	2455	120	0.0066	16.1921	2.75	2.105	18.2968
11250.0	16.20	25.07	25.30	7.18	0.80	2455	120	0.0069	16.8803	2.75	2.201	19.0817
11500.0	16.56	25.62	25.30	7.34	0.84	2455	120	0.0072	17.5816	2.75	2.300	19.8819
11750.0	16.92	26.18	25.30	7.50	0.87	2455	120	0.0075	18.2960	2.75	2.401	20.6975
12000.0	17.28	26.74	25.30	7.66	0.91	2455	120	0.0077	19.0234	2.75	2.505	21.5282

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To C Modified High Point

12250.0	17.64	27.30	25.30	7.82	0.95	2455	120	0.0081	19.7639	2.75	2.610	22.3741
12500.0	18.00	27.85	25.30	7.98	0.99	2455	120	0.0084	20.5174	2.75	2.718	23.2353
12750.0	18.36	28.41	25.30	8.14	1.03	2455	120	0.0087	21.2838	2.75	2.828	24.1115
13000.0	18.72	28.97	25.30	8.30	1.07	2455	120	0.0090	22.0632	2.75	2.940	25.0028
13250.0	19.08	29.52	25.30	8.46	1.11	2455	120	0.0093	22.8554	2.75	3.054	25.9092
13500.0	19.44	30.08	25.30	8.62	1.15	2455	120	0.0096	23.6605	2.75	3.170	26.8306
13750.0	19.80	30.64	25.30	8.78	1.20	2455	120	0.0100	24.4783	2.75	3.289	27.7669
14000.0	20.16	31.19	25.30	8.94	1.24	2455	120	0.0103	25.3090	2.75	3.409	28.7182
14250.0	20.52	31.75	25.30	9.09	1.28	2455	120	0.0107	26.1523	2.75	3.532	29.6844
14500.0	20.88	32.31	25.30	9.25	1.33	2455	120	0.0110	27.0084	2.75	3.657	30.6655
14750.0	21.24	32.87	25.30	9.41	1.38	2455	120	0.0114	27.8771	2.75	3.784	31.6615
15000.0	21.60	33.42	25.30	9.57	1.42	2455	120	0.0117	28.7585	2.75	3.914	32.6722
15250.0	21.96	33.98	25.30	9.73	1.47	2455	120	0.0121	29.6525	2.75	4.045	33.6977
15500.0	22.32	34.54	25.30	9.89	1.52	2455	120	0.0124	30.5590	2.75	4.179	34.7380
15750.0	22.68	35.09	25.30	10.05	1.57	2455	120	0.0128	31.4781	2.75	4.315	35.7930
16000.0	23.04	35.65	25.30	10.21	1.62	2455	120	0.0132	32.4097	2.75	4.453	36.8626

FM System Curve – 24"

Diameter =	24	in
Area =	3.1416	ft^2
RH=D/4=	0.5	
C=	100	

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	10158	100	0.0000	0.0000	7.16	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	10158	100	0.0000	0.1098	7.16	0.003	0.1133
500.0	0.72	1.11	24.00	0.35	0.00	10158	100	0.0000	0.3964	7.16	0.014	0.4104
750.0	1.08	1.67	24.00	0.53	0.00	10158	100	0.0001	0.8399	7.16	0.031	0.8714
1000.0	1.44	2.23	24.00	0.71	0.01	10158	100	0.0001	1.4310	7.16	0.056	1.4869
1250.0	1.80	2.79	24.00	0.89	0.01	10158	100	0.0002	2.1633	7.16	0.087	2.2506
1500.0	2.16	3.34	24.00	1.06	0.02	10158	100	0.0003	3.0322	7.16	0.126	3.1580
1750.0	2.52	3.90	24.00	1.24	0.02	10158	100	0.0004	4.0340	7.16	0.171	4.2053
2000.0	2.88	4.46	24.00	1.42	0.03	10158	100	0.0005	5.1658	7.16	0.224	5.3895
2250.0	3.24	5.01	24.00	1.60	0.04	10158	100	0.0006	6.4250	7.16	0.283	6.7081
2500.0	3.60	5.57	24.00	1.77	0.05	10158	100	0.0008	7.8094	7.16	0.350	8.1589
2750.0	3.96	6.13	24.00	1.95	0.06	10158	100	0.0009	9.3170	7.16	0.423	9.7399
3000.0	4.32	6.68	24.00	2.13	0.07	10158	100	0.0011	10.9461	7.16	0.503	11.4495
3250.0	4.68	7.24	24.00	2.31	0.08	10158	100	0.0012	12.6952	7.16	0.591	13.2859
3500.0	5.04	7.80	24.00	2.48	0.10	10158	100	0.0014	14.5628	7.16	0.685	15.2479
3750.0	5.40	8.36	24.00	2.66	0.11	10158	100	0.0016	16.5477	7.16	0.786	17.3342
4000.0	5.76	8.91	24.00	2.84	0.12	10158	100	0.0018	18.6486	7.16	0.895	19.5434
4250.0	6.12	9.47	24.00	3.01	0.14	10158	100	0.0021	20.8645	7.16	1.010	21.8747
4500.0	6.48	10.03	24.00	3.19	0.16	10158	100	0.0023	23.1943	7.16	1.133	24.3268
4750.0	6.84	10.58	24.00	3.37	0.18	10158	100	0.0025	25.6370	7.16	1.262	26.8989
5000.0	7.20	11.14	24.00	3.55	0.20	10158	100	0.0028	28.1919	7.16	1.398	29.5900
5250.0	7.56	11.70	24.00	3.72	0.22	10158	100	0.0030	30.8579	7.16	1.541	32.3994
5500.0	7.92	12.25	24.00	3.90	0.24	10158	100	0.0033	33.6343	7.16	1.692	35.3261
5750.0	8.28	12.81	24.00	4.08	0.26	10158	100	0.0036	36.5204	7.16	1.849	38.3695
6000.0	8.64	13.37	24.00	4.26	0.28	10158	100	0.0039	39.5155	7.16	2.013	41.5289
6250.0	9.00	13.93	24.00	4.43	0.31	10158	100	0.0042	42.6188	7.16	2.185	44.8034
6500.0	9.36	14.48	24.00	4.61	0.33	10158	100	0.0045	45.8297	7.16	2.363	48.1926
6750.0	9.72	15.04	24.00	4.79	0.36	10158	100	0.0048	49.1475	7.16	2.548	51.6957
7000.0	10.08	15.60	24.00	4.96	0.38	10158	100	0.0052	52.5718	7.16	2.740	55.3122
7250.0	10.44	16.15	24.00	5.14	0.41	10158	100	0.0055	56.1018	7.16	2.940	59.0415
7500.0	10.80	16.71	24.00	5.32	0.44	10158	100	0.0059	59.7372	7.16	3.146	62.8831
7750.0	11.16	17.27	24.00	5.50	0.47	10158	100	0.0062	63.4772	7.16	3.359	66.8363
8000.0	11.52	17.83	24.00	5.67	0.50	10158	100	0.0066	67.3215	7.16	3.579	70.9008
8250.0	11.88	18.38	24.00	5.85	0.53	10158	100	0.0070	71.2695	7.16	3.807	75.0761
8500.0	12.24	18.94	24.00	6.03	0.56	10158	100	0.0074	75.3208	7.16	4.041	79.3615
8750.0	12.60	19.50	24.00	6.21	0.60	10158	100	0.0078	79.4749	7.16	4.282	83.7568

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To C Modified High Point

9000.0	12.96	20.05	24.00	6.38	0.63	10158	100	0.0082	83.7314	7.16	4.530	88.2615
9250.0	13.32	20.61	24.00	6.56	0.67	10158	100	0.0087	88.0898	7.16	4.785	92.8751
9500.0	13.68	21.17	24.00	6.74	0.70	10158	100	0.0091	92.5498	7.16	5.047	97.5972
9750.0	14.04	21.72	24.00	6.92	0.74	10158	100	0.0096	97.1108	7.16	5.317	102.4274
10000.0	14.40	22.28	24.00	7.09	0.78	10158	100	0.0100	101.7727	7.16	5.593	107.3654
10250.0	14.76	22.84	24.00	7.27	0.82	10158	100	0.0105	106.5349	7.16	5.876	112.4107
10500.0	15.12	23.40	24.00	7.45	0.86	10158	100	0.0110	111.3971	7.16	6.166	117.5630
10750.0	15.48	23.95	24.00	7.62	0.90	10158	100	0.0115	116.3589	7.16	6.463	122.8220
11000.0	15.84	24.51	24.00	7.80	0.95	10158	100	0.0120	121.4201	7.16	6.767	128.1872
11250.0	16.20	25.07	24.00	7.98	0.99	10158	100	0.0125	126.5802	7.16	7.078	133.6584
11500.0	16.56	25.62	24.00	8.16	1.03	10158	100	0.0130	131.8389	7.16	7.396	139.2353
11750.0	16.92	26.18	24.00	8.33	1.08	10158	100	0.0135	137.1960	7.16	7.721	144.9174
12000.0	17.28	26.74	24.00	8.51	1.12	10158	100	0.0140	142.6510	7.16	8.053	150.7045
12250.0	17.64	27.30	24.00	8.69	1.17	10158	100	0.0146	148.2038	7.16	8.393	156.5963
12500.0	18.00	27.85	24.00	8.87	1.22	10158	100	0.0151	153.8539	7.16	8.739	162.5925
12750.0	18.36	28.41	24.00	9.04	1.27	10158	100	0.0157	159.6012	7.16	9.092	168.6928
13000.0	18.72	28.97	24.00	9.22	1.32	10158	100	0.0163	165.4452	7.16	9.452	174.8969
13250.0	19.08	29.52	24.00	9.40	1.37	10158	100	0.0169	171.3859	7.16	9.819	181.2046
13500.0	19.44	30.08	24.00	9.57	1.42	10158	100	0.0175	177.4228	7.16	10.193	187.6155
13750.0	19.80	30.64	24.00	9.75	1.48	10158	100	0.0181	183.5557	7.16	10.574	194.1294
14000.0	20.16	31.19	24.00	9.93	1.53	10158	100	0.0187	189.7843	7.16	10.962	200.7460
14250.0	20.52	31.75	24.00	10.11	1.59	10158	100	0.0193	196.1085	7.16	11.357	207.4651
14500.0	20.88	32.31	24.00	10.28	1.64	10158	100	0.0199	202.5278	7.16	11.759	214.2865
14750.0	21.24	32.87	24.00	10.46	1.70	10158	100	0.0206	209.0422	7.16	12.168	221.2098
15000.0	21.60	33.42	24.00	10.64	1.76	10158	100	0.0212	215.6514	7.16	12.584	228.2349
15250.0	21.96	33.98	24.00	10.82	1.82	10158	100	0.0219	222.3550	7.16	13.007	235.3615
15500.0	22.32	34.54	24.00	10.99	1.88	10158	100	0.0226	229.1530	7.16	13.436	242.5894
15750.0	22.68	35.09	24.00	11.17	1.94	10158	100	0.0232	236.0450	7.16	13.873	249.9184
16000.0	23.04	35.65	24.00	11.35	2.00	10158	100	0.0239	243.0308	7.16	14.317	257.3482

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To C Modified High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	1.53
500.0	0.72	5.55
750.0	1.08	11.77
1000.0	1.44	20.07
1250.0	1.80	30.37
1500.0	2.16	42.60
1750.0	2.52	56.71
2000.0	2.88	72.66
2250.0	3.24	90.41
2500.0	3.60	109.94
2750.0	3.96	131.22
3000.0	4.32	154.22
3250.0	4.68	178.92
3500.0	5.04	205.31
3750.0	5.40	233.37
4000.0	5.76	263.07
4250.0	6.12	294.41
4500.0	6.48	327.37
4750.0	6.84	361.94
5000.0	7.20	398.10
5250.0	7.56	435.85
5500.0	7.92	475.17
5750.0	8.28	516.05
6000.0	8.64	558.49
6250.0	9.00	602.46
6500.0	9.36	647.97
6750.0	9.72	695.01
7000.0	10.08	743.57
7250.0	10.44	793.63
7500.0	10.80	845.20
7750.0	11.16	898.26
8000.0	11.52	952.81
8250.0	11.88	1008.84
8500.0	12.24	1066.35
8750.0	12.60	1125.33
9000.0	12.96	1185.77
9250.0	13.32	1247.66
9500.0	13.68	1311.01
9750.0	14.04	1375.80
10000.0	14.40	1442.03
10250.0	14.76	1509.70
10500.0	15.12	1578.80
10750.0	15.48	1649.32
11000.0	15.84	1721.27
11250.0	16.20	1794.63
11500.0	16.56	1869.40
11750.0	16.92	1945.58
12000.0	17.28	2023.17
12250.0	17.64	2102.15
12500.0	18.00	2182.52
12750.0	18.36	2264.29
13000.0	18.72	2347.44
13250.0	19.08	2431.98
13500.0	19.44	2517.90
13750.0	19.80	2605.19
14000.0	20.16	2693.85
14250.0	20.52	2783.89
14500.0	20.88	2875.28
14750.0	21.24	2968.04
15000.0	21.60	3062.16
15250.0	21.96	3157.64
15500.0	22.32	3254.46
15750.0	22.68	3352.64
16000.0	23.04	3452.16

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	24.85	29.35
250.0	0.36	26.38	30.88
500.0	0.72	30.40	34.90
750.0	1.08	36.62	41.12
1000.0	1.44	44.92	49.42
1250.0	1.80	55.22	59.72
1500.0	2.16	67.45	71.95
1750.0	2.52	81.56	86.06
2000.0	2.88	97.51	102.01
2250.0	3.24	115.26	119.76
2500.0	3.60	134.79	139.29
2750.0	3.96	156.07	160.57
3000.0	4.32	179.07	183.57
3250.0	4.68	203.77	208.27
3500.0	5.04	230.16	234.66
3750.0	5.40	258.22	262.72
4000.0	5.76	287.92	292.42
4250.0	6.12	319.26	323.76
4500.0	6.48	352.22	356.72
4750.0	6.84	386.79	391.29
5000.0	7.20	422.95	427.45
5250.0	7.56	460.70	465.20
5500.0	7.92	500.02	504.52
5750.0	8.28	540.90	545.40
6000.0	8.64	583.34	587.84
6250.0	9.00	627.31	631.81
6500.0	9.36	672.82	677.32
6750.0	9.72	719.86	724.36
7000.0	10.08	768.42	772.92
7250.0	10.44	818.48	822.98
7500.0	10.80	870.05	874.55
7750.0	11.16	923.11	927.61
8000.0	11.52	977.66	982.16
8250.0	11.88	1033.69	1038.19
8500.0	12.24	1091.20	1095.70
8750.0	12.60	1150.18	1154.68
9000.0	12.96	1210.62	1215.12
9250.0	13.32	1272.51	1277.01
9500.0	13.68	1335.86	1340.36
9750.0	14.04	1400.65	1405.15
10000.0	14.40	1466.88	1471.38
10250.0	14.76	1534.55	1539.05
10500.0	15.12	1603.65	1608.15
10750.0	15.48	1674.17	1678.67
11000.0	15.84	1746.12	1750.62
11250.0	16.20	1819.48	1823.98
11500.0	16.56	1894.25	1898.75
11750.0	16.92	1970.43	1974.93
12000.0	17.28	2048.02	2052.52
12250.0	17.64	2127.00	2131.50
12500.0	18.00	2207.37	2211.87
12750.0	18.36	2289.14	2293.64
13000.0	18.72	2372.29	2376.79
13250.0	19.08	2456.83	2461.33
13500.0	19.44	2542.75	2547.25
13750.0	19.80	2630.04	2634.54
14000.0	20.16	2718.70	2723.20
14250.0	20.52	2808.74	2813.24
14500.0	20.88	2900.13	2904.63
14750.0	21.24	2992.89	2997.39
15000.0	21.60	3087.01	3091.51
15250.0	21.96	3182.49	3186.99
15500.0	22.32	3279.31	3283.81
15750.0	22.68	3377.49	3381.99
16000.0	23.04	3477.01	3481.51

MIN Static Head = 24.85
MAX Static Head = 29.35

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To D Modified High Point

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FM System Curve – 24"

Diameter = 24 in
Area = 3.141593 ft^2
RH=D/4= 0.5
C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To D Modified High Point

13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve – 24" (24" Parallel FM Portion)

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	316	100	0.0000	0.0000	3.8	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	316	100	0.0000	0.0034	3.8	0.002	0.0053
500.0	0.72	1.11	24.00	0.35	0.00	316	100	0.0000	0.0123	3.8	0.007	0.0198
750.0	1.08	1.67	24.00	0.53	0.00	316	100	0.0001	0.0261	3.8	0.017	0.0428
1000.0	1.44	2.23	24.00	0.71	0.01	316	100	0.0001	0.0445	3.8	0.030	0.0742
1250.0	1.80	2.79	24.00	0.89	0.01	316	100	0.0002	0.0673	3.8	0.046	0.1137
1500.0	2.16	3.34	24.00	1.06	0.02	316	100	0.0003	0.0943	3.8	0.067	0.1611
1750.0	2.52	3.90	24.00	1.24	0.02	316	100	0.0004	0.1255	3.8	0.091	0.2164
2000.0	2.88	4.46	24.00	1.42	0.03	316	100	0.0005	0.1607	3.8	0.119	0.2794
2250.0	3.24	5.01	24.00	1.60	0.04	316	100	0.0006	0.1999	3.8	0.150	0.3501
2500.0	3.60	5.57	24.00	1.77	0.05	316	100	0.0008	0.2429	3.8	0.186	0.4284
2750.0	3.96	6.13	24.00	1.95	0.06	316	100	0.0009	0.2898	3.8	0.224	0.5143
3000.0	4.32	6.68	24.00	2.13	0.07	316	100	0.0011	0.3405	3.8	0.267	0.6077
3250.0	4.68	7.24	24.00	2.31	0.08	316	100	0.0012	0.3949	3.8	0.314	0.7084
3500.0	5.04	7.80	24.00	2.48	0.10	316	100	0.0014	0.4530	3.8	0.364	0.8166
3750.0	5.40	8.36	24.00	2.66	0.11	316	100	0.0016	0.5148	3.8	0.417	0.9322
4000.0	5.76	8.91	24.00	2.84	0.12	316	100	0.0018	0.5801	3.8	0.475	1.0550
4250.0	6.12	9.47	24.00	3.01	0.14	316	100	0.0021	0.6491	3.8	0.536	1.1852
4500.0	6.48	10.03	24.00	3.19	0.16	316	100	0.0023	0.7215	3.8	0.601	1.3226
4750.0	6.84	10.58	24.00	3.37	0.18	316	100	0.0025	0.7975	3.8	0.670	1.4672
5000.0	7.20	11.14	24.00	3.55	0.20	316	100	0.0028	0.8770	3.8	0.742	1.6191
5250.0	7.56	11.70	24.00	3.72	0.22	316	100	0.0030	0.9599	3.8	0.818	1.7781
5500.0	7.92	12.25	24.00	3.90	0.24	316	100	0.0033	1.0463	3.8	0.898	1.9442
5750.0	8.28	12.81	24.00	4.08	0.26	316	100	0.0036	1.1361	3.8	0.981	2.1175
6000.0	8.64	13.37	24.00	4.26	0.28	316	100	0.0039	1.2293	3.8	1.069	2.2978
6250.0	9.00	13.93	24.00	4.43	0.31	316	100	0.0042	1.3258	3.8	1.159	2.4853
6500.0	9.36	14.48	24.00	4.61	0.33	316	100	0.0045	1.4257	3.8	1.254	2.6798
6750.0	9.72	15.04	24.00	4.79	0.36	316	100	0.0048	1.5289	3.8	1.352	2.8813
7000.0	10.08	15.60	24.00	4.96	0.38	316	100	0.0052	1.6354	3.8	1.454	3.0898
7250.0	10.44	16.15	24.00	5.14	0.41	316	100	0.0055	1.7452	3.8	1.560	3.3054
7500.0	10.80	16.71	24.00	5.32	0.44	316	100	0.0059	1.8583	3.8	1.670	3.5279
7750.0	11.16	17.27	24.00	5.50	0.47	316	100	0.0062	1.9747	3.8	1.783	3.7575
8000.0	11.52	17.83	24.00	5.67	0.50	316	100	0.0066	2.0943	3.8	1.900	3.9939
8250.0	11.88	18.38	24.00	5.85	0.53	316	100	0.0070	2.2171	3.8	2.020	4.2373
8500.0	12.24	18.94	24.00	6.03	0.56	316	100	0.0074	2.3431	3.8	2.145	4.4876
8750.0	12.60	19.50	24.00	6.21	0.60	316	100	0.0078	2.4723	3.8	2.273	4.7449
9000.0	12.96	20.05	24.00	6.38	0.63	316	100	0.0082	2.6048	3.8	2.404	5.0090
9250.0	13.32	20.61	24.00	6.56	0.67	316	100	0.0087	2.7403	3.8	2.540	5.2800
9500.0	13.68	21.17	24.00	6.74	0.70	316	100	0.0091	2.8791	3.8	2.679	5.5579
9750.0	14.04	21.72	24.00	6.92	0.74	316	100	0.0096	3.0210	3.8	2.822	5.8426
10000.0	14.40	22.28	24.00	7.09	0.78	316	100	0.0100	3.1660	3.8	2.968	6.1342
10250.0	14.76	22.84	24.00	7.27	0.82	316	100	0.0105	3.3141	3.8	3.118	6.4326
10500.0	15.12	23.40	24.00	7.45	0.86	316	100	0.0110	3.4654	3.8	3.272	6.7378

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To D Modified High Point

10750.0	15.48	23.95	24.00	7.62	0.90	316	100	0.0115	3.6197	3.8	3.430	7.0499
11000.0	15.84	24.51	24.00	7.80	0.95	316	100	0.0120	3.7772	3.8	3.592	7.3687
11250.0	16.20	25.07	24.00	7.98	0.99	316	100	0.0125	3.9377	3.8	3.757	7.6943
11500.0	16.56	25.62	24.00	8.16	1.03	316	100	0.0130	4.1013	3.8	3.925	8.0267
11750.0	16.92	26.18	24.00	8.33	1.08	316	100	0.0135	4.2680	3.8	4.098	8.3659
12000.0	17.28	26.74	24.00	8.51	1.12	316	100	0.0140	4.4377	3.8	4.274	8.7119
12250.0	17.64	27.30	24.00	8.69	1.17	316	100	0.0146	4.6104	3.8	4.454	9.0645
12500.0	18.00	27.85	24.00	8.87	1.22	316	100	0.0151	4.7862	3.8	4.638	9.4240
12750.0	18.36	28.41	24.00	9.04	1.27	316	100	0.0157	4.9650	3.8	4.825	9.7901
13000.0	18.72	28.97	24.00	9.22	1.32	316	100	0.0163	5.1468	3.8	5.016	10.1630
13250.0	19.08	29.52	24.00	9.40	1.37	316	100	0.0169	5.3316	3.8	5.211	10.5426
13500.0	19.44	30.08	24.00	9.57	1.42	316	100	0.0175	5.5194	3.8	5.410	10.9289
13750.0	19.80	30.64	24.00	9.75	1.48	316	100	0.0181	5.7101	3.8	5.612	11.3219
14000.0	20.16	31.19	24.00	9.93	1.53	316	100	0.0187	5.9039	3.8	5.818	11.7216
14250.0	20.52	31.75	24.00	10.11	1.59	316	100	0.0193	6.1006	3.8	6.027	12.1279
14500.0	20.88	32.31	24.00	10.28	1.64	316	100	0.0199	6.3003	3.8	6.241	12.5410
14750.0	21.24	32.87	24.00	10.46	1.70	316	100	0.0206	6.5030	3.8	6.458	12.9607
15000.0	21.60	33.42	24.00	10.64	1.76	316	100	0.0212	6.7086	3.8	6.678	13.3870
15250.0	21.96	33.98	24.00	10.82	1.82	316	100	0.0219	6.9171	3.8	6.903	13.8200
15500.0	22.32	34.54	24.00	10.99	1.88	316	100	0.0226	7.1286	3.8	7.131	14.2597
15750.0	22.68	35.09	24.00	11.17	1.94	316	100	0.0232	7.3430	3.8	7.363	14.7060
16000.0	23.04	35.65	24.00	11.35	2.00	316	100	0.0239	7.5603	3.8	7.599	15.1589

FM System Curve – 14" (14" Parallel FM Portion)

Diameter = 14 in

Area = 1.069014 ft^2

RH=D/4= 0.291667

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	14.00	0.00	0.00	68.50	100	0.0000	0.0000	1.72	0.000	0.0000
250.0	0.36	0.56	14.00	0.52	0.00	68.50	100	0.0001	0.0102	1.72	0.007	0.0175
500.0	0.72	1.11	14.00	1.04	0.02	68.50	100	0.0005	0.0369	1.72	0.029	0.0659
750.0	1.08	1.67	14.00	1.56	0.04	68.50	100	0.0011	0.0782	1.72	0.065	0.1435
1000.0	1.44	2.23	14.00	2.08	0.07	68.50	100	0.0019	0.1333	1.72	0.116	0.2493
1250.0	1.80	2.79	14.00	2.61	0.11	68.50	100	0.0029	0.2014	1.72	0.181	0.3827
1500.0	2.16	3.34	14.00	3.13	0.15	68.50	100	0.0041	0.2824	1.72	0.261	0.5434
1750.0	2.52	3.90	14.00	3.65	0.21	68.50	100	0.0055	0.3756	1.72	0.355	0.7310
2000.0	2.88	4.46	14.00	4.17	0.27	68.50	100	0.0070	0.4810	1.72	0.464	0.9452
2250.0	3.24	5.01	14.00	4.69	0.34	68.50	100	0.0087	0.5983	1.72	0.587	1.1857
2500.0	3.60	5.57	14.00	5.21	0.42	68.50	100	0.0106	0.7272	1.72	0.725	1.4524
2750.0	3.96	6.13	14.00	5.73	0.51	68.50	100	0.0127	0.8676	1.72	0.877	1.7451
3000.0	4.32	6.68	14.00	6.25	0.61	68.50	100	0.0149	1.0193	1.72	1.044	2.0636
3250.0	4.68	7.24	14.00	6.77	0.71	68.50	100	0.0173	1.1822	1.72	1.226	2.4077
3500.0	5.04	7.80	14.00	7.30	0.83	68.50	100	0.0198	1.3561	1.72	1.421	2.7775
3750.0	5.40	8.36	14.00	7.82	0.95	68.50	100	0.0225	1.5409	1.72	1.632	3.1726
4000.0	5.76	8.91	14.00	8.34	1.08	68.50	100	0.0254	1.7366	1.72	1.856	3.5930
4250.0	6.12	9.47	14.00	8.86	1.22	68.50	100	0.0284	1.9429	1.72	2.096	4.0387
4500.0	6.48	10.03	14.00	9.38	1.37	68.50	100	0.0315	2.1599	1.72	2.350	4.5095
4750.0	6.84	10.58	14.00	9.90	1.52	68.50	100	0.0349	2.3873	1.72	2.618	5.0053
5000.0	7.20	11.14	14.00	10.42	1.69	68.50	100	0.0383	2.6252	1.72	2.901	5.5260
5250.0	7.56	11.70	14.00	10.94	1.86	68.50	100	0.0419	2.8735	1.72	3.198	6.0716
5500.0	7.92	12.25	14.00	11.46	2.04	68.50	100	0.0457	3.1320	1.72	3.510	6.6420
5750.0	8.28	12.81	14.00	11.98	2.23	68.50	100	0.0496	3.4008	1.72	3.836	7.2370
6000.0	8.64	13.37	14.00	12.51	2.43	68.50	100	0.0537	3.6797	1.72	4.177	7.8568
6250.0	9.00	13.93	14.00	13.03	2.64	68.50	100	0.0579	3.9687	1.72	4.532	8.5011
6500.0	9.36	14.48	14.00	13.55	2.85	68.50	100	0.0623	4.2677	1.72	4.902	9.1699
6750.0	9.72	15.04	14.00	14.07	3.07	68.50	100	0.0668	4.5766	1.72	5.287	9.8633
7000.0	10.08	15.60	14.00	14.59	3.31	68.50	100	0.0715	4.8955	1.72	5.685	10.5810
7250.0	10.44	16.15	14.00	15.11	3.55	68.50	100	0.0763	5.2242	1.72	6.099	11.3231
7500.0	10.80	16.71	14.00	15.63	3.79	68.50	100	0.0812	5.5628	1.72	6.527	12.0894

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To D Modified High Point

7750.0	11.16	17.27	14.00	16.15	4.05	68.50	100	0.0863	5.9110	1.72	6.969	12.8801
8000.0	11.52	17.83	14.00	16.67	4.32	68.50	100	0.0915	6.2690	1.72	7.426	13.6949
8250.0	11.88	18.38	14.00	17.20	4.59	68.50	100	0.0969	6.6367	1.72	7.897	14.5339
8500.0	12.24	18.94	14.00	17.72	4.87	68.50	100	0.1024	7.0139	1.72	8.383	15.3971
8750.0	12.60	19.50	14.00	18.24	5.16	68.50	100	0.1080	7.4007	1.72	8.884	16.2843
9000.0	12.96	20.05	14.00	18.76	5.46	68.50	100	0.1138	7.7971	1.72	9.398	17.1955
9250.0	13.32	20.61	14.00	19.28	5.77	68.50	100	0.1198	8.2030	1.72	9.928	18.1308
9500.0	13.68	21.17	14.00	19.80	6.09	68.50	100	0.1258	8.6183	1.72	10.472	19.0900
9750.0	14.04	21.72	14.00	20.32	6.41	68.50	100	0.1320	9.0430	1.72	11.030	20.0731
10000.0	14.40	22.28	14.00	20.84	6.75	68.50	100	0.1384	9.4771	1.72	11.603	21.0801
10250.0	14.76	22.84	14.00	21.36	7.09	68.50	100	0.1448	9.9206	1.72	12.190	22.1110
10500.0	15.12	23.40	14.00	21.89	7.44	68.50	100	0.1514	10.3734	1.72	12.792	23.1657
10750.0	15.48	23.95	14.00	22.41	7.80	68.50	100	0.1582	10.8354	1.72	13.409	24.2441
11000.0	15.84	24.51	14.00	22.93	8.16	68.50	100	0.1651	11.3067	1.72	14.040	25.3463
11250.0	16.20	25.07	14.00	23.45	8.54	68.50	100	0.1721	11.7872	1.72	14.685	26.4722
11500.0	16.56	25.62	14.00	23.97	8.92	68.50	100	0.1792	12.2769	1.72	15.345	27.6219
11750.0	16.92	26.18	14.00	24.49	9.31	68.50	100	0.1865	12.7758	1.72	16.019	28.7951
12000.0	17.28	26.74	14.00	25.01	9.71	68.50	100	0.1939	13.2837	1.72	16.708	29.9920
12250.0	17.64	27.30	14.00	25.53	10.12	68.50	100	0.2015	13.8008	1.72	17.412	31.2126
12500.0	18.00	27.85	14.00	26.05	10.54	68.50	100	0.2092	14.3270	1.72	18.130	32.4566
12750.0	18.36	28.41	14.00	26.58	10.97	68.50	100	0.2170	14.8621	1.72	18.862	33.7243
13000.0	18.72	28.97	14.00	27.10	11.40	68.50	100	0.2249	15.4063	1.72	19.609	35.0154
13250.0	19.08	29.52	14.00	27.62	11.84	68.50	100	0.2330	15.9595	1.72	20.371	36.3300
13500.0	19.44	30.08	14.00	28.14	12.29	68.50	100	0.2412	16.5217	1.72	21.146	37.6682
13750.0	19.80	30.64	14.00	28.66	12.75	68.50	100	0.2495	17.0928	1.72	21.937	39.0297
14000.0	20.16	31.19	14.00	29.18	13.22	68.50	100	0.2580	17.6728	1.72	22.742	40.4147
14250.0	20.52	31.75	14.00	29.70	13.70	68.50	100	0.2666	18.2617	1.72	23.561	41.8230
14500.0	20.88	32.31	14.00	30.22	14.18	68.50	100	0.2753	18.8595	1.72	24.395	43.2548
14750.0	21.24	32.87	14.00	30.74	14.68	68.50	100	0.2842	19.4661	1.72	25.244	44.7099
15000.0	21.60	33.42	14.00	31.26	15.18	68.50	100	0.2932	20.0816	1.72	26.107	46.1883
15250.0	21.96	33.98	14.00	31.79	15.69	68.50	100	0.3023	20.7058	1.72	26.984	47.6900
15500.0	22.32	34.54	14.00	32.31	16.21	68.50	100	0.3115	21.3388	1.72	27.876	49.2150
15750.0	22.68	35.09	14.00	32.83	16.73	68.50	100	0.3209	21.9806	1.72	28.783	50.7633
16000.0	23.04	35.65	14.00	33.35	17.27	68.50	100	0.3304	22.6312	1.72	29.704	52.3348

FM System Curve – 13.5" (14" Parallel FM Portion)

Diameter = 13.5 in

Area = 0.99402 ft^2

RH=D/4= 0.28125

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	13.50	0.00	0.00	10640.5	120	0.0000	0.0000	3.1	0.000	0.0000
250.0	0.36	0.56	13.50	0.56	0.00	10640.5	120	0.0001	1.3528	3.1	0.015	1.3679
500.0	0.72	1.11	13.50	1.12	0.02	10640.5	120	0.0005	4.8835	3.1	0.060	4.9439
750.0	1.08	1.67	13.50	1.68	0.04	10640.5	120	0.0010	10.3478	3.1	0.136	10.4839
1000.0	1.44	2.23	13.50	2.24	0.08	10640.5	120	0.0017	17.6293	3.1	0.242	17.8711
1250.0	1.80	2.79	13.50	2.80	0.12	10640.5	120	0.0025	26.6509	3.1	0.378	27.0288
1500.0	2.16	3.34	13.50	3.36	0.18	10640.5	120	0.0035	37.3556	3.1	0.544	37.8998
1750.0	2.52	3.90	13.50	3.92	0.24	10640.5	120	0.0047	49.6982	3.1	0.741	50.4390
2000.0	2.88	4.46	13.50	4.48	0.31	10640.5	120	0.0060	63.6417	3.1	0.967	64.6092
2250.0	3.24	5.01	13.50	5.04	0.39	10640.5	120	0.0074	79.1547	3.1	1.224	80.3791
2500.0	3.60	5.57	13.50	5.60	0.49	10640.5	120	0.0090	96.2098	3.1	1.512	97.7215
2750.0	3.96	6.13	13.50	6.16	0.59	10640.5	120	0.0108	114.7833	3.1	1.829	116.6124
3000.0	4.32	6.68	13.50	6.72	0.70	10640.5	120	0.0127	134.8538	3.1	2.177	137.0306
3250.0	4.68	7.24	13.50	7.29	0.82	10640.5	120	0.0147	156.4021	3.1	2.555	158.9568
3500.0	5.04	7.80	13.50	7.85	0.96	10640.5	120	0.0169	179.4108	3.1	2.963	182.3737
3750.0	5.40	8.36	13.50	8.41	1.10	10640.5	120	0.0192	203.8640	3.1	3.401	207.2652
4000.0	5.76	8.91	13.50	8.97	1.25	10640.5	120	0.0216	229.7469	3.1	3.870	233.6168
4250.0	6.12	9.47	13.50	9.53	1.41	10640.5	120	0.0242	257.0460	3.1	4.369	261.4148
4500.0	6.48	10.03	13.50	10.09	1.58	10640.5	120	0.0269	285.7486	3.1	4.898	290.6465

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To D Modified High Point

4750.0	6.84	10.58	13.50	10.65	1.76	10640.5	120	0.0297	315.8429	3.1	5.457	321.3001
5000.0	7.20	11.14	13.50	11.21	1.95	10640.5	120	0.0326	347.3178	3.1	6.047	353.3645
5250.0	7.56	11.70	13.50	11.77	2.15	10640.5	120	0.0357	380.1628	3.1	6.667	386.8293
5500.0	7.92	12.25	13.50	12.33	2.36	10640.5	120	0.0389	414.3680	3.1	7.317	421.6846
5750.0	8.28	12.81	13.50	12.89	2.58	10640.5	120	0.0423	449.9242	3.1	7.997	457.9210
6000.0	8.64	13.37	13.50	13.45	2.81	10640.5	120	0.0458	486.8225	3.1	8.707	495.5298
6250.0	9.00	13.93	13.50	14.01	3.05	10640.5	120	0.0493	525.0544	3.1	9.448	534.5025
6500.0	9.36	14.48	13.50	14.57	3.30	10640.5	120	0.0531	564.6120	3.1	10.219	574.8309
6750.0	9.72	15.04	13.50	15.13	3.55	10640.5	120	0.0569	605.4874	3.1	11.020	616.5076
7000.0	10.08	15.60	13.50	15.69	3.82	10640.5	120	0.0609	647.6735	3.1	11.852	659.5251
7250.0	10.44	16.15	13.50	16.25	4.10	10640.5	120	0.0650	691.1631	3.1	12.713	703.8763
7500.0	10.80	16.71	13.50	16.81	4.39	10640.5	120	0.0692	735.9495	3.1	13.605	749.5546
7750.0	11.16	17.27	13.50	17.37	4.69	10640.5	120	0.0735	782.0262	3.1	14.527	796.5535
8000.0	11.52	17.83	13.50	17.93	4.99	10640.5	120	0.0779	829.3870	3.1	15.480	844.8666
8250.0	11.88	18.38	13.50	18.49	5.31	10640.5	120	0.0825	878.0258	3.1	16.462	894.4880
8500.0	12.24	18.94	13.50	19.05	5.64	10640.5	120	0.0872	927.9368	3.1	17.475	945.4118
8750.0	12.60	19.50	13.50	19.61	5.97	10640.5	120	0.0920	979.1145	3.1	18.518	997.6326
9000.0	12.96	20.05	13.50	20.17	6.32	10640.5	120	0.0969	1031.5533	3.1	19.591	1051.1447
9250.0	13.32	20.61	13.50	20.73	6.68	10640.5	120	0.1020	1085.2481	3.1	20.695	1105.9430
9500.0	13.68	21.17	13.50	21.29	7.04	10640.5	120	0.1072	1140.1938	3.1	21.829	1162.0225
9750.0	14.04	21.72	13.50	21.86	7.42	10640.5	120	0.1124	1196.3854	3.1	22.993	1219.3781
10000.0	14.40	22.28	13.50	22.42	7.80	10640.5	120	0.1178	1253.8181	3.1	24.187	1278.0050
10250.0	14.76	22.84	13.50	22.98	8.20	10640.5	120	0.1233	1312.4874	3.1	25.411	1337.8988
10500.0	15.12	23.40	13.50	23.54	8.60	10640.5	120	0.1290	1372.3887	3.1	26.666	1399.0548
10750.0	15.48	23.95	13.50	24.10	9.02	10640.5	120	0.1347	1433.5176	3.1	27.951	1461.4686
11000.0	15.84	24.51	13.50	24.66	9.44	10640.5	120	0.1406	1495.8698	3.1	29.266	1525.1360
11250.0	16.20	25.07	13.50	25.22	9.87	10640.5	120	0.1466	1559.4413	3.1	30.612	1590.0528
11500.0	16.56	25.62	13.50	25.78	10.32	10640.5	120	0.1526	1624.2278	3.1	31.987	1656.2150
11750.0	16.92	26.18	13.50	26.34	10.77	10640.5	120	0.1588	1690.2256	3.1	33.393	1723.6187
12000.0	17.28	26.74	13.50	26.90	11.24	10640.5	120	0.1652	1757.4307	3.1	34.829	1792.2599
12250.0	17.64	27.30	13.50	27.46	11.71	10640.5	120	0.1716	1825.8394	3.1	36.295	1862.1349
12500.0	18.00	27.85	13.50	28.02	12.19	10640.5	120	0.1781	1895.4481	3.1	37.792	1933.2401
12750.0	18.36	28.41	13.50	28.58	12.68	10640.5	120	0.1848	1966.2531	3.1	39.319	2005.5719
13000.0	18.72	28.97	13.50	29.14	13.19	10640.5	120	0.1916	2038.2509	3.1	40.876	2079.1267
13250.0	19.08	29.52	13.50	29.70	13.70	10640.5	120	0.1984	2111.4381	3.1	42.463	2153.9012
13500.0	19.44	30.08	13.50	30.26	14.22	10640.5	120	0.2054	2185.8114	3.1	44.081	2229.8920
13750.0	19.80	30.64	13.50	30.82	14.75	10640.5	120	0.2125	2261.3675	3.1	45.728	2307.0959
14000.0	20.16	31.19	13.50	31.38	15.29	10640.5	120	0.2197	2338.1032	3.1	47.406	2385.5095
14250.0	20.52	31.75	13.50	31.94	15.84	10640.5	120	0.2271	2416.0153	3.1	49.115	2465.1298
14500.0	20.88	32.31	13.50	32.50	16.40	10640.5	120	0.2345	2495.1008	3.1	50.853	2545.9537
14750.0	21.24	32.87	13.50	33.06	16.97	10640.5	120	0.2420	2575.3566	3.1	52.622	2627.9782
15000.0	21.60	33.42	13.50	33.62	17.56	10640.5	120	0.2497	2656.7798	3.1	54.421	2711.2003
15250.0	21.96	33.98	13.50	34.18	18.15	10640.5	120	0.2574	2739.3675	3.1	56.250	2795.6172
15500.0	22.32	34.54	13.50	34.74	18.74	10640.5	120	0.2653	2823.1168	3.1	58.109	2881.2259
15750.0	22.68	35.09	13.50	35.30	19.35	10640.5	120	0.2733	2908.0250	3.1	59.999	2968.0237
16000.0	23.04	35.65	13.50	35.87	19.97	10640.5	120	0.2814	2994.0893	3.1	61.918	3056.0078

FM System Curve – 23.85" (28" Parallel FM Portion)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.456875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	619.99	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	619.99	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	619.99	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	619.99	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	619.99	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	619.99	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	619.99	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	619.99	120	0.0003	0.1811	2.7	0.066	0.2473

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To D Modified High Point

2000.0	2.88	4.46	23.85	1.44	0.03	619.99	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	619.99	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	619.99	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	619.99	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	619.99	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	619.99	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	619.99	120	0.0011	0.6538	2.7	0.265	0.9187
3750.0	5.40	8.36	23.85	2.69	0.11	619.99	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	619.99	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	619.99	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	619.99	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	619.99	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	619.99	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	619.99	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	619.99	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	619.99	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	619.99	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	619.99	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	619.99	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	619.99	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	619.99	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	619.99	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	619.99	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	619.99	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	619.99	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	619.99	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	619.99	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	619.99	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	619.99	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	619.99	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	619.99	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	619.99	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	619.99	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	619.99	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	619.99	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	619.99	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	619.99	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	619.99	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	619.99	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	619.99	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	619.99	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	619.99	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	619.99	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	619.99	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	619.99	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	619.99	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	619.99	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	619.99	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	619.99	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	619.99	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	619.99	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	619.99	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	619.99	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	619.99	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	619.99	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	619.99	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	619.99	120	0.0176	10.9108	2.7	5.536	16.4469

FM System Curve – 25.14" (28" DIP))

Diameter =	25.14	in
Area =	3.4471	ft^2
RH=D/4=	0.5238	
C=	100	

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To D Modified High Point

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.14	0.00	0.00	625	100	0.0000	0.0000	0.6	0.000	0.0000
250.0	0.36	0.56	25.14	0.16	0.00	625	100	0.0000	0.0054	0.6	0.000	0.0056
500.0	0.72	1.11	25.14	0.32	0.00	625	100	0.0000	0.0195	0.6	0.001	0.0204
750.0	1.08	1.67	25.14	0.48	0.00	625	100	0.0001	0.0412	0.6	0.002	0.0434
1000.0	1.44	2.23	25.14	0.65	0.01	625	100	0.0001	0.0702	0.6	0.004	0.0741
1250.0	1.80	2.79	25.14	0.81	0.01	625	100	0.0002	0.1062	0.6	0.006	0.1123
1500.0	2.16	3.34	25.14	0.97	0.01	625	100	0.0002	0.1488	0.6	0.009	0.1576
1750.0	2.52	3.90	25.14	1.13	0.02	625	100	0.0003	0.1980	0.6	0.012	0.2099
2000.0	2.88	4.46	25.14	1.29	0.03	625	100	0.0004	0.2535	0.6	0.016	0.2691
2250.0	3.24	5.01	25.14	1.45	0.03	625	100	0.0005	0.3153	0.6	0.020	0.3350
2500.0	3.60	5.57	25.14	1.62	0.04	625	100	0.0006	0.3833	0.6	0.024	0.4076
2750.0	3.96	6.13	25.14	1.78	0.05	625	100	0.0007	0.4573	0.6	0.029	0.4867
3000.0	4.32	6.68	25.14	1.94	0.06	625	100	0.0009	0.5372	0.6	0.035	0.5723
3250.0	4.68	7.24	25.14	2.10	0.07	625	100	0.0010	0.6231	0.6	0.041	0.6642
3500.0	5.04	7.80	25.14	2.26	0.08	625	100	0.0011	0.7147	0.6	0.048	0.7624
3750.0	5.40	8.36	25.14	2.42	0.09	625	100	0.0013	0.8122	0.6	0.055	0.8669
4000.0	5.76	8.91	25.14	2.59	0.10	625	100	0.0015	0.9153	0.6	0.062	0.9776
4250.0	6.12	9.47	25.14	2.75	0.12	625	100	0.0016	1.0240	0.6	0.070	1.0943
4500.0	6.48	10.03	25.14	2.91	0.13	625	100	0.0018	1.1384	0.6	0.079	1.2172
4750.0	6.84	10.58	25.14	3.07	0.15	625	100	0.0020	1.2583	0.6	0.088	1.3461
5000.0	7.20	11.14	25.14	3.23	0.16	625	100	0.0022	1.3837	0.6	0.097	1.4810
5250.0	7.56	11.70	25.14	3.39	0.18	625	100	0.0024	1.5145	0.6	0.107	1.6218
5500.0	7.92	12.25	25.14	3.56	0.20	625	100	0.0026	1.6508	0.6	0.118	1.7685
5750.0	8.28	12.81	25.14	3.72	0.21	625	100	0.0029	1.7924	0.6	0.129	1.9211
6000.0	8.64	13.37	25.14	3.88	0.23	625	100	0.0031	1.9394	0.6	0.140	2.0796
6250.0	9.00	13.93	25.14	4.04	0.25	625	100	0.0033	2.0917	0.6	0.152	2.2438
6500.0	9.36	14.48	25.14	4.20	0.27	625	100	0.0036	2.2493	0.6	0.164	2.4138
6750.0	9.72	15.04	25.14	4.36	0.30	625	100	0.0039	2.4122	0.6	0.177	2.5895
7000.0	10.08	15.60	25.14	4.52	0.32	625	100	0.0041	2.5802	0.6	0.191	2.7710
7250.0	10.44	16.15	25.14	4.69	0.34	625	100	0.0044	2.7535	0.6	0.205	2.9581
7500.0	10.80	16.71	25.14	4.85	0.36	625	100	0.0047	2.9319	0.6	0.219	3.1509
7750.0	11.16	17.27	25.14	5.01	0.39	625	100	0.0050	3.1155	0.6	0.234	3.3493
8000.0	11.52	17.83	25.14	5.17	0.42	625	100	0.0053	3.3042	0.6	0.249	3.5533
8250.0	11.88	18.38	25.14	5.33	0.44	625	100	0.0056	3.4979	0.6	0.265	3.7629
8500.0	12.24	18.94	25.14	5.49	0.47	625	100	0.0059	3.6968	0.6	0.281	3.9780
8750.0	12.60	19.50	25.14	5.66	0.50	625	100	0.0062	3.9006	0.6	0.298	4.1987
9000.0	12.96	20.05	25.14	5.82	0.53	625	100	0.0066	4.1096	0.6	0.315	4.4249
9250.0	13.32	20.61	25.14	5.98	0.56	625	100	0.0069	4.3235	0.6	0.333	4.6565
9500.0	13.68	21.17	25.14	6.14	0.59	625	100	0.0073	4.5424	0.6	0.351	4.8937
9750.0	14.04	21.72	25.14	6.30	0.62	625	100	0.0076	4.7662	0.6	0.370	5.1363
10000.0	14.40	22.28	25.14	6.46	0.65	625	100	0.0080	4.9950	0.6	0.389	5.3843
10250.0	14.76	22.84	25.14	6.63	0.68	625	100	0.0084	5.2288	0.6	0.409	5.6377
10500.0	15.12	23.40	25.14	6.79	0.72	625	100	0.0087	5.4674	0.6	0.429	5.8966
10750.0	15.48	23.95	25.14	6.95	0.75	625	100	0.0091	5.7109	0.6	0.450	6.1608
11000.0	15.84	24.51	25.14	7.11	0.79	625	100	0.0095	5.9593	0.6	0.471	6.4303
11250.0	16.20	25.07	25.14	7.27	0.82	625	100	0.0099	6.2126	0.6	0.493	6.7052
11500.0	16.56	25.62	25.14	7.43	0.86	625	100	0.0104	6.4707	0.6	0.515	6.9855
11750.0	16.92	26.18	25.14	7.59	0.90	625	100	0.0108	6.7336	0.6	0.537	7.2710
12000.0	17.28	26.74	25.14	7.76	0.93	625	100	0.0112	7.0013	0.6	0.561	7.5619
12250.0	17.64	27.30	25.14	7.92	0.97	625	100	0.0116	7.2739	0.6	0.584	7.8580
12500.0	18.00	27.85	25.14	8.08	1.01	625	100	0.0121	7.5512	0.6	0.608	8.1594
12750.0	18.36	28.41	25.14	8.24	1.05	625	100	0.0125	7.8333	0.6	0.633	8.4661
13000.0	18.72	28.97	25.14	8.40	1.10	625	100	0.0130	8.1201	0.6	0.658	8.7779
13250.0	19.08	29.52	25.14	8.56	1.14	625	100	0.0135	8.4117	0.6	0.683	9.0951
13500.0	19.44	30.08	25.14	8.73	1.18	625	100	0.0139	8.7079	0.6	0.709	9.4174
13750.0	19.80	30.64	25.14	8.89	1.23	625	100	0.0144	9.0089	0.6	0.736	9.7449
14000.0	20.16	31.19	25.14	9.05	1.27	625	100	0.0149	9.3147	0.6	0.763	10.0776
14250.0	20.52	31.75	25.14	9.21	1.32	625	100	0.0154	9.6250	0.6	0.790	10.4155
14500.0	20.88	32.31	25.14	9.37	1.36	625	100	0.0159	9.9401	0.6	0.818	10.7585
14750.0	21.24	32.87	25.14	9.53	1.41	625	100	0.0164	10.2598	0.6	0.847	11.1067
15000.0	21.60	33.42	25.14	9.70	1.46	625	100	0.0169	10.5842	0.6	0.876	11.4601
15250.0	21.96	33.98	25.14	9.86	1.51	625	100	0.0175	10.9132	0.6	0.905	11.8185

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To D Modified High Point

15500.0	22.32	34.54	25.14	10.02	1.56	625	100	0.0180	11.2469	0.6	0.935	12.1821
15750.0	22.68	35.09	25.14	10.18	1.61	625	100	0.0185	11.5851	0.6	0.966	12.5508
16000.0	23.04	35.65	25.14	10.34	1.66	625	100	0.0191	11.9280	0.6	0.997	12.9245

FM System Curve – 25.3" (30" HDPE)

Diameter = 25.3 in
Area = 3.4911 ft^2
RH=D/4= 0.5271
C= 120

Q (gpm)	Q (mgd)	Q (cfs)	Pipe Dia. (in)	V (fps)	V^2/2g (ft)	L (ft)	C	S	Friction Losses S x L (ft)	K	Minor Losses K x (v^2/2g) (ft)	Total Losses (ft)
0.0	0.00	0.00	25.30	0.00	0.00	2455	120	0.0000	0.0000	2.75	0.000	0.0000
250.0	0.36	0.56	25.30	0.16	0.00	2455	120	0.0000	0.0146	2.75	0.001	0.0157
500.0	0.72	1.11	25.30	0.32	0.00	2455	120	0.0000	0.0529	2.75	0.004	0.0572
750.0	1.08	1.67	25.30	0.48	0.00	2455	120	0.0000	0.1120	2.75	0.010	0.1218
1000.0	1.44	2.23	25.30	0.64	0.01	2455	120	0.0001	0.1908	2.75	0.017	0.2082
1250.0	1.80	2.79	25.30	0.80	0.01	2455	120	0.0001	0.2885	2.75	0.027	0.3157
1500.0	2.16	3.34	25.30	0.96	0.01	2455	120	0.0002	0.4044	2.75	0.039	0.4435
1750.0	2.52	3.90	25.30	1.12	0.02	2455	120	0.0002	0.5380	2.75	0.053	0.5912
2000.0	2.88	4.46	25.30	1.28	0.03	2455	120	0.0003	0.6889	2.75	0.070	0.7585
2250.0	3.24	5.01	25.30	1.44	0.03	2455	120	0.0003	0.8568	2.75	0.088	0.9449
2500.0	3.60	5.57	25.30	1.60	0.04	2455	120	0.0004	1.0414	2.75	0.109	1.1501
2750.0	3.96	6.13	25.30	1.76	0.05	2455	120	0.0005	1.2425	2.75	0.132	1.3740
3000.0	4.32	6.68	25.30	1.91	0.06	2455	120	0.0006	1.4597	2.75	0.157	1.6163
3250.0	4.68	7.24	25.30	2.07	0.07	2455	120	0.0007	1.6930	2.75	0.184	1.8767
3500.0	5.04	7.80	25.30	2.23	0.08	2455	120	0.0008	1.9420	2.75	0.213	2.1551
3750.0	5.40	8.36	25.30	2.39	0.09	2455	120	0.0009	2.2067	2.75	0.245	2.4513
4000.0	5.76	8.91	25.30	2.55	0.10	2455	120	0.0010	2.4869	2.75	0.278	2.7652
4250.0	6.12	9.47	25.30	2.71	0.11	2455	120	0.0011	2.7824	2.75	0.314	3.0966
4500.0	6.48	10.03	25.30	2.87	0.13	2455	120	0.0013	3.0931	2.75	0.352	3.4453
4750.0	6.84	10.58	25.30	3.03	0.14	2455	120	0.0014	3.4189	2.75	0.392	3.8113
5000.0	7.20	11.14	25.30	3.19	0.16	2455	120	0.0015	3.7596	2.75	0.435	4.1944
5250.0	7.56	11.70	25.30	3.35	0.17	2455	120	0.0017	4.1151	2.75	0.479	4.5945
5500.0	7.92	12.25	25.30	3.51	0.19	2455	120	0.0018	4.4854	2.75	0.526	5.0115
5750.0	8.28	12.81	25.30	3.67	0.21	2455	120	0.0020	4.8702	2.75	0.575	5.4453
6000.0	8.64	13.37	25.30	3.83	0.23	2455	120	0.0021	5.2696	2.75	0.626	5.8958
6250.0	9.00	13.93	25.30	3.99	0.25	2455	120	0.0023	5.6835	2.75	0.679	6.3629
6500.0	9.36	14.48	25.30	4.15	0.27	2455	120	0.0025	6.1117	2.75	0.735	6.8466
6750.0	9.72	15.04	25.30	4.31	0.29	2455	120	0.0027	6.5541	2.75	0.793	7.3467
7000.0	10.08	15.60	25.30	4.47	0.31	2455	120	0.0029	7.0108	2.75	0.852	7.8631
7250.0	10.44	16.15	25.30	4.63	0.33	2455	120	0.0030	7.4815	2.75	0.914	8.3958
7500.0	10.80	16.71	25.30	4.79	0.36	2455	120	0.0032	7.9663	2.75	0.978	8.9448
7750.0	11.16	17.27	25.30	4.95	0.38	2455	120	0.0034	8.4651	2.75	1.045	9.5098
8000.0	11.52	17.83	25.30	5.11	0.40	2455	120	0.0037	8.9778	2.75	1.113	10.0910
8250.0	11.88	18.38	25.30	5.27	0.43	2455	120	0.0039	9.5043	2.75	1.184	10.6881
8500.0	12.24	18.94	25.30	5.42	0.46	2455	120	0.0041	10.0445	2.75	1.257	11.3012
8750.0	12.60	19.50	25.30	5.58	0.48	2455	120	0.0043	10.5985	2.75	1.332	11.9302
9000.0	12.96	20.05	25.30	5.74	0.51	2455	120	0.0045	11.1661	2.75	1.409	12.5751
9250.0	13.32	20.61	25.30	5.90	0.54	2455	120	0.0048	11.7473	2.75	1.488	13.2356
9500.0	13.68	21.17	25.30	6.06	0.57	2455	120	0.0050	12.3421	2.75	1.570	13.9119
9750.0	14.04	21.72	25.30	6.22	0.60	2455	120	0.0053	12.9504	2.75	1.654	14.6039
10000.0	14.40	22.28	25.30	6.38	0.63	2455	120	0.0055	13.5720	2.75	1.739	15.3115
10250.0	14.76	22.84	25.30	6.54	0.66	2455	120	0.0058	14.2071	2.75	1.827	16.0346
10500.0	15.12	23.40	25.30	6.70	0.70	2455	120	0.0061	14.8555	2.75	1.918	16.7732
10750.0	15.48	23.95	25.30	6.86	0.73	2455	120	0.0063	15.5172	2.75	2.010	17.5273
11000.0	15.84	24.51	25.30	7.02	0.77	2455	120	0.0066	16.1921	2.75	2.105	18.2968
11250.0	16.20	25.07	25.30	7.18	0.80	2455	120	0.0069	16.8803	2.75	2.201	19.0817
11500.0	16.56	25.62	25.30	7.34	0.84	2455	120	0.0072	17.5816	2.75	2.300	19.8819
11750.0	16.92	26.18	25.30	7.50	0.87	2455	120	0.0075	18.2960	2.75	2.401	20.6975
12000.0	17.28	26.74	25.30	7.66	0.91	2455	120	0.0077	19.0234	2.75	2.505	21.5282

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To D Modified High Point

12250.0	17.64	27.30	25.30	7.82	0.95	2455	120	0.0081	19.7639	2.75	2.610	22.3741
12500.0	18.00	27.85	25.30	7.98	0.99	2455	120	0.0084	20.5174	2.75	2.718	23.2353
12750.0	18.36	28.41	25.30	8.14	1.03	2455	120	0.0087	21.2838	2.75	2.828	24.1115
13000.0	18.72	28.97	25.30	8.30	1.07	2455	120	0.0090	22.0632	2.75	2.940	25.0028
13250.0	19.08	29.52	25.30	8.46	1.11	2455	120	0.0093	22.8554	2.75	3.054	25.9092
13500.0	19.44	30.08	25.30	8.62	1.15	2455	120	0.0096	23.6605	2.75	3.170	26.8306
13750.0	19.80	30.64	25.30	8.78	1.20	2455	120	0.0100	24.4783	2.75	3.289	27.7669
14000.0	20.16	31.19	25.30	8.94	1.24	2455	120	0.0103	25.3090	2.75	3.409	28.7182
14250.0	20.52	31.75	25.30	9.09	1.28	2455	120	0.0107	26.1523	2.75	3.532	29.6844
14500.0	20.88	32.31	25.30	9.25	1.33	2455	120	0.0110	27.0084	2.75	3.657	30.6655
14750.0	21.24	32.87	25.30	9.41	1.38	2455	120	0.0114	27.8771	2.75	3.784	31.6615
15000.0	21.60	33.42	25.30	9.57	1.42	2455	120	0.0117	28.7585	2.75	3.914	32.6722
15250.0	21.96	33.98	25.30	9.73	1.47	2455	120	0.0121	29.6525	2.75	4.045	33.6977
15500.0	22.32	34.54	25.30	9.89	1.52	2455	120	0.0124	30.5590	2.75	4.179	34.7380
15750.0	22.68	35.09	25.30	10.05	1.57	2455	120	0.0128	31.4781	2.75	4.315	35.7930
16000.0	23.04	35.65	25.30	10.21	1.62	2455	120	0.0132	32.4097	2.75	4.453	36.8626

FM System Curve – 24"

Diameter =	24	in
Area =	3.1416	ft^2
RH=D/4=	0.5	
C=	100	

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	12682	100	0.0000	0.0000	8.16	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	12682	100	0.0000	0.1371	8.16	0.004	0.1411
500.0	0.72	1.11	24.00	0.35	0.00	12682	100	0.0000	0.4949	8.16	0.016	0.5108
750.0	1.08	1.67	24.00	0.53	0.00	12682	100	0.0001	1.0486	8.16	0.036	1.0845
1000.0	1.44	2.23	24.00	0.71	0.01	12682	100	0.0001	1.7865	8.16	0.064	1.8503
1250.0	1.80	2.79	24.00	0.89	0.01	12682	100	0.0002	2.7008	8.16	0.100	2.8004
1500.0	2.16	3.34	24.00	1.06	0.02	12682	100	0.0003	3.7856	8.16	0.143	3.9290
1750.0	2.52	3.90	24.00	1.24	0.02	12682	100	0.0004	5.0364	8.16	0.195	5.2316
2000.0	2.88	4.46	24.00	1.42	0.03	12682	100	0.0005	6.4494	8.16	0.255	6.7043
2250.0	3.24	5.01	24.00	1.60	0.04	12682	100	0.0006	8.0214	8.16	0.323	8.3441
2500.0	3.60	5.57	24.00	1.77	0.05	12682	100	0.0008	9.7498	8.16	0.398	10.1482
2750.0	3.96	6.13	24.00	1.95	0.06	12682	100	0.0009	11.6320	8.16	0.482	12.1140
3000.0	4.32	6.68	24.00	2.13	0.07	12682	100	0.0011	13.6659	8.16	0.574	14.2396
3250.0	4.68	7.24	24.00	2.31	0.08	12682	100	0.0012	15.8496	8.16	0.673	16.5228
3500.0	5.04	7.80	24.00	2.48	0.10	12682	100	0.0014	18.1813	8.16	0.781	18.9621
3750.0	5.40	8.36	24.00	2.66	0.11	12682	100	0.0016	20.6593	8.16	0.896	21.5557
4000.0	5.76	8.91	24.00	2.84	0.12	12682	100	0.0018	23.2823	8.16	1.020	24.3021
4250.0	6.12	9.47	24.00	3.01	0.14	12682	100	0.0021	26.0488	8.16	1.151	27.2000
4500.0	6.48	10.03	24.00	3.19	0.16	12682	100	0.0023	28.9574	8.16	1.291	30.2481
4750.0	6.84	10.58	24.00	3.37	0.18	12682	100	0.0025	32.0072	8.16	1.438	33.4453
5000.0	7.20	11.14	24.00	3.55	0.20	12682	100	0.0028	35.1968	8.16	1.593	36.7903
5250.0	7.56	11.70	24.00	3.72	0.22	12682	100	0.0030	38.5253	8.16	1.757	40.2821
5500.0	7.92	12.25	24.00	3.90	0.24	12682	100	0.0033	41.9916	8.16	1.928	43.9197
5750.0	8.28	12.81	24.00	4.08	0.26	12682	100	0.0036	45.5948	8.16	2.107	47.7022
6000.0	8.64	13.37	24.00	4.26	0.28	12682	100	0.0039	49.3341	8.16	2.295	51.6286
6250.0	9.00	13.93	24.00	4.43	0.31	12682	100	0.0042	53.2084	8.16	2.490	55.6982
6500.0	9.36	14.48	24.00	4.61	0.33	12682	100	0.0045	57.2172	8.16	2.693	59.9101
6750.0	9.72	15.04	24.00	4.79	0.36	12682	100	0.0048	61.3594	8.16	2.904	64.2635
7000.0	10.08	15.60	24.00	4.96	0.38	12682	100	0.0052	65.6345	8.16	3.123	68.7577
7250.0	10.44	16.15	24.00	5.14	0.41	12682	100	0.0055	70.0417	8.16	3.350	73.3919
7500.0	10.80	16.71	24.00	5.32	0.44	12682	100	0.0059	74.5803	8.16	3.585	78.1656
7750.0	11.16	17.27	24.00	5.50	0.47	12682	100	0.0062	79.2497	8.16	3.828	83.0779
8000.0	11.52	17.83	24.00	5.67	0.50	12682	100	0.0066	84.0492	8.16	4.079	88.1284
8250.0	11.88	18.38	24.00	5.85	0.53	12682	100	0.0070	88.9782	8.16	4.338	93.3163
8500.0	12.24	18.94	24.00	6.03	0.56	12682	100	0.0074	94.0361	8.16	4.605	98.6412
8750.0	12.60	19.50	24.00	6.21	0.60	12682	100	0.0078	99.2224	8.16	4.880	104.1023

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To D Modified High Point

9000.0	12.96	20.05	24.00	6.38	0.63	12682	100	0.0082	104.5365	8.16	5.163	109.6993
9250.0	13.32	20.61	24.00	6.56	0.67	12682	100	0.0087	109.9778	8.16	5.454	115.4314
9500.0	13.68	21.17	24.00	6.74	0.70	12682	100	0.0091	115.5460	8.16	5.752	121.2983
9750.0	14.04	21.72	24.00	6.92	0.74	12682	100	0.0096	121.2404	8.16	6.059	127.2995
10000.0	14.40	22.28	24.00	7.09	0.78	12682	100	0.0100	127.0605	8.16	6.374	133.4344
10250.0	14.76	22.84	24.00	7.27	0.82	12682	100	0.0105	133.0060	8.16	6.696	139.7025
10500.0	15.12	23.40	24.00	7.45	0.86	12682	100	0.0110	139.0764	8.16	7.027	146.1035
10750.0	15.48	23.95	24.00	7.62	0.90	12682	100	0.0115	145.2711	8.16	7.366	152.6368
11000.0	15.84	24.51	24.00	7.80	0.95	12682	100	0.0120	151.5898	8.16	7.712	159.3021
11250.0	16.20	25.07	24.00	7.98	0.99	12682	100	0.0125	158.0321	8.16	8.067	166.0989
11500.0	16.56	25.62	24.00	8.16	1.03	12682	100	0.0130	164.5975	8.16	8.429	173.0268
11750.0	16.92	26.18	24.00	8.33	1.08	12682	100	0.0135	171.2856	8.16	8.800	180.0854
12000.0	17.28	26.74	24.00	8.51	1.12	12682	100	0.0140	178.0961	8.16	9.178	187.2744
12250.0	17.64	27.30	24.00	8.69	1.17	12682	100	0.0146	185.0286	8.16	9.565	194.5933
12500.0	18.00	27.85	24.00	8.87	1.22	12682	100	0.0151	192.0826	8.16	9.959	202.0417
12750.0	18.36	28.41	24.00	9.04	1.27	12682	100	0.0157	199.2579	8.16	10.361	209.6193
13000.0	18.72	28.97	24.00	9.22	1.32	12682	100	0.0163	206.5541	8.16	10.772	217.3258
13250.0	19.08	29.52	24.00	9.40	1.37	12682	100	0.0169	213.9708	8.16	11.190	225.1608
13500.0	19.44	30.08	24.00	9.57	1.42	12682	100	0.0175	221.5077	8.16	11.616	233.1240
13750.0	19.80	30.64	24.00	9.75	1.48	12682	100	0.0181	229.1645	8.16	12.050	241.2150
14000.0	20.16	31.19	24.00	9.93	1.53	12682	100	0.0187	236.9408	8.16	12.493	249.4335
14250.0	20.52	31.75	24.00	10.11	1.59	12682	100	0.0193	244.8363	8.16	12.943	257.7791
14500.0	20.88	32.31	24.00	10.28	1.64	12682	100	0.0199	252.8508	8.16	13.401	266.2517
14750.0	21.24	32.87	24.00	10.46	1.70	12682	100	0.0206	260.9838	8.16	13.867	274.8508
15000.0	21.60	33.42	24.00	10.64	1.76	12682	100	0.0212	269.2351	8.16	14.341	283.5762
15250.0	21.96	33.98	24.00	10.82	1.82	12682	100	0.0219	277.6045	8.16	14.823	292.4276
15500.0	22.32	34.54	24.00	10.99	1.88	12682	100	0.0226	286.0916	8.16	15.313	301.4046
15750.0	22.68	35.09	24.00	11.17	1.94	12682	100	0.0232	294.6961	8.16	15.811	310.5071
16000.0	23.04	35.65	24.00	11.35	2.00	12682	100	0.0239	303.4177	8.16	16.317	319.7347

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To D Modified High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	1.56
500.0	0.72	5.65
750.0	1.08	11.98
1000.0	1.44	20.44
1250.0	1.80	30.92
1500.0	2.16	43.37
1750.0	2.52	57.73
2000.0	2.88	73.97
2250.0	3.24	92.05
2500.0	3.60	111.93
2750.0	3.96	133.59
3000.0	4.32	157.01
3250.0	4.68	182.16
3500.0	5.04	209.03
3750.0	5.40	237.59
4000.0	5.76	267.83
4250.0	6.12	299.74
4500.0	6.48	333.29
4750.0	6.84	368.49
5000.0	7.20	405.30
5250.0	7.56	443.73
5500.0	7.92	483.76
5750.0	8.28	525.38
6000.0	8.64	568.58
6250.0	9.00	613.36
6500.0	9.36	659.69
6750.0	9.72	707.58
7000.0	10.08	757.01
7250.0	10.44	807.98
7500.0	10.80	860.48
7750.0	11.16	914.50
8000.0	11.52	970.04
8250.0	11.88	1027.09
8500.0	12.24	1085.63
8750.0	12.60	1145.67
9000.0	12.96	1207.20
9250.0	13.32	1270.22
9500.0	13.68	1334.71
9750.0	14.04	1400.67
10000.0	14.40	1468.10
10250.0	14.76	1536.99
10500.0	15.12	1607.34
10750.0	15.48	1679.14
11000.0	15.84	1752.38
11250.0	16.20	1827.07
11500.0	16.56	1903.19
11750.0	16.92	1980.75
12000.0	17.28	2059.73
12250.0	17.64	2140.14
12500.0	18.00	2221.97
12750.0	18.36	2305.22
13000.0	18.72	2389.87
13250.0	19.08	2475.94
13500.0	19.44	2563.41
13750.0	19.80	2652.27
14000.0	20.16	2742.54
14250.0	20.52	2834.20
14500.0	20.88	2927.25
14750.0	21.24	3021.68
15000.0	21.60	3117.50
15250.0	21.96	3214.70
15500.0	22.32	3313.28
15750.0	22.68	3413.23
16000.0	23.04	3514.55

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	24.18	28.68
250.0	0.36	25.74	30.24
500.0	0.72	29.83	34.33
750.0	1.08	36.16	40.66
1000.0	1.44	44.62	49.12
1250.0	1.80	55.10	59.60
1500.0	2.16	67.55	72.05
1750.0	2.52	81.91	86.41
2000.0	2.88	98.15	102.65
2250.0	3.24	116.23	120.73
2500.0	3.60	136.11	140.61
2750.0	3.96	157.77	162.27
3000.0	4.32	181.19	185.69
3250.0	4.68	206.34	210.84
3500.0	5.04	233.21	237.71
3750.0	5.40	261.77	266.27
4000.0	5.76	292.01	296.51
4250.0	6.12	323.92	328.42
4500.0	6.48	357.47	361.97
4750.0	6.84	392.67	397.17
5000.0	7.20	429.48	433.98
5250.0	7.56	467.91	472.41
5500.0	7.92	507.94	512.44
5750.0	8.28	549.56	554.06
6000.0	8.64	592.76	597.26
6250.0	9.00	637.54	642.04
6500.0	9.36	683.87	688.37
6750.0	9.72	731.76	736.26
7000.0	10.08	781.19	785.69
7250.0	10.44	832.16	836.66
7500.0	10.80	884.66	889.16
7750.0	11.16	938.68	943.18
8000.0	11.52	994.22	998.72
8250.0	11.88	1051.27	1055.77
8500.0	12.24	1109.81	1114.31
8750.0	12.60	1169.85	1174.35
9000.0	12.96	1231.38	1235.88
9250.0	13.32	1294.40	1298.90
9500.0	13.68	1358.89	1363.39
9750.0	14.04	1424.85	1429.35
10000.0	14.40	1492.28	1496.78
10250.0	14.76	1561.17	1565.67
10500.0	15.12	1631.52	1636.02
10750.0	15.48	1703.32	1707.82
11000.0	15.84	1776.56	1781.06
11250.0	16.20	1851.25	1855.75
11500.0	16.56	1927.37	1931.87
11750.0	16.92	2004.93	2009.43
12000.0	17.28	2083.91	2088.41
12250.0	17.64	2164.32	2168.82
12500.0	18.00	2246.15	2250.65
12750.0	18.36	2329.40	2333.90
13000.0	18.72	2414.05	2418.55
13250.0	19.08	2500.12	2504.62
13500.0	19.44	2587.59	2592.09
13750.0	19.80	2676.45	2680.95
14000.0	20.16	2766.72	2771.22
14250.0	20.52	2858.38	2862.88
14500.0	20.88	2951.43	2955.93
14750.0	21.24	3045.86	3050.36
15000.0	21.60	3141.68	3146.18
15250.0	21.96	3238.88	3243.38
15500.0	22.32	3337.46	3341.96
15750.0	22.68	3437.41	3441.91
16000.0	23.04	3538.73	3543.23

MIN Static Head = 24.18
MAX Static Head = 28.68

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To E Modified High Point

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FM System Curve – 24"

Diameter = 24 in
Area = 3.141593 ft^2
RH=D/4= 0.5
C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To E Modified High Point

13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve – 24" (24" Parallel FM Portion)

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	316	100	0.0000	0.0000	3.8	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	316	100	0.0000	0.0034	3.8	0.002	0.0053
500.0	0.72	1.11	24.00	0.35	0.00	316	100	0.0000	0.0123	3.8	0.007	0.0198
750.0	1.08	1.67	24.00	0.53	0.00	316	100	0.0001	0.0261	3.8	0.017	0.0428
1000.0	1.44	2.23	24.00	0.71	0.01	316	100	0.0001	0.0445	3.8	0.030	0.0742
1250.0	1.80	2.79	24.00	0.89	0.01	316	100	0.0002	0.0673	3.8	0.046	0.1137
1500.0	2.16	3.34	24.00	1.06	0.02	316	100	0.0003	0.0943	3.8	0.067	0.1611
1750.0	2.52	3.90	24.00	1.24	0.02	316	100	0.0004	0.1255	3.8	0.091	0.2164
2000.0	2.88	4.46	24.00	1.42	0.03	316	100	0.0005	0.1607	3.8	0.119	0.2794
2250.0	3.24	5.01	24.00	1.60	0.04	316	100	0.0006	0.1999	3.8	0.150	0.3501
2500.0	3.60	5.57	24.00	1.77	0.05	316	100	0.0008	0.2429	3.8	0.186	0.4284
2750.0	3.96	6.13	24.00	1.95	0.06	316	100	0.0009	0.2898	3.8	0.224	0.5143
3000.0	4.32	6.68	24.00	2.13	0.07	316	100	0.0011	0.3405	3.8	0.267	0.6077
3250.0	4.68	7.24	24.00	2.31	0.08	316	100	0.0012	0.3949	3.8	0.314	0.7084
3500.0	5.04	7.80	24.00	2.48	0.10	316	100	0.0014	0.4530	3.8	0.364	0.8166
3750.0	5.40	8.36	24.00	2.66	0.11	316	100	0.0016	0.5148	3.8	0.417	0.9322
4000.0	5.76	8.91	24.00	2.84	0.12	316	100	0.0018	0.5801	3.8	0.475	1.0550
4250.0	6.12	9.47	24.00	3.01	0.14	316	100	0.0021	0.6491	3.8	0.536	1.1852
4500.0	6.48	10.03	24.00	3.19	0.16	316	100	0.0023	0.7215	3.8	0.601	1.3226
4750.0	6.84	10.58	24.00	3.37	0.18	316	100	0.0025	0.7975	3.8	0.670	1.4672
5000.0	7.20	11.14	24.00	3.55	0.20	316	100	0.0028	0.8770	3.8	0.742	1.6191
5250.0	7.56	11.70	24.00	3.72	0.22	316	100	0.0030	0.9599	3.8	0.818	1.7781
5500.0	7.92	12.25	24.00	3.90	0.24	316	100	0.0033	1.0463	3.8	0.898	1.9442
5750.0	8.28	12.81	24.00	4.08	0.26	316	100	0.0036	1.1361	3.8	0.981	2.1175
6000.0	8.64	13.37	24.00	4.26	0.28	316	100	0.0039	1.2293	3.8	1.069	2.2978
6250.0	9.00	13.93	24.00	4.43	0.31	316	100	0.0042	1.3258	3.8	1.159	2.4853
6500.0	9.36	14.48	24.00	4.61	0.33	316	100	0.0045	1.4257	3.8	1.254	2.6798
6750.0	9.72	15.04	24.00	4.79	0.36	316	100	0.0048	1.5289	3.8	1.352	2.8813
7000.0	10.08	15.60	24.00	4.96	0.38	316	100	0.0052	1.6354	3.8	1.454	3.0898
7250.0	10.44	16.15	24.00	5.14	0.41	316	100	0.0055	1.7452	3.8	1.560	3.3054
7500.0	10.80	16.71	24.00	5.32	0.44	316	100	0.0059	1.8583	3.8	1.670	3.5279
7750.0	11.16	17.27	24.00	5.50	0.47	316	100	0.0062	1.9747	3.8	1.783	3.7575
8000.0	11.52	17.83	24.00	5.67	0.50	316	100	0.0066	2.0943	3.8	1.900	3.9939
8250.0	11.88	18.38	24.00	5.85	0.53	316	100	0.0070	2.2171	3.8	2.020	4.2373
8500.0	12.24	18.94	24.00	6.03	0.56	316	100	0.0074	2.3431	3.8	2.145	4.4876
8750.0	12.60	19.50	24.00	6.21	0.60	316	100	0.0078	2.4723	3.8	2.273	4.7449
9000.0	12.96	20.05	24.00	6.38	0.63	316	100	0.0082	2.6048	3.8	2.404	5.0090
9250.0	13.32	20.61	24.00	6.56	0.67	316	100	0.0087	2.7403	3.8	2.540	5.2800
9500.0	13.68	21.17	24.00	6.74	0.70	316	100	0.0091	2.8791	3.8	2.679	5.5579
9750.0	14.04	21.72	24.00	6.92	0.74	316	100	0.0096	3.0210	3.8	2.822	5.8426
10000.0	14.40	22.28	24.00	7.09	0.78	316	100	0.0100	3.1660	3.8	2.968	6.1342
10250.0	14.76	22.84	24.00	7.27	0.82	316	100	0.0105	3.3141	3.8	3.118	6.4326
10500.0	15.12	23.40	24.00	7.45	0.86	316	100	0.0110	3.4654	3.8	3.272	6.7378

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To E Modified High Point

10750.0	15.48	23.95	24.00	7.62	0.90	316	100	0.0115	3.6197	3.8	3.430	7.0499
11000.0	15.84	24.51	24.00	7.80	0.95	316	100	0.0120	3.7772	3.8	3.592	7.3687
11250.0	16.20	25.07	24.00	7.98	0.99	316	100	0.0125	3.9377	3.8	3.757	7.6943
11500.0	16.56	25.62	24.00	8.16	1.03	316	100	0.0130	4.1013	3.8	3.925	8.0267
11750.0	16.92	26.18	24.00	8.33	1.08	316	100	0.0135	4.2680	3.8	4.098	8.3659
12000.0	17.28	26.74	24.00	8.51	1.12	316	100	0.0140	4.4377	3.8	4.274	8.7119
12250.0	17.64	27.30	24.00	8.69	1.17	316	100	0.0146	4.6104	3.8	4.454	9.0645
12500.0	18.00	27.85	24.00	8.87	1.22	316	100	0.0151	4.7862	3.8	4.638	9.4240
12750.0	18.36	28.41	24.00	9.04	1.27	316	100	0.0157	4.9650	3.8	4.825	9.7901
13000.0	18.72	28.97	24.00	9.22	1.32	316	100	0.0163	5.1468	3.8	5.016	10.1630
13250.0	19.08	29.52	24.00	9.40	1.37	316	100	0.0169	5.3316	3.8	5.211	10.5426
13500.0	19.44	30.08	24.00	9.57	1.42	316	100	0.0175	5.5194	3.8	5.410	10.9289
13750.0	19.80	30.64	24.00	9.75	1.48	316	100	0.0181	5.7101	3.8	5.612	11.3219
14000.0	20.16	31.19	24.00	9.93	1.53	316	100	0.0187	5.9039	3.8	5.818	11.7216
14250.0	20.52	31.75	24.00	10.11	1.59	316	100	0.0193	6.1006	3.8	6.027	12.1279
14500.0	20.88	32.31	24.00	10.28	1.64	316	100	0.0199	6.3003	3.8	6.241	12.5410
14750.0	21.24	32.87	24.00	10.46	1.70	316	100	0.0206	6.5030	3.8	6.458	12.9607
15000.0	21.60	33.42	24.00	10.64	1.76	316	100	0.0212	6.7086	3.8	6.678	13.3870
15250.0	21.96	33.98	24.00	10.82	1.82	316	100	0.0219	6.9171	3.8	6.903	13.8200
15500.0	22.32	34.54	24.00	10.99	1.88	316	100	0.0226	7.1286	3.8	7.131	14.2597
15750.0	22.68	35.09	24.00	11.17	1.94	316	100	0.0232	7.3430	3.8	7.363	14.7060
16000.0	23.04	35.65	24.00	11.35	2.00	316	100	0.0239	7.5603	3.8	7.599	15.1589

FM System Curve – 14" (14" Parallel FM Portion)

Diameter = 14 in

Area = 1.069014 ft^2

RH=D/4= 0.291667

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	14.00	0.00	0.00	68.50	100	0.0000	0.0000	1.72	0.000	0.0000
250.0	0.36	0.56	14.00	0.52	0.00	68.50	100	0.0001	0.0102	1.72	0.007	0.0175
500.0	0.72	1.11	14.00	1.04	0.02	68.50	100	0.0005	0.0369	1.72	0.029	0.0659
750.0	1.08	1.67	14.00	1.56	0.04	68.50	100	0.0011	0.0782	1.72	0.065	0.1435
1000.0	1.44	2.23	14.00	2.08	0.07	68.50	100	0.0019	0.1333	1.72	0.116	0.2493
1250.0	1.80	2.79	14.00	2.61	0.11	68.50	100	0.0029	0.2014	1.72	0.181	0.3827
1500.0	2.16	3.34	14.00	3.13	0.15	68.50	100	0.0041	0.2824	1.72	0.261	0.5434
1750.0	2.52	3.90	14.00	3.65	0.21	68.50	100	0.0055	0.3756	1.72	0.355	0.7310
2000.0	2.88	4.46	14.00	4.17	0.27	68.50	100	0.0070	0.4810	1.72	0.464	0.9452
2250.0	3.24	5.01	14.00	4.69	0.34	68.50	100	0.0087	0.5983	1.72	0.587	1.1857
2500.0	3.60	5.57	14.00	5.21	0.42	68.50	100	0.0106	0.7272	1.72	0.725	1.4524
2750.0	3.96	6.13	14.00	5.73	0.51	68.50	100	0.0127	0.8676	1.72	0.877	1.7451
3000.0	4.32	6.68	14.00	6.25	0.61	68.50	100	0.0149	1.0193	1.72	1.044	2.0636
3250.0	4.68	7.24	14.00	6.77	0.71	68.50	100	0.0173	1.1822	1.72	1.226	2.4077
3500.0	5.04	7.80	14.00	7.30	0.83	68.50	100	0.0198	1.3561	1.72	1.421	2.7775
3750.0	5.40	8.36	14.00	7.82	0.95	68.50	100	0.0225	1.5409	1.72	1.632	3.1726
4000.0	5.76	8.91	14.00	8.34	1.08	68.50	100	0.0254	1.7366	1.72	1.856	3.5930
4250.0	6.12	9.47	14.00	8.86	1.22	68.50	100	0.0284	1.9429	1.72	2.096	4.0387
4500.0	6.48	10.03	14.00	9.38	1.37	68.50	100	0.0315	2.1599	1.72	2.350	4.5095
4750.0	6.84	10.58	14.00	9.90	1.52	68.50	100	0.0349	2.3873	1.72	2.618	5.0053
5000.0	7.20	11.14	14.00	10.42	1.69	68.50	100	0.0383	2.6252	1.72	2.901	5.5260
5250.0	7.56	11.70	14.00	10.94	1.86	68.50	100	0.0419	2.8735	1.72	3.198	6.0716
5500.0	7.92	12.25	14.00	11.46	2.04	68.50	100	0.0457	3.1320	1.72	3.510	6.6420
5750.0	8.28	12.81	14.00	11.98	2.23	68.50	100	0.0496	3.4008	1.72	3.836	7.2370
6000.0	8.64	13.37	14.00	12.51	2.43	68.50	100	0.0537	3.6797	1.72	4.177	7.8568
6250.0	9.00	13.93	14.00	13.03	2.64	68.50	100	0.0579	3.9687	1.72	4.532	8.5011
6500.0	9.36	14.48	14.00	13.55	2.85	68.50	100	0.0623	4.2677	1.72	4.902	9.1699
6750.0	9.72	15.04	14.00	14.07	3.07	68.50	100	0.0668	4.5766	1.72	5.287	9.8633
7000.0	10.08	15.60	14.00	14.59	3.31	68.50	100	0.0715	4.8955	1.72	5.685	10.5810
7250.0	10.44	16.15	14.00	15.11	3.55	68.50	100	0.0763	5.2242	1.72	6.099	11.3231
7500.0	10.80	16.71	14.00	15.63	3.79	68.50	100	0.0812	5.5628	1.72	6.527	12.0894

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To E Modified High Point

7750.0	11.16	17.27	14.00	16.15	4.05	68.50	100	0.0863	5.9110	1.72	6.969	12.8801
8000.0	11.52	17.83	14.00	16.67	4.32	68.50	100	0.0915	6.2690	1.72	7.426	13.6949
8250.0	11.88	18.38	14.00	17.20	4.59	68.50	100	0.0969	6.6367	1.72	7.897	14.5339
8500.0	12.24	18.94	14.00	17.72	4.87	68.50	100	0.1024	7.0139	1.72	8.383	15.3971
8750.0	12.60	19.50	14.00	18.24	5.16	68.50	100	0.1080	7.4007	1.72	8.884	16.2843
9000.0	12.96	20.05	14.00	18.76	5.46	68.50	100	0.1138	7.7971	1.72	9.398	17.1955
9250.0	13.32	20.61	14.00	19.28	5.77	68.50	100	0.1198	8.2030	1.72	9.928	18.1308
9500.0	13.68	21.17	14.00	19.80	6.09	68.50	100	0.1258	8.6183	1.72	10.472	19.0900
9750.0	14.04	21.72	14.00	20.32	6.41	68.50	100	0.1320	9.0430	1.72	11.030	20.0731
10000.0	14.40	22.28	14.00	20.84	6.75	68.50	100	0.1384	9.4771	1.72	11.603	21.0801
10250.0	14.76	22.84	14.00	21.36	7.09	68.50	100	0.1448	9.9206	1.72	12.190	22.1110
10500.0	15.12	23.40	14.00	21.89	7.44	68.50	100	0.1514	10.3734	1.72	12.792	23.1657
10750.0	15.48	23.95	14.00	22.41	7.80	68.50	100	0.1582	10.8354	1.72	13.409	24.2441
11000.0	15.84	24.51	14.00	22.93	8.16	68.50	100	0.1651	11.3067	1.72	14.040	25.3463
11250.0	16.20	25.07	14.00	23.45	8.54	68.50	100	0.1721	11.7872	1.72	14.685	26.4722
11500.0	16.56	25.62	14.00	23.97	8.92	68.50	100	0.1792	12.2769	1.72	15.345	27.6219
11750.0	16.92	26.18	14.00	24.49	9.31	68.50	100	0.1865	12.7758	1.72	16.019	28.7951
12000.0	17.28	26.74	14.00	25.01	9.71	68.50	100	0.1939	13.2837	1.72	16.708	29.9920
12250.0	17.64	27.30	14.00	25.53	10.12	68.50	100	0.2015	13.8008	1.72	17.412	31.2126
12500.0	18.00	27.85	14.00	26.05	10.54	68.50	100	0.2092	14.3270	1.72	18.130	32.4566
12750.0	18.36	28.41	14.00	26.58	10.97	68.50	100	0.2170	14.8621	1.72	18.862	33.7243
13000.0	18.72	28.97	14.00	27.10	11.40	68.50	100	0.2249	15.4063	1.72	19.609	35.0154
13250.0	19.08	29.52	14.00	27.62	11.84	68.50	100	0.2330	15.9595	1.72	20.371	36.3300
13500.0	19.44	30.08	14.00	28.14	12.29	68.50	100	0.2412	16.5217	1.72	21.146	37.6682
13750.0	19.80	30.64	14.00	28.66	12.75	68.50	100	0.2495	17.0928	1.72	21.937	39.0297
14000.0	20.16	31.19	14.00	29.18	13.22	68.50	100	0.2580	17.6728	1.72	22.742	40.4147
14250.0	20.52	31.75	14.00	29.70	13.70	68.50	100	0.2666	18.2617	1.72	23.561	41.8230
14500.0	20.88	32.31	14.00	30.22	14.18	68.50	100	0.2753	18.8595	1.72	24.395	43.2548
14750.0	21.24	32.87	14.00	30.74	14.68	68.50	100	0.2842	19.4661	1.72	25.244	44.7099
15000.0	21.60	33.42	14.00	31.26	15.18	68.50	100	0.2932	20.0816	1.72	26.107	46.1883
15250.0	21.96	33.98	14.00	31.79	15.69	68.50	100	0.3023	20.7058	1.72	26.984	47.6900
15500.0	22.32	34.54	14.00	32.31	16.21	68.50	100	0.3115	21.3388	1.72	27.876	49.2150
15750.0	22.68	35.09	14.00	32.83	16.73	68.50	100	0.3209	21.9806	1.72	28.783	50.7633
16000.0	23.04	35.65	14.00	33.35	17.27	68.50	100	0.3304	22.6312	1.72	29.704	52.3348

FM System Curve – 13.5" (14" Parallel FM Portion)

Diameter = 13.5 in

Area = 0.99402 ft^2

RH=D/4= 0.28125

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	13.50	0.00	0.00	10640.5	120	0.0000	0.0000	3.1	0.000	0.0000
250.0	0.36	0.56	13.50	0.56	0.00	10640.5	120	0.0001	1.3528	3.1	0.015	1.3679
500.0	0.72	1.11	13.50	1.12	0.02	10640.5	120	0.0005	4.8835	3.1	0.060	4.9439
750.0	1.08	1.67	13.50	1.68	0.04	10640.5	120	0.0010	10.3478	3.1	0.136	10.4839
1000.0	1.44	2.23	13.50	2.24	0.08	10640.5	120	0.0017	17.6293	3.1	0.242	17.8711
1250.0	1.80	2.79	13.50	2.80	0.12	10640.5	120	0.0025	26.6509	3.1	0.378	27.0288
1500.0	2.16	3.34	13.50	3.36	0.18	10640.5	120	0.0035	37.3556	3.1	0.544	37.8998
1750.0	2.52	3.90	13.50	3.92	0.24	10640.5	120	0.0047	49.6982	3.1	0.741	50.4390
2000.0	2.88	4.46	13.50	4.48	0.31	10640.5	120	0.0060	63.6417	3.1	0.967	64.6092
2250.0	3.24	5.01	13.50	5.04	0.39	10640.5	120	0.0074	79.1547	3.1	1.224	80.3791
2500.0	3.60	5.57	13.50	5.60	0.49	10640.5	120	0.0090	96.2098	3.1	1.512	97.7215
2750.0	3.96	6.13	13.50	6.16	0.59	10640.5	120	0.0108	114.7833	3.1	1.829	116.6124
3000.0	4.32	6.68	13.50	6.72	0.70	10640.5	120	0.0127	134.8538	3.1	2.177	137.0306
3250.0	4.68	7.24	13.50	7.29	0.82	10640.5	120	0.0147	156.4021	3.1	2.555	158.9568
3500.0	5.04	7.80	13.50	7.85	0.96	10640.5	120	0.0169	179.4108	3.1	2.963	182.3737
3750.0	5.40	8.36	13.50	8.41	1.10	10640.5	120	0.0192	203.8640	3.1	3.401	207.2652
4000.0	5.76	8.91	13.50	8.97	1.25	10640.5	120	0.0216	229.7469	3.1	3.870	233.6168
4250.0	6.12	9.47	13.50	9.53	1.41	10640.5	120	0.0242	257.0460	3.1	4.369	261.4148
4500.0	6.48	10.03	13.50	10.09	1.58	10640.5	120	0.0269	285.7486	3.1	4.898	290.6465

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To E Modified High Point

4750.0	6.84	10.58	13.50	10.65	1.76	10640.5	120	0.0297	315.8429	3.1	5.457	321.3001
5000.0	7.20	11.14	13.50	11.21	1.95	10640.5	120	0.0326	347.3178	3.1	6.047	353.3645
5250.0	7.56	11.70	13.50	11.77	2.15	10640.5	120	0.0357	380.1628	3.1	6.667	386.8293
5500.0	7.92	12.25	13.50	12.33	2.36	10640.5	120	0.0389	414.3680	3.1	7.317	421.6846
5750.0	8.28	12.81	13.50	12.89	2.58	10640.5	120	0.0423	449.9242	3.1	7.997	457.9210
6000.0	8.64	13.37	13.50	13.45	2.81	10640.5	120	0.0458	486.8225	3.1	8.707	495.5298
6250.0	9.00	13.93	13.50	14.01	3.05	10640.5	120	0.0493	525.0544	3.1	9.448	534.5025
6500.0	9.36	14.48	13.50	14.57	3.30	10640.5	120	0.0531	564.6120	3.1	10.219	574.8309
6750.0	9.72	15.04	13.50	15.13	3.55	10640.5	120	0.0569	605.4874	3.1	11.020	616.5076
7000.0	10.08	15.60	13.50	15.69	3.82	10640.5	120	0.0609	647.6735	3.1	11.852	659.5251
7250.0	10.44	16.15	13.50	16.25	4.10	10640.5	120	0.0650	691.1631	3.1	12.713	703.8763
7500.0	10.80	16.71	13.50	16.81	4.39	10640.5	120	0.0692	735.9495	3.1	13.605	749.5546
7750.0	11.16	17.27	13.50	17.37	4.69	10640.5	120	0.0735	782.0262	3.1	14.527	796.5535
8000.0	11.52	17.83	13.50	17.93	4.99	10640.5	120	0.0779	829.3870	3.1	15.480	844.8666
8250.0	11.88	18.38	13.50	18.49	5.31	10640.5	120	0.0825	878.0258	3.1	16.462	894.4880
8500.0	12.24	18.94	13.50	19.05	5.64	10640.5	120	0.0872	927.9368	3.1	17.475	945.4118
8750.0	12.60	19.50	13.50	19.61	5.97	10640.5	120	0.0920	979.1145	3.1	18.518	997.6326
9000.0	12.96	20.05	13.50	20.17	6.32	10640.5	120	0.0969	1031.5533	3.1	19.591	1051.1447
9250.0	13.32	20.61	13.50	20.73	6.68	10640.5	120	0.1020	1085.2481	3.1	20.695	1105.9430
9500.0	13.68	21.17	13.50	21.29	7.04	10640.5	120	0.1072	1140.1938	3.1	21.829	1162.0225
9750.0	14.04	21.72	13.50	21.86	7.42	10640.5	120	0.1124	1196.3854	3.1	22.993	1219.3781
10000.0	14.40	22.28	13.50	22.42	7.80	10640.5	120	0.1178	1253.8181	3.1	24.187	1278.0050
10250.0	14.76	22.84	13.50	22.98	8.20	10640.5	120	0.1233	1312.4874	3.1	25.411	1337.8988
10500.0	15.12	23.40	13.50	23.54	8.60	10640.5	120	0.1290	1372.3887	3.1	26.666	1399.0548
10750.0	15.48	23.95	13.50	24.10	9.02	10640.5	120	0.1347	1433.5176	3.1	27.951	1461.4686
11000.0	15.84	24.51	13.50	24.66	9.44	10640.5	120	0.1406	1495.8698	3.1	29.266	1525.1360
11250.0	16.20	25.07	13.50	25.22	9.87	10640.5	120	0.1466	1559.4413	3.1	30.612	1590.0528
11500.0	16.56	25.62	13.50	25.78	10.32	10640.5	120	0.1526	1624.2278	3.1	31.987	1656.2150
11750.0	16.92	26.18	13.50	26.34	10.77	10640.5	120	0.1588	1690.2256	3.1	33.393	1723.6187
12000.0	17.28	26.74	13.50	26.90	11.24	10640.5	120	0.1652	1757.4307	3.1	34.829	1792.2599
12250.0	17.64	27.30	13.50	27.46	11.71	10640.5	120	0.1716	1825.8394	3.1	36.295	1862.1349
12500.0	18.00	27.85	13.50	28.02	12.19	10640.5	120	0.1781	1895.4481	3.1	37.792	1933.2401
12750.0	18.36	28.41	13.50	28.58	12.68	10640.5	120	0.1848	1966.2531	3.1	39.319	2005.5719
13000.0	18.72	28.97	13.50	29.14	13.19	10640.5	120	0.1916	2038.2509	3.1	40.876	2079.1267
13250.0	19.08	29.52	13.50	29.70	13.70	10640.5	120	0.1984	2111.4381	3.1	42.463	2153.9012
13500.0	19.44	30.08	13.50	30.26	14.22	10640.5	120	0.2054	2185.8114	3.1	44.081	2229.8920
13750.0	19.80	30.64	13.50	30.82	14.75	10640.5	120	0.2125	2261.3675	3.1	45.728	2307.0959
14000.0	20.16	31.19	13.50	31.38	15.29	10640.5	120	0.2197	2338.1032	3.1	47.406	2385.5095
14250.0	20.52	31.75	13.50	31.94	15.84	10640.5	120	0.2271	2416.0153	3.1	49.115	2465.1298
14500.0	20.88	32.31	13.50	32.50	16.40	10640.5	120	0.2345	2495.1008	3.1	50.853	2545.9537
14750.0	21.24	32.87	13.50	33.06	16.97	10640.5	120	0.2420	2575.3566	3.1	52.622	2627.9782
15000.0	21.60	33.42	13.50	33.62	17.56	10640.5	120	0.2497	2656.7798	3.1	54.421	2711.2003
15250.0	21.96	33.98	13.50	34.18	18.15	10640.5	120	0.2574	2739.3675	3.1	56.250	2795.6172
15500.0	22.32	34.54	13.50	34.74	18.74	10640.5	120	0.2653	2823.1168	3.1	58.109	2881.2259
15750.0	22.68	35.09	13.50	35.30	19.35	10640.5	120	0.2733	2908.0250	3.1	59.999	2968.0237
16000.0	23.04	35.65	13.50	35.87	19.97	10640.5	120	0.2814	2994.0893	3.1	61.918	3056.0078

FM System Curve – 23.85" (28" Parallel FM Portion)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.456875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	619.99	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	619.99	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	619.99	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	619.99	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	619.99	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	619.99	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	619.99	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	619.99	120	0.0003	0.1811	2.7	0.066	0.2473

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To E Modified High Point

2000.0	2.88	4.46	23.85	1.44	0.03	619.99	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	619.99	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	619.99	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	619.99	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	619.99	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	619.99	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	619.99	120	0.0011	0.6538	2.7	0.265	0.9187
3750.0	5.40	8.36	23.85	2.69	0.11	619.99	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	619.99	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	619.99	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	619.99	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	619.99	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	619.99	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	619.99	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	619.99	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	619.99	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	619.99	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	619.99	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	619.99	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	619.99	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	619.99	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	619.99	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	619.99	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	619.99	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	619.99	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	619.99	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	619.99	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	619.99	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	619.99	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	619.99	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	619.99	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	619.99	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	619.99	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	619.99	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	619.99	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	619.99	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	619.99	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	619.99	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	619.99	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	619.99	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	619.99	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	619.99	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	619.99	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	619.99	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	619.99	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	619.99	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	619.99	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	619.99	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	619.99	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	619.99	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	619.99	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	619.99	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	619.99	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	619.99	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	619.99	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	619.99	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	619.99	120	0.0176	10.9108	2.7	5.536	16.4469

FM System Curve – 25.14" (28" DIP))

Diameter =	25.14	in
Area =	3.4471	ft^2
RH=D/4=	0.5238	
C=	100	

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To E Modified High Point

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.14	0.00	0.00	625	100	0.0000	0.0000	0.6	0.000	0.0000
250.0	0.36	0.56	25.14	0.16	0.00	625	100	0.0000	0.0054	0.6	0.000	0.0056
500.0	0.72	1.11	25.14	0.32	0.00	625	100	0.0000	0.0195	0.6	0.001	0.0204
750.0	1.08	1.67	25.14	0.48	0.00	625	100	0.0001	0.0412	0.6	0.002	0.0434
1000.0	1.44	2.23	25.14	0.65	0.01	625	100	0.0001	0.0702	0.6	0.004	0.0741
1250.0	1.80	2.79	25.14	0.81	0.01	625	100	0.0002	0.1062	0.6	0.006	0.1123
1500.0	2.16	3.34	25.14	0.97	0.01	625	100	0.0002	0.1488	0.6	0.009	0.1576
1750.0	2.52	3.90	25.14	1.13	0.02	625	100	0.0003	0.1980	0.6	0.012	0.2099
2000.0	2.88	4.46	25.14	1.29	0.03	625	100	0.0004	0.2535	0.6	0.016	0.2691
2250.0	3.24	5.01	25.14	1.45	0.03	625	100	0.0005	0.3153	0.6	0.020	0.3350
2500.0	3.60	5.57	25.14	1.62	0.04	625	100	0.0006	0.3833	0.6	0.024	0.4076
2750.0	3.96	6.13	25.14	1.78	0.05	625	100	0.0007	0.4573	0.6	0.029	0.4867
3000.0	4.32	6.68	25.14	1.94	0.06	625	100	0.0009	0.5372	0.6	0.035	0.5723
3250.0	4.68	7.24	25.14	2.10	0.07	625	100	0.0010	0.6231	0.6	0.041	0.6642
3500.0	5.04	7.80	25.14	2.26	0.08	625	100	0.0011	0.7147	0.6	0.048	0.7624
3750.0	5.40	8.36	25.14	2.42	0.09	625	100	0.0013	0.8122	0.6	0.055	0.8669
4000.0	5.76	8.91	25.14	2.59	0.10	625	100	0.0015	0.9153	0.6	0.062	0.9776
4250.0	6.12	9.47	25.14	2.75	0.12	625	100	0.0016	1.0240	0.6	0.070	1.0943
4500.0	6.48	10.03	25.14	2.91	0.13	625	100	0.0018	1.1384	0.6	0.079	1.2172
4750.0	6.84	10.58	25.14	3.07	0.15	625	100	0.0020	1.2583	0.6	0.088	1.3461
5000.0	7.20	11.14	25.14	3.23	0.16	625	100	0.0022	1.3837	0.6	0.097	1.4810
5250.0	7.56	11.70	25.14	3.39	0.18	625	100	0.0024	1.5145	0.6	0.107	1.6218
5500.0	7.92	12.25	25.14	3.56	0.20	625	100	0.0026	1.6508	0.6	0.118	1.7685
5750.0	8.28	12.81	25.14	3.72	0.21	625	100	0.0029	1.7924	0.6	0.129	1.9211
6000.0	8.64	13.37	25.14	3.88	0.23	625	100	0.0031	1.9394	0.6	0.140	2.0796
6250.0	9.00	13.93	25.14	4.04	0.25	625	100	0.0033	2.0917	0.6	0.152	2.2438
6500.0	9.36	14.48	25.14	4.20	0.27	625	100	0.0036	2.2493	0.6	0.164	2.4138
6750.0	9.72	15.04	25.14	4.36	0.30	625	100	0.0039	2.4122	0.6	0.177	2.5895
7000.0	10.08	15.60	25.14	4.52	0.32	625	100	0.0041	2.5802	0.6	0.191	2.7710
7250.0	10.44	16.15	25.14	4.69	0.34	625	100	0.0044	2.7535	0.6	0.205	2.9581
7500.0	10.80	16.71	25.14	4.85	0.36	625	100	0.0047	2.9319	0.6	0.219	3.1509
7750.0	11.16	17.27	25.14	5.01	0.39	625	100	0.0050	3.1155	0.6	0.234	3.3493
8000.0	11.52	17.83	25.14	5.17	0.42	625	100	0.0053	3.3042	0.6	0.249	3.5533
8250.0	11.88	18.38	25.14	5.33	0.44	625	100	0.0056	3.4979	0.6	0.265	3.7629
8500.0	12.24	18.94	25.14	5.49	0.47	625	100	0.0059	3.6968	0.6	0.281	3.9780
8750.0	12.60	19.50	25.14	5.66	0.50	625	100	0.0062	3.9006	0.6	0.298	4.1987
9000.0	12.96	20.05	25.14	5.82	0.53	625	100	0.0066	4.1096	0.6	0.315	4.4249
9250.0	13.32	20.61	25.14	5.98	0.56	625	100	0.0069	4.3235	0.6	0.333	4.6565
9500.0	13.68	21.17	25.14	6.14	0.59	625	100	0.0073	4.5424	0.6	0.351	4.8937
9750.0	14.04	21.72	25.14	6.30	0.62	625	100	0.0076	4.7662	0.6	0.370	5.1363
10000.0	14.40	22.28	25.14	6.46	0.65	625	100	0.0080	4.9950	0.6	0.389	5.3843
10250.0	14.76	22.84	25.14	6.63	0.68	625	100	0.0084	5.2288	0.6	0.409	5.6377
10500.0	15.12	23.40	25.14	6.79	0.72	625	100	0.0087	5.4674	0.6	0.429	5.8966
10750.0	15.48	23.95	25.14	6.95	0.75	625	100	0.0091	5.7109	0.6	0.450	6.1608
11000.0	15.84	24.51	25.14	7.11	0.79	625	100	0.0095	5.9593	0.6	0.471	6.4303
11250.0	16.20	25.07	25.14	7.27	0.82	625	100	0.0099	6.2126	0.6	0.493	6.7052
11500.0	16.56	25.62	25.14	7.43	0.86	625	100	0.0104	6.4707	0.6	0.515	6.9855
11750.0	16.92	26.18	25.14	7.59	0.90	625	100	0.0108	6.7336	0.6	0.537	7.2710
12000.0	17.28	26.74	25.14	7.76	0.93	625	100	0.0112	7.0013	0.6	0.561	7.5619
12250.0	17.64	27.30	25.14	7.92	0.97	625	100	0.0116	7.2739	0.6	0.584	7.8580
12500.0	18.00	27.85	25.14	8.08	1.01	625	100	0.0121	7.5512	0.6	0.608	8.1594
12750.0	18.36	28.41	25.14	8.24	1.05	625	100	0.0125	7.8333	0.6	0.633	8.4661
13000.0	18.72	28.97	25.14	8.40	1.10	625	100	0.0130	8.1201	0.6	0.658	8.7779
13250.0	19.08	29.52	25.14	8.56	1.14	625	100	0.0135	8.4117	0.6	0.683	9.0951
13500.0	19.44	30.08	25.14	8.73	1.18	625	100	0.0139	8.7079	0.6	0.709	9.4174
13750.0	19.80	30.64	25.14	8.89	1.23	625	100	0.0144	9.0089	0.6	0.736	9.7449
14000.0	20.16	31.19	25.14	9.05	1.27	625	100	0.0149	9.3147	0.6	0.763	10.0776
14250.0	20.52	31.75	25.14	9.21	1.32	625	100	0.0154	9.6250	0.6	0.790	10.4155
14500.0	20.88	32.31	25.14	9.37	1.36	625	100	0.0159	9.9401	0.6	0.818	10.7585
14750.0	21.24	32.87	25.14	9.53	1.41	625	100	0.0164	10.2598	0.6	0.847	11.1067
15000.0	21.60	33.42	25.14	9.70	1.46	625	100	0.0169	10.5842	0.6	0.876	11.4601
15250.0	21.96	33.98	25.14	9.86	1.51	625	100	0.0175	10.9132	0.6	0.905	11.8185

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To E Modified High Point

15500.0	22.32	34.54	25.14	10.02	1.56	625	100	0.0180	11.2469	0.6	0.935	12.1821
15750.0	22.68	35.09	25.14	10.18	1.61	625	100	0.0185	11.5851	0.6	0.966	12.5508
16000.0	23.04	35.65	25.14	10.34	1.66	625	100	0.0191	11.9280	0.6	0.997	12.9245

FM System Curve – 25.3" (30" HDPE)

Diameter = 25.3 in
Area = 3.4911 ft^2
RH=D/4= 0.5271
C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.30	0.00	0.00	2455	120	0.0000	0.0000	2.75	0.000	0.0000
250.0	0.36	0.56	25.30	0.16	0.00	2455	120	0.0000	0.0146	2.75	0.001	0.0157
500.0	0.72	1.11	25.30	0.32	0.00	2455	120	0.0000	0.0529	2.75	0.004	0.0572
750.0	1.08	1.67	25.30	0.48	0.00	2455	120	0.0000	0.1120	2.75	0.010	0.1218
1000.0	1.44	2.23	25.30	0.64	0.01	2455	120	0.0001	0.1908	2.75	0.017	0.2082
1250.0	1.80	2.79	25.30	0.80	0.01	2455	120	0.0001	0.2885	2.75	0.027	0.3157
1500.0	2.16	3.34	25.30	0.96	0.01	2455	120	0.0002	0.4044	2.75	0.039	0.4435
1750.0	2.52	3.90	25.30	1.12	0.02	2455	120	0.0002	0.5380	2.75	0.053	0.5912
2000.0	2.88	4.46	25.30	1.28	0.03	2455	120	0.0003	0.6889	2.75	0.070	0.7585
2250.0	3.24	5.01	25.30	1.44	0.03	2455	120	0.0003	0.8568	2.75	0.088	0.9449
2500.0	3.60	5.57	25.30	1.60	0.04	2455	120	0.0004	1.0414	2.75	0.109	1.1501
2750.0	3.96	6.13	25.30	1.76	0.05	2455	120	0.0005	1.2425	2.75	0.132	1.3740
3000.0	4.32	6.68	25.30	1.91	0.06	2455	120	0.0006	1.4597	2.75	0.157	1.6163
3250.0	4.68	7.24	25.30	2.07	0.07	2455	120	0.0007	1.6930	2.75	0.184	1.8767
3500.0	5.04	7.80	25.30	2.23	0.08	2455	120	0.0008	1.9420	2.75	0.213	2.1551
3750.0	5.40	8.36	25.30	2.39	0.09	2455	120	0.0009	2.2067	2.75	0.245	2.4513
4000.0	5.76	8.91	25.30	2.55	0.10	2455	120	0.0010	2.4869	2.75	0.278	2.7652
4250.0	6.12	9.47	25.30	2.71	0.11	2455	120	0.0011	2.7824	2.75	0.314	3.0966
4500.0	6.48	10.03	25.30	2.87	0.13	2455	120	0.0013	3.0931	2.75	0.352	3.4453
4750.0	6.84	10.58	25.30	3.03	0.14	2455	120	0.0014	3.4189	2.75	0.392	3.8113
5000.0	7.20	11.14	25.30	3.19	0.16	2455	120	0.0015	3.7596	2.75	0.435	4.1944
5250.0	7.56	11.70	25.30	3.35	0.17	2455	120	0.0017	4.1151	2.75	0.479	4.5945
5500.0	7.92	12.25	25.30	3.51	0.19	2455	120	0.0018	4.4854	2.75	0.526	5.0115
5750.0	8.28	12.81	25.30	3.67	0.21	2455	120	0.0020	4.8702	2.75	0.575	5.4453
6000.0	8.64	13.37	25.30	3.83	0.23	2455	120	0.0021	5.2696	2.75	0.626	5.8958
6250.0	9.00	13.93	25.30	3.99	0.25	2455	120	0.0023	5.6835	2.75	0.679	6.3629
6500.0	9.36	14.48	25.30	4.15	0.27	2455	120	0.0025	6.1117	2.75	0.735	6.8466
6750.0	9.72	15.04	25.30	4.31	0.29	2455	120	0.0027	6.5541	2.75	0.793	7.3467
7000.0	10.08	15.60	25.30	4.47	0.31	2455	120	0.0029	7.0108	2.75	0.852	7.8631
7250.0	10.44	16.15	25.30	4.63	0.33	2455	120	0.0030	7.4815	2.75	0.914	8.3958
7500.0	10.80	16.71	25.30	4.79	0.36	2455	120	0.0032	7.9663	2.75	0.978	8.9448
7750.0	11.16	17.27	25.30	4.95	0.38	2455	120	0.0034	8.4651	2.75	1.045	9.5098
8000.0	11.52	17.83	25.30	5.11	0.40	2455	120	0.0037	8.9778	2.75	1.113	10.0910
8250.0	11.88	18.38	25.30	5.27	0.43	2455	120	0.0039	9.5043	2.75	1.184	10.6881
8500.0	12.24	18.94	25.30	5.42	0.46	2455	120	0.0041	10.0445	2.75	1.257	11.3012
8750.0	12.60	19.50	25.30	5.58	0.48	2455	120	0.0043	10.5985	2.75	1.332	11.9302
9000.0	12.96	20.05	25.30	5.74	0.51	2455	120	0.0045	11.1661	2.75	1.409	12.5751
9250.0	13.32	20.61	25.30	5.90	0.54	2455	120	0.0048	11.7473	2.75	1.488	13.2356
9500.0	13.68	21.17	25.30	6.06	0.57	2455	120	0.0050	12.3421	2.75	1.570	13.9119
9750.0	14.04	21.72	25.30	6.22	0.60	2455	120	0.0053	12.9504	2.75	1.654	14.6039
10000.0	14.40	22.28	25.30	6.38	0.63	2455	120	0.0055	13.5720	2.75	1.739	15.3115
10250.0	14.76	22.84	25.30	6.54	0.66	2455	120	0.0058	14.2071	2.75	1.827	16.0346
10500.0	15.12	23.40	25.30	6.70	0.70	2455	120	0.0061	14.8555	2.75	1.918	16.7732
10750.0	15.48	23.95	25.30	6.86	0.73	2455	120	0.0063	15.5172	2.75	2.010	17.5273
11000.0	15.84	24.51	25.30	7.02	0.77	2455	120	0.0066	16.1921	2.75	2.105	18.2968
11250.0	16.20	25.07	25.30	7.18	0.80	2455	120	0.0069	16.8803	2.75	2.201	19.0817
11500.0	16.56	25.62	25.30	7.34	0.84	2455	120	0.0072	17.5816	2.75	2.300	19.8819
11750.0	16.92	26.18	25.30	7.50	0.87	2455	120	0.0075	18.2960	2.75	2.401	20.6975
12000.0	17.28	26.74	25.30	7.66	0.91	2455	120	0.0077	19.0234	2.75	2.505	21.5282

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To E Modified High Point

12250.0	17.64	27.30	25.30	7.82	0.95	2455	120	0.0081	19.7639	2.75	2.610	22.3741
12500.0	18.00	27.85	25.30	7.98	0.99	2455	120	0.0084	20.5174	2.75	2.718	23.2353
12750.0	18.36	28.41	25.30	8.14	1.03	2455	120	0.0087	21.2838	2.75	2.828	24.1115
13000.0	18.72	28.97	25.30	8.30	1.07	2455	120	0.0090	22.0632	2.75	2.940	25.0028
13250.0	19.08	29.52	25.30	8.46	1.11	2455	120	0.0093	22.8554	2.75	3.054	25.9092
13500.0	19.44	30.08	25.30	8.62	1.15	2455	120	0.0096	23.6605	2.75	3.170	26.8306
13750.0	19.80	30.64	25.30	8.78	1.20	2455	120	0.0100	24.4783	2.75	3.289	27.7669
14000.0	20.16	31.19	25.30	8.94	1.24	2455	120	0.0103	25.3090	2.75	3.409	28.7182
14250.0	20.52	31.75	25.30	9.09	1.28	2455	120	0.0107	26.1523	2.75	3.532	29.6844
14500.0	20.88	32.31	25.30	9.25	1.33	2455	120	0.0110	27.0084	2.75	3.657	30.6655
14750.0	21.24	32.87	25.30	9.41	1.38	2455	120	0.0114	27.8771	2.75	3.784	31.6615
15000.0	21.60	33.42	25.30	9.57	1.42	2455	120	0.0117	28.7585	2.75	3.914	32.6722
15250.0	21.96	33.98	25.30	9.73	1.47	2455	120	0.0121	29.6525	2.75	4.045	33.6977
15500.0	22.32	34.54	25.30	9.89	1.52	2455	120	0.0124	30.5590	2.75	4.179	34.7380
15750.0	22.68	35.09	25.30	10.05	1.57	2455	120	0.0128	31.4781	2.75	4.315	35.7930
16000.0	23.04	35.65	25.30	10.21	1.62	2455	120	0.0132	32.4097	2.75	4.453	36.8626

FM System Curve – 24”

Diameter =	24	in
Area =	3.1416	ft^2
RH=D/4=	0.5	
C=	100	

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	14931	100	0.0000	0.0000	11.94	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	14931	100	0.0000	0.1614	11.94	0.006	0.1672
500.0	0.72	1.11	24.00	0.35	0.00	14931	100	0.0000	0.5826	11.94	0.023	0.6060
750.0	1.08	1.67	24.00	0.53	0.00	14931	100	0.0001	1.2346	11.94	0.052	1.2871
1000.0	1.44	2.23	24.00	0.71	0.01	14931	100	0.0001	2.1034	11.94	0.093	2.1966
1250.0	1.80	2.79	24.00	0.89	0.01	14931	100	0.0002	3.1797	11.94	0.146	3.3254
1500.0	2.16	3.34	24.00	1.06	0.02	14931	100	0.0003	4.4569	11.94	0.210	4.6667
1750.0	2.52	3.90	24.00	1.24	0.02	14931	100	0.0004	5.9295	11.94	0.286	6.2151
2000.0	2.88	4.46	24.00	1.42	0.03	14931	100	0.0005	7.5931	11.94	0.373	7.9662
2250.0	3.24	5.01	24.00	1.60	0.04	14931	100	0.0006	9.4440	11.94	0.472	9.9161
2500.0	3.60	5.57	24.00	1.77	0.05	14931	100	0.0008	11.4788	11.94	0.583	12.0617
2750.0	3.96	6.13	24.00	1.95	0.06	14931	100	0.0009	13.6948	11.94	0.705	14.4001
3000.0	4.32	6.68	24.00	2.13	0.07	14931	100	0.0011	16.0894	11.94	0.839	16.9288
3250.0	4.68	7.24	24.00	2.31	0.08	14931	100	0.0012	18.6604	11.94	0.985	19.6455
3500.0	5.04	7.80	24.00	2.48	0.10	14931	100	0.0014	21.4055	11.94	1.142	22.5480
3750.0	5.40	8.36	24.00	2.66	0.11	14931	100	0.0016	24.3230	11.94	1.312	25.6346
4000.0	5.76	8.91	24.00	2.84	0.12	14931	100	0.0018	27.4111	11.94	1.492	28.9034
4250.0	6.12	9.47	24.00	3.01	0.14	14931	100	0.0021	30.6682	11.94	1.685	32.3528
4500.0	6.48	10.03	24.00	3.19	0.16	14931	100	0.0023	34.0927	11.94	1.889	35.9813
4750.0	6.84	10.58	24.00	3.37	0.18	14931	100	0.0025	37.6833	11.94	2.104	39.7875
5000.0	7.20	11.14	24.00	3.55	0.20	14931	100	0.0028	41.4385	11.94	2.332	43.7701
5250.0	7.56	11.70	24.00	3.72	0.22	14931	100	0.0030	45.3573	11.94	2.571	47.9279
5500.0	7.92	12.25	24.00	3.90	0.24	14931	100	0.0033	49.4383	11.94	2.821	52.2595
5750.0	8.28	12.81	24.00	4.08	0.26	14931	100	0.0036	53.6805	11.94	3.084	56.7641
6000.0	8.64	13.37	24.00	4.26	0.28	14931	100	0.0039	58.0829	11.94	3.357	61.4404
6250.0	9.00	13.93	24.00	4.43	0.31	14931	100	0.0042	62.6443	11.94	3.643	66.2874
6500.0	9.36	14.48	24.00	4.61	0.33	14931	100	0.0045	67.3639	11.94	3.940	71.3043
6750.0	9.72	15.04	24.00	4.79	0.36	14931	100	0.0048	72.2408	11.94	4.249	76.4901
7000.0	10.08	15.60	24.00	4.96	0.38	14931	100	0.0052	77.2740	11.94	4.570	81.8439
7250.0	10.44	16.15	24.00	5.14	0.41	14931	100	0.0055	82.4628	11.94	4.902	87.3649
7500.0	10.80	16.71	24.00	5.32	0.44	14931	100	0.0059	87.8062	11.94	5.246	93.0523
7750.0	11.16	17.27	24.00	5.50	0.47	14931	100	0.0062	93.3036	11.94	5.602	98.9053
8000.0	11.52	17.83	24.00	5.67	0.50	14931	100	0.0066	98.9543	11.94	5.969	104.9231
8250.0	11.88	18.38	24.00	5.85	0.53	14931	100	0.0070	104.7574	11.94	6.348	111.1051
8500.0	12.24	18.94	24.00	6.03	0.56	14931	100	0.0074	110.7123	11.94	6.738	117.4506
8750.0	12.60	19.50	24.00	6.21	0.60	14931	100	0.0078	116.8183	11.94	7.141	123.9588

Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To E Modified High Point

9000.0	12.96	20.05	24.00	6.38	0.63	14931	100	0.0082	123.0748	11.94	7.554	130.6291
9250.0	13.32	20.61	24.00	6.56	0.67	14931	100	0.0087	129.4811	11.94	7.980	137.4610
9500.0	13.68	21.17	24.00	6.74	0.70	14931	100	0.0091	136.0367	11.94	8.417	144.4537
9750.0	14.04	21.72	24.00	6.92	0.74	14931	100	0.0096	142.7409	11.94	8.866	151.6068
10000.0	14.40	22.28	24.00	7.09	0.78	14931	100	0.0100	149.5932	11.94	9.326	158.9196
10250.0	14.76	22.84	24.00	7.27	0.82	14931	100	0.0105	156.5930	11.94	9.799	166.3916
10500.0	15.12	23.40	24.00	7.45	0.86	14931	100	0.0110	163.7399	11.94	10.282	174.0222
10750.0	15.48	23.95	24.00	7.62	0.90	14931	100	0.0115	171.0332	11.94	10.778	181.8110
11000.0	15.84	24.51	24.00	7.80	0.95	14931	100	0.0120	178.4724	11.94	11.285	189.7573
11250.0	16.20	25.07	24.00	7.98	0.99	14931	100	0.0125	186.0571	11.94	11.804	197.8608
11500.0	16.56	25.62	24.00	8.16	1.03	14931	100	0.0130	193.7868	11.94	12.334	206.1210
11750.0	16.92	26.18	24.00	8.33	1.08	14931	100	0.0135	201.6610	11.94	12.876	214.5373
12000.0	17.28	26.74	24.00	8.51	1.12	14931	100	0.0140	209.6793	11.94	13.430	223.1093
12250.0	17.64	27.30	24.00	8.69	1.17	14931	100	0.0146	217.8411	11.94	13.995	231.8365
12500.0	18.00	27.85	24.00	8.87	1.22	14931	100	0.0151	226.1462	11.94	14.572	240.7186
12750.0	18.36	28.41	24.00	9.04	1.27	14931	100	0.0157	234.5939	11.94	15.161	249.7551
13000.0	18.72	28.97	24.00	9.22	1.32	14931	100	0.0163	243.1840	11.94	15.762	258.9456
13250.0	19.08	29.52	24.00	9.40	1.37	14931	100	0.0169	251.9160	11.94	16.374	268.2896
13500.0	19.44	30.08	24.00	9.57	1.42	14931	100	0.0175	260.7894	11.94	16.997	277.7868
13750.0	19.80	30.64	24.00	9.75	1.48	14931	100	0.0181	269.8041	11.94	17.633	287.4367
14000.0	20.16	31.19	24.00	9.93	1.53	14931	100	0.0187	278.9594	11.94	18.280	297.2391
14250.0	20.52	31.75	24.00	10.11	1.59	14931	100	0.0193	288.2551	11.94	18.938	307.1935
14500.0	20.88	32.31	24.00	10.28	1.64	14931	100	0.0199	297.6908	11.94	19.609	317.2995
14750.0	21.24	32.87	24.00	10.46	1.70	14931	100	0.0206	307.2661	11.94	20.291	327.5568
15000.0	21.60	33.42	24.00	10.64	1.76	14931	100	0.0212	316.9807	11.94	20.984	337.9651
15250.0	21.96	33.98	24.00	10.82	1.82	14931	100	0.0219	326.8343	11.94	21.690	348.5240
15500.0	22.32	34.54	24.00	10.99	1.88	14931	100	0.0226	336.8264	11.94	22.407	359.2331
15750.0	22.68	35.09	24.00	11.17	1.94	14931	100	0.0232	346.9569	11.94	23.135	370.0921
16000.0	23.04	35.65	24.00	11.35	2.00	14931	100	0.0239	357.2252	11.94	23.876	381.1007

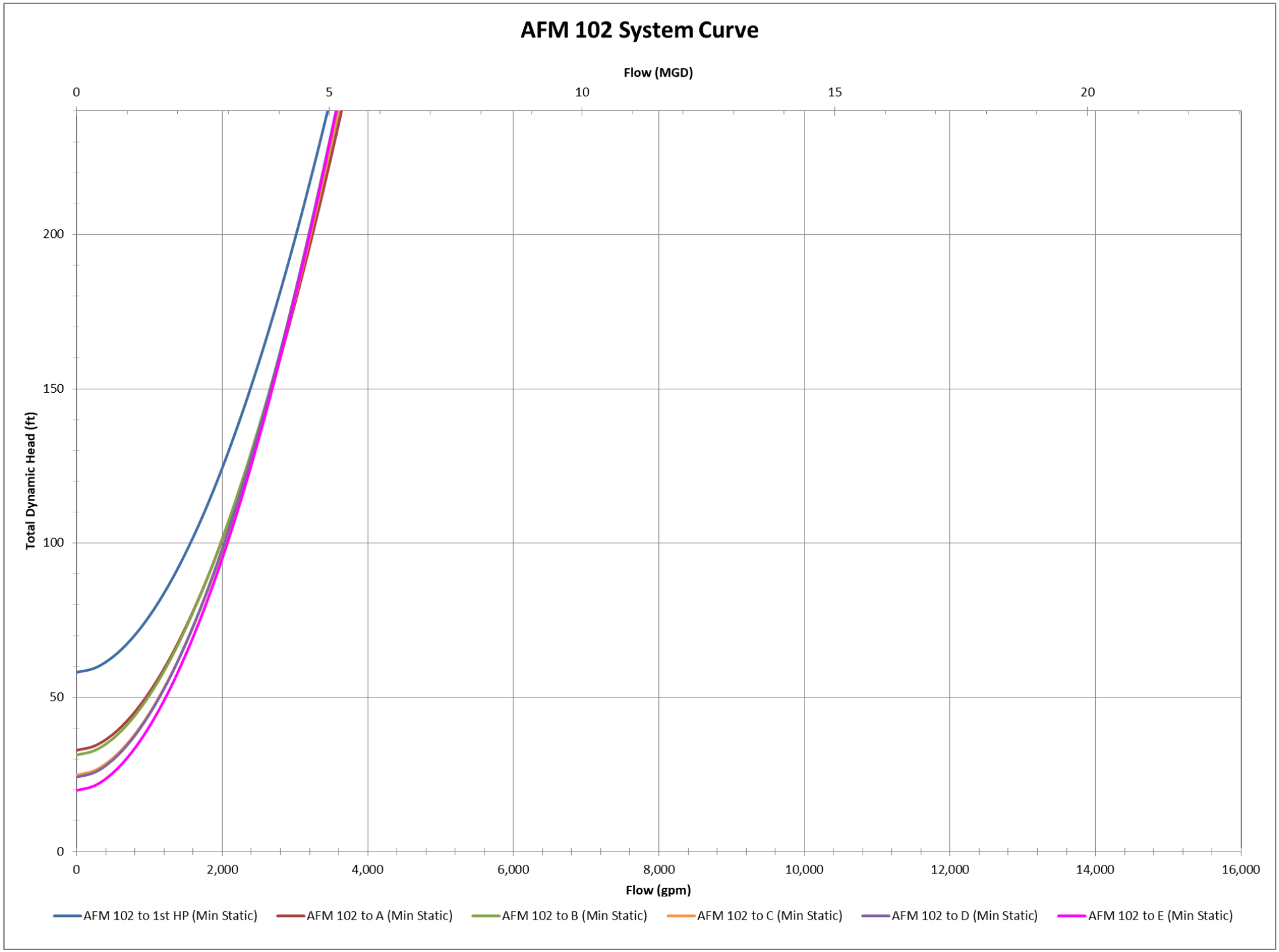
Bridgehead Pump Station with AFM102

AFM 102 (14-inch Parallel Forcemain Portion Only) – To E Modified High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	1.59
500.0	0.72	5.74
750.0	1.08	12.19
1000.0	1.44	20.78
1250.0	1.80	31.44
1500.0	2.16	44.11
1750.0	2.52	58.72
2000.0	2.88	75.23
2250.0	3.24	93.62
2500.0	3.60	113.84
2750.0	3.96	135.88
3000.0	4.32	159.70
3250.0	4.68	185.28
3500.0	5.04	212.61
3750.0	5.40	241.67
4000.0	5.76	272.43
4250.0	6.12	304.89
4500.0	6.48	339.03
4750.0	6.84	374.83
5000.0	7.20	412.28
5250.0	7.56	451.38
5500.0	7.92	492.10
5750.0	8.28	534.45
6000.0	8.64	578.40
6250.0	9.00	623.95
6500.0	9.36	671.09
6750.0	9.72	719.81
7000.0	10.08	770.10
7250.0	10.44	821.96
7500.0	10.80	875.37
7750.0	11.16	930.33
8000.0	11.52	986.84
8250.0	11.88	1044.87
8500.0	12.24	1104.44
8750.0	12.60	1165.53
9000.0	12.96	1228.13
9250.0	13.32	1292.25
9500.0	13.68	1357.86
9750.0	14.04	1424.98
10000.0	14.40	1493.59
10250.0	14.76	1563.68
10500.0	15.12	1635.26
10750.0	15.48	1708.31
11000.0	15.84	1782.84
11250.0	16.20	1858.83
11500.0	16.56	1936.29
11750.0	16.92	2015.20
12000.0	17.28	2095.57
12250.0	17.64	2177.39
12500.0	18.00	2260.65
12750.0	18.36	2345.35
13000.0	18.72	2431.49
13250.0	19.08	2519.07
13500.0	19.44	2608.07
13750.0	19.80	2698.50
14000.0	20.16	2790.35
14250.0	20.52	2883.61
14500.0	20.88	2978.30
14750.0	21.24	3074.39
15000.0	21.60	3171.89
15250.0	21.96	3270.80
15500.0	22.32	3371.11
15750.0	22.68	3472.81
16000.0	23.04	3575.91

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	19.85	24.35
250.0	0.36	21.44	25.94
500.0	0.72	25.59	30.09
750.0	1.08	32.04	36.54
1000.0	1.44	40.63	45.13
1250.0	1.80	51.29	55.79
1500.0	2.16	63.96	68.46
1750.0	2.52	78.57	83.07
2000.0	2.88	95.08	99.58
2250.0	3.24	113.47	117.97
2500.0	3.60	133.69	138.19
2750.0	3.96	155.73	160.23
3000.0	4.32	179.55	184.05
3250.0	4.68	205.13	209.63
3500.0	5.04	232.46	236.96
3750.0	5.40	261.52	266.02
4000.0	5.76	292.28	296.78
4250.0	6.12	324.74	329.24
4500.0	6.48	358.88	363.38
4750.0	6.84	394.68	399.18
5000.0	7.20	432.13	436.63
5250.0	7.56	471.23	475.73
5500.0	7.92	511.95	516.45
5750.0	8.28	554.30	558.80
6000.0	8.64	598.25	602.75
6250.0	9.00	643.80	648.30
6500.0	9.36	690.94	695.44
6750.0	9.72	739.66	744.16
7000.0	10.08	789.95	794.45
7250.0	10.44	841.81	846.31
7500.0	10.80	895.22	899.72
7750.0	11.16	950.18	954.68
8000.0	11.52	1006.69	1011.19
8250.0	11.88	1064.72	1069.22
8500.0	12.24	1124.29	1128.79
8750.0	12.60	1185.38	1189.88
9000.0	12.96	1247.98	1252.48
9250.0	13.32	1312.10	1316.60
9500.0	13.68	1377.71	1382.21
9750.0	14.04	1444.83	1449.33
10000.0	14.40	1513.44	1517.94
10250.0	14.76	1583.53	1588.03
10500.0	15.12	1655.11	1659.61
10750.0	15.48	1728.16	1732.66
11000.0	15.84	1802.69	1807.19
11250.0	16.20	1878.68	1883.18
11500.0	16.56	1956.14	1960.64
11750.0	16.92	2035.05	2039.55
12000.0	17.28	2115.42	2119.92
12250.0	17.64	2197.24	2201.74
12500.0	18.00	2280.50	2285.00
12750.0	18.36	2365.20	2369.70
13000.0	18.72	2451.34	2455.84
13250.0	19.08	2538.92	2543.42
13500.0	19.44	2627.92	2632.42
13750.0	19.80	2718.35	2722.85
14000.0	20.16	2810.20	2814.70
14250.0	20.52	2903.46	2907.96
14500.0	20.88	2998.15	3002.65
14750.0	21.24	3094.24	3098.74
15000.0	21.60	3191.74	3196.24
15250.0	21.96	3290.65	3295.15
15500.0	22.32	3390.96	3395.46
15750.0	22.68	3492.66	3497.16
16000.0	23.04	3595.76	3600.26

MIN Static Head = 19.85
MAX Static Head = 24.35


AFM 102 System Curve
Flow (MGD)
0
5
10
15
20
Total Dynamic Head (ft)
0
50
100
150
200
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
Flow (gpm)
AFM 102 to 1st HP (Min Static)
AFM 102 to A (Min Static)
AFM 102 to B (Min Static)
AFM 102 to C (Min Static)
AFM 102 to D (Min Static)
AFM 102 to E (Min Static)

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To 1st High Point (Wilber Ave Bridge)

FM System Curve – 24"

Diameter = 24 in
Area = 3.141593 ft^2
RH=D/4= 0.5
C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To 1st High Point (Wilber Ave Bridge)

13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve – 24" (24" Parallel FM Portion)

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	36.00	100	0.0000	0.0000	1.9	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	36.00	100	0.0000	0.0004	1.9	0.001	0.0013
500.0	0.72	1.11	24.00	0.35	0.00	36.00	100	0.0000	0.0014	1.9	0.004	0.0051
750.0	1.08	1.67	24.00	0.53	0.00	36.00	100	0.0001	0.0030	1.9	0.008	0.0113
1000.0	1.44	2.23	24.00	0.71	0.01	36.00	100	0.0001	0.0051	1.9	0.015	0.0199
1250.0	1.80	2.79	24.00	0.89	0.01	36.00	100	0.0002	0.0077	1.9	0.023	0.0309
1500.0	2.16	3.34	24.00	1.06	0.02	36.00	100	0.0003	0.0107	1.9	0.033	0.0441
1750.0	2.52	3.90	24.00	1.24	0.02	36.00	100	0.0004	0.0143	1.9	0.045	0.0597
2000.0	2.88	4.46	24.00	1.42	0.03	36.00	100	0.0005	0.0183	1.9	0.059	0.0777
2250.0	3.24	5.01	24.00	1.60	0.04	36.00	100	0.0006	0.0228	1.9	0.075	0.0979
2500.0	3.60	5.57	24.00	1.77	0.05	36.00	100	0.0008	0.0277	1.9	0.093	0.1204
2750.0	3.96	6.13	24.00	1.95	0.06	36.00	100	0.0009	0.0330	1.9	0.112	0.1453
3000.0	4.32	6.68	24.00	2.13	0.07	36.00	100	0.0011	0.0388	1.9	0.134	0.1724
3250.0	4.68	7.24	24.00	2.31	0.08	36.00	100	0.0012	0.0450	1.9	0.157	0.2017
3500.0	5.04	7.80	24.00	2.48	0.10	36.00	100	0.0014	0.0516	1.9	0.182	0.2334
3750.0	5.40	8.36	24.00	2.66	0.11	36.00	100	0.0016	0.0586	1.9	0.209	0.2673
4000.0	5.76	8.91	24.00	2.84	0.12	36.00	100	0.0018	0.0661	1.9	0.237	0.3035
4250.0	6.12	9.47	24.00	3.01	0.14	36.00	100	0.0021	0.0739	1.9	0.268	0.3420
4500.0	6.48	10.03	24.00	3.19	0.16	36.00	100	0.0023	0.0822	1.9	0.301	0.3827
4750.0	6.84	10.58	24.00	3.37	0.18	36.00	100	0.0025	0.0909	1.9	0.335	0.4257
5000.0	7.20	11.14	24.00	3.55	0.20	36.00	100	0.0028	0.0999	1.9	0.371	0.4709
5250.0	7.56	11.70	24.00	3.72	0.22	36.00	100	0.0030	0.1094	1.9	0.409	0.5184
5500.0	7.92	12.25	24.00	3.90	0.24	36.00	100	0.0033	0.1192	1.9	0.449	0.5681
5750.0	8.28	12.81	24.00	4.08	0.26	36.00	100	0.0036	0.1294	1.9	0.491	0.6201
6000.0	8.64	13.37	24.00	4.26	0.28	36.00	100	0.0039	0.1400	1.9	0.534	0.6743
6250.0	9.00	13.93	24.00	4.43	0.31	36.00	100	0.0042	0.1510	1.9	0.580	0.7308
6500.0	9.36	14.48	24.00	4.61	0.33	36.00	100	0.0045	0.1624	1.9	0.627	0.7895
6750.0	9.72	15.04	24.00	4.79	0.36	36.00	100	0.0048	0.1742	1.9	0.676	0.8504
7000.0	10.08	15.60	24.00	4.96	0.38	36.00	100	0.0052	0.1863	1.9	0.727	0.9135
7250.0	10.44	16.15	24.00	5.14	0.41	36.00	100	0.0055	0.1988	1.9	0.780	0.9789
7500.0	10.80	16.71	24.00	5.32	0.44	36.00	100	0.0059	0.2117	1.9	0.835	1.0465
7750.0	11.16	17.27	24.00	5.50	0.47	36.00	100	0.0062	0.2250	1.9	0.891	1.1163
8000.0	11.52	17.83	24.00	5.67	0.50	36.00	100	0.0066	0.2386	1.9	0.950	1.1884
8250.0	11.88	18.38	24.00	5.85	0.53	36.00	100	0.0070	0.2526	1.9	1.010	1.2627
8500.0	12.24	18.94	24.00	6.03	0.56	36.00	100	0.0074	0.2669	1.9	1.072	1.3392
8750.0	12.60	19.50	24.00	6.21	0.60	36.00	100	0.0078	0.2817	1.9	1.136	1.4179
9000.0	12.96	20.05	24.00	6.38	0.63	36.00	100	0.0082	0.2967	1.9	1.202	1.4989
9250.0	13.32	20.61	24.00	6.56	0.67	36.00	100	0.0087	0.3122	1.9	1.270	1.5820
9500.0	13.68	21.17	24.00	6.74	0.70	36.00	100	0.0091	0.3280	1.9	1.339	1.6674
9750.0	14.04	21.72	24.00	6.92	0.74	36.00	100	0.0096	0.3442	1.9	1.411	1.7550
10000.0	14.40	22.28	24.00	7.09	0.78	36.00	100	0.0100	0.3607	1.9	1.484	1.8448

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To 1st High Point (Wilber Ave Bridge)

10250.0	14.76	22.84	24.00	7.27	0.82	36.00	100	0.0105	0.3776	1.9	1.559	1.9368
10500.0	15.12	23.40	24.00	7.45	0.86	36.00	100	0.0110	0.3948	1.9	1.636	2.0310
10750.0	15.48	23.95	24.00	7.62	0.90	36.00	100	0.0115	0.4124	1.9	1.715	2.1274
11000.0	15.84	24.51	24.00	7.80	0.95	36.00	100	0.0120	0.4303	1.9	1.796	2.2261
11250.0	16.20	25.07	24.00	7.98	0.99	36.00	100	0.0125	0.4486	1.9	1.878	2.3269
11500.0	16.56	25.62	24.00	8.16	1.03	36.00	100	0.0130	0.4672	1.9	1.963	2.4300
11750.0	16.92	26.18	24.00	8.33	1.08	36.00	100	0.0135	0.4862	1.9	2.049	2.5352
12000.0	17.28	26.74	24.00	8.51	1.12	36.00	100	0.0140	0.5056	1.9	2.137	2.6427
12250.0	17.64	27.30	24.00	8.69	1.17	36.00	100	0.0146	0.5252	1.9	2.227	2.7523
12500.0	18.00	27.85	24.00	8.87	1.22	36.00	100	0.0151	0.5453	1.9	2.319	2.8642
12750.0	18.36	28.41	24.00	9.04	1.27	36.00	100	0.0157	0.5656	1.9	2.413	2.9782
13000.0	18.72	28.97	24.00	9.22	1.32	36.00	100	0.0163	0.5863	1.9	2.508	3.0945
13250.0	19.08	29.52	24.00	9.40	1.37	36.00	100	0.0169	0.6074	1.9	2.606	3.2129
13500.0	19.44	30.08	24.00	9.57	1.42	36.00	100	0.0175	0.6288	1.9	2.705	3.3336
13750.0	19.80	30.64	24.00	9.75	1.48	36.00	100	0.0181	0.6505	1.9	2.806	3.4564
14000.0	20.16	31.19	24.00	9.93	1.53	36.00	100	0.0187	0.6726	1.9	2.909	3.5814
14250.0	20.52	31.75	24.00	10.11	1.59	36.00	100	0.0193	0.6950	1.9	3.014	3.7087
14500.0	20.88	32.31	24.00	10.28	1.64	36.00	100	0.0199	0.7178	1.9	3.120	3.8381
14750.0	21.24	32.87	24.00	10.46	1.70	36.00	100	0.0206	0.7408	1.9	3.229	3.9697
15000.0	21.60	33.42	24.00	10.64	1.76	36.00	100	0.0212	0.7643	1.9	3.339	4.1035
15250.0	21.96	33.98	24.00	10.82	1.82	36.00	100	0.0219	0.7880	1.9	3.451	4.2395
15500.0	22.32	34.54	24.00	10.99	1.88	36.00	100	0.0226	0.8121	1.9	3.566	4.3777
15750.0	22.68	35.09	24.00	11.17	1.94	36.00	100	0.0232	0.8365	1.9	3.681	4.5180
16000.0	23.04	35.65	24.00	11.35	2.00	36.00	100	0.0239	0.8613	1.9	3.799	4.6606

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	10260	120	0.0000	0.0000	4.5	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	10260	120	0.0000	0.0816	4.5	0.002	0.0838
500.0	0.72	1.11	23.85	0.36	0.00	10260	120	0.0000	0.2945	4.5	0.009	0.3035
750.0	1.08	1.67	23.85	0.54	0.00	10260	120	0.0001	0.6240	4.5	0.020	0.6443
1000.0	1.44	2.23	23.85	0.72	0.01	10260	120	0.0001	1.0631	4.5	0.036	1.0992
1250.0	1.80	2.79	23.85	0.90	0.01	10260	120	0.0002	1.6072	4.5	0.056	1.6635
1500.0	2.16	3.34	23.85	1.08	0.02	10260	120	0.0002	2.2527	4.5	0.081	2.3338
1750.0	2.52	3.90	23.85	1.26	0.02	10260	120	0.0003	2.9971	4.5	0.110	3.1074
2000.0	2.88	4.46	23.85	1.44	0.03	10260	120	0.0004	3.8379	4.5	0.144	3.9821
2250.0	3.24	5.01	23.85	1.62	0.04	10260	120	0.0005	4.7734	4.5	0.182	4.9559
2500.0	3.60	5.57	23.85	1.80	0.05	10260	120	0.0006	5.8019	4.5	0.225	6.0272
2750.0	3.96	6.13	23.85	1.98	0.06	10260	120	0.0007	6.9220	4.5	0.273	7.1946
3000.0	4.32	6.68	23.85	2.15	0.07	10260	120	0.0008	8.1324	4.5	0.324	8.4568
3250.0	4.68	7.24	23.85	2.33	0.08	10260	120	0.0009	9.4319	4.5	0.381	9.8126
3500.0	5.04	7.80	23.85	2.51	0.10	10260	120	0.0011	10.8194	4.5	0.442	11.2609
3750.0	5.40	8.36	23.85	2.69	0.11	10260	120	0.0012	12.2940	4.5	0.507	12.8009
4000.0	5.76	8.91	23.85	2.87	0.13	10260	120	0.0014	13.8549	4.5	0.577	14.4316
4250.0	6.12	9.47	23.85	3.05	0.14	10260	120	0.0015	15.5012	4.5	0.651	16.1522
4500.0	6.48	10.03	23.85	3.23	0.16	10260	120	0.0017	17.2321	4.5	0.730	17.9620
4750.0	6.84	10.58	23.85	3.41	0.18	10260	120	0.0019	19.0470	4.5	0.813	19.8602
5000.0	7.20	11.14	23.85	3.59	0.20	10260	120	0.0020	20.9451	4.5	0.901	21.8461
5250.0	7.56	11.70	23.85	3.77	0.22	10260	120	0.0022	22.9258	4.5	0.993	23.9192
5500.0	7.92	12.25	23.85	3.95	0.24	10260	120	0.0024	24.9885	4.5	1.090	26.0788
5750.0	8.28	12.81	23.85	4.13	0.26	10260	120	0.0026	27.1328	4.5	1.192	28.3244
6000.0	8.64	13.37	23.85	4.31	0.29	10260	120	0.0029	29.3579	4.5	1.298	30.6554
6250.0	9.00	13.93	23.85	4.49	0.31	10260	120	0.0031	31.6635	4.5	1.408	33.0714
6500.0	9.36	14.48	23.85	4.67	0.34	10260	120	0.0033	34.0490	4.5	1.523	35.5718
6750.0	9.72	15.04	23.85	4.85	0.36	10260	120	0.0036	36.5140	4.5	1.642	38.1562

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To 1st High Point (Wilber Ave Bridge)

7000.0	10.08	15.60	23.85	5.03	0.39	10260	120	0.0038	39.0581	4.5	1.766	40.8241
7250.0	10.44	16.15	23.85	5.21	0.42	10260	120	0.0041	41.6807	4.5	1.894	43.5752
7500.0	10.80	16.71	23.85	5.39	0.45	10260	120	0.0043	44.3816	4.5	2.027	46.4089
7750.0	11.16	17.27	23.85	5.57	0.48	10260	120	0.0046	47.1602	4.5	2.165	49.3250
8000.0	11.52	17.83	23.85	5.75	0.51	10260	120	0.0049	50.0163	4.5	2.307	52.3230
8250.0	11.88	18.38	23.85	5.93	0.55	10260	120	0.0052	52.9495	4.5	2.453	55.4026
8500.0	12.24	18.94	23.85	6.10	0.58	10260	120	0.0055	55.9594	4.5	2.604	58.5634
8750.0	12.60	19.50	23.85	6.28	0.61	10260	120	0.0058	59.0457	4.5	2.759	61.8051
9000.0	12.96	20.05	23.85	6.46	0.65	10260	120	0.0061	62.2080	4.5	2.919	65.1274
9250.0	13.32	20.61	23.85	6.64	0.69	10260	120	0.0064	65.4461	4.5	3.084	68.5299
9500.0	13.68	21.17	23.85	6.82	0.72	10260	120	0.0067	68.7596	4.5	3.253	72.0124
9750.0	14.04	21.72	23.85	7.00	0.76	10260	120	0.0070	72.1482	4.5	3.426	75.5745
10000.0	14.40	22.28	23.85	7.18	0.80	10260	120	0.0074	75.6117	4.5	3.604	79.2159
10250.0	14.76	22.84	23.85	7.36	0.84	10260	120	0.0077	79.1498	4.5	3.787	82.9365
10500.0	15.12	23.40	23.85	7.54	0.88	10260	120	0.0081	82.7621	4.5	3.974	86.7358
10750.0	15.48	23.95	23.85	7.72	0.93	10260	120	0.0084	86.4485	4.5	4.165	90.6137
11000.0	15.84	24.51	23.85	7.90	0.97	10260	120	0.0088	90.2087	4.5	4.361	94.5698
11250.0	16.20	25.07	23.85	8.08	1.01	10260	120	0.0092	94.0424	4.5	4.562	98.6040
11500.0	16.56	25.62	23.85	8.26	1.06	10260	120	0.0095	97.9493	4.5	4.767	102.7159
11750.0	16.92	26.18	23.85	8.44	1.11	10260	120	0.0099	101.9293	4.5	4.976	106.9054
12000.0	17.28	26.74	23.85	8.62	1.15	10260	120	0.0103	105.9822	4.5	5.190	111.1722
12250.0	17.64	27.30	23.85	8.80	1.20	10260	120	0.0107	110.1075	4.5	5.409	115.5161
12500.0	18.00	27.85	23.85	8.98	1.25	10260	120	0.0111	114.3053	4.5	5.632	119.9369
12750.0	18.36	28.41	23.85	9.16	1.30	10260	120	0.0116	118.5752	4.5	5.859	124.4343
13000.0	18.72	28.97	23.85	9.34	1.35	10260	120	0.0120	122.9171	4.5	6.091	129.0082
13250.0	19.08	29.52	23.85	9.52	1.41	10260	120	0.0124	127.3306	4.5	6.328	133.6583
13500.0	19.44	30.08	23.85	9.70	1.46	10260	120	0.0128	131.8157	4.5	6.569	138.3844
13750.0	19.80	30.64	23.85	9.88	1.51	10260	120	0.0133	136.3721	4.5	6.814	143.1864
14000.0	20.16	31.19	23.85	10.05	1.57	10260	120	0.0137	140.9997	4.5	7.064	148.0640
14250.0	20.52	31.75	23.85	10.23	1.63	10260	120	0.0142	145.6982	4.5	7.319	153.0170
14500.0	20.88	32.31	23.85	10.41	1.68	10260	120	0.0147	150.4675	4.5	7.578	158.0454
14750.0	21.24	32.87	23.85	10.59	1.74	10260	120	0.0151	155.3073	4.5	7.841	163.1488
15000.0	21.60	33.42	23.85	10.77	1.80	10260	120	0.0156	160.2175	4.5	8.110	168.3271
15250.0	21.96	33.98	23.85	10.95	1.86	10260	120	0.0161	165.1980	4.5	8.382	173.5801
15500.0	22.32	34.54	23.85	11.13	1.92	10260	120	0.0166	170.2485	4.5	8.659	178.9077
15750.0	22.68	35.09	23.85	11.31	1.99	10260	120	0.0171	175.3689	4.5	8.941	184.3097
16000.0	23.04	35.65	23.85	11.49	2.05	10260	120	0.0176	180.5591	4.5	9.227	189.7859

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	620	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	620	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	620	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	620	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	620	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	620	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	620	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	620	120	0.0003	0.1811	2.7	0.066	0.2473
2000.0	2.88	4.46	23.85	1.44	0.03	620	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	620	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	620	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	620	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	620	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	620	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	620	120	0.0011	0.6538	2.7	0.265	0.9187

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To 1st High Point (Wilber Ave Bridge)

3750.0	5.40	8.36	23.85	2.69	0.11	620	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	620	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	620	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	620	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	620	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	620	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	620	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	620	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	620	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	620	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	620	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	620	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	620	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	620	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	620	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	620	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	620	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	620	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	620	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	620	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	620	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	620	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	620	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	620	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	620	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	620	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	620	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	620	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	620	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	620	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	620	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	620	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	620	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	620	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	620	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	620	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	620	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	620	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	620	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	620	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	620	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	620	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	620	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	620	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	620	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	620	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	620	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	620	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	620	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	620	120	0.0176	10.9108	2.7	5.536	16.4469

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To 1st High Point (Wilber Ave Bridge)

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	0.09
500.0	0.72	0.34
750.0	1.08	0.72
1000.0	1.44	1.23
1250.0	1.80	1.86
1500.0	2.16	2.61
1750.0	2.52	3.48
2000.0	2.88	4.47
2250.0	3.24	5.56
2500.0	3.60	6.77
2750.0	3.96	8.08
3000.0	4.32	9.51
3250.0	4.68	11.04
3500.0	5.04	12.67
3750.0	5.40	14.41
4000.0	5.76	16.26
4250.0	6.12	18.20
4500.0	6.48	20.25
4750.0	6.84	22.40
5000.0	7.20	24.64
5250.0	7.56	26.99
5500.0	7.92	29.44
5750.0	8.28	31.98
6000.0	8.64	34.63
6250.0	9.00	37.37
6500.0	9.36	40.20
6750.0	9.72	43.13
7000.0	10.08	46.16
7250.0	10.44	49.29
7500.0	10.80	52.50
7750.0	11.16	55.82
8000.0	11.52	59.22
8250.0	11.88	62.72
8500.0	12.24	66.32
8750.0	12.60	70.00
9000.0	12.96	73.78
9250.0	13.32	77.65
9500.0	13.68	81.61
9750.0	14.04	85.67
10000.0	14.40	89.81
10250.0	14.76	94.05
10500.0	15.12	98.38
10750.0	15.48	102.79
11000.0	15.84	107.30
11250.0	16.20	111.90
11500.0	16.56	116.58
11750.0	16.92	121.36
12000.0	17.28	126.22
12250.0	17.64	131.17
12500.0	18.00	136.22
12750.0	18.36	141.35
13000.0	18.72	146.56
13250.0	19.08	151.87
13500.0	19.44	157.26
13750.0	19.80	162.74
14000.0	20.16	168.31
14250.0	20.52	173.97
14500.0	20.88	179.71
14750.0	21.24	185.54
15000.0	21.60	191.45
15250.0	21.96	197.45
15500.0	22.32	203.54
15750.0	22.68	209.71
16000.0	23.04	215.97

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	58.13	62.63
250.0	0.36	58.22	62.72
500.0	0.72	58.47	62.97
750.0	1.08	58.85	63.35
1000.0	1.44	59.36	63.86
1250.0	1.80	59.99	64.49
1500.0	2.16	60.74	65.24
1750.0	2.52	61.61	66.11
2000.0	2.88	62.60	67.10
2250.0	3.24	63.69	68.19
2500.0	3.60	64.90	69.40
2750.0	3.96	66.21	70.71
3000.0	4.32	67.64	72.14
3250.0	4.68	69.17	73.67
3500.0	5.04	70.80	75.30
3750.0	5.40	72.54	77.04
4000.0	5.76	74.39	78.89
4250.0	6.12	76.33	80.83
4500.0	6.48	78.38	82.88
4750.0	6.84	80.53	85.03
5000.0	7.20	82.77	87.27
5250.0	7.56	85.12	89.62
5500.0	7.92	87.57	92.07
5750.0	8.28	90.11	94.61
6000.0	8.64	92.76	97.26
6250.0	9.00	95.50	100.00
6500.0	9.36	98.33	102.83
6750.0	9.72	101.26	105.76
7000.0	10.08	104.29	108.79
7250.0	10.44	107.42	111.92
7500.0	10.80	110.63	115.13
7750.0	11.16	113.95	118.45
8000.0	11.52	117.35	121.85
8250.0	11.88	120.85	125.35
8500.0	12.24	124.45	128.95
8750.0	12.60	128.13	132.63
9000.0	12.96	131.91	136.41
9250.0	13.32	135.78	140.28
9500.0	13.68	139.74	144.24
9750.0	14.04	143.80	148.30
10000.0	14.40	147.94	152.44
10250.0	14.76	152.18	156.68
10500.0	15.12	156.51	161.01
10750.0	15.48	160.92	165.42
11000.0	15.84	165.43	169.93
11250.0	16.20	170.03	174.53
11500.0	16.56	174.71	179.21
11750.0	16.92	179.49	183.99
12000.0	17.28	184.35	188.85
12250.0	17.64	189.30	193.80
12500.0	18.00	194.35	198.85
12750.0	18.36	199.48	203.98
13000.0	18.72	204.69	209.19
13250.0	19.08	210.00	214.50
13500.0	19.44	215.39	219.89
13750.0	19.80	220.87	225.37
14000.0	20.16	226.44	230.94
14250.0	20.52	232.10	236.60
14500.0	20.88	237.84	242.34
14750.0	21.24	243.67	248.17
15000.0	21.60	249.58	254.08
15250.0	21.96	255.58	260.08
15500.0	22.32	261.67	266.17
15750.0	22.68	267.84	272.34
16000.0	23.04	274.10	278.60

MIN Static Head = 58.13
MAX Static Head = 62.63

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To A Modified High Point

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FM System Curve – 24"

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To A Modified High Point

13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve – 24" (24" Parallel FM Portion)

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	36.00	100	0.0000	0.0000	1.9	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	36.00	100	0.0000	0.0004	1.9	0.001	0.0013
500.0	0.72	1.11	24.00	0.35	0.00	36.00	100	0.0000	0.0014	1.9	0.004	0.0051
750.0	1.08	1.67	24.00	0.53	0.00	36.00	100	0.0001	0.0030	1.9	0.008	0.0113
1000.0	1.44	2.23	24.00	0.71	0.01	36.00	100	0.0001	0.0051	1.9	0.015	0.0199
1250.0	1.80	2.79	24.00	0.89	0.01	36.00	100	0.0002	0.0077	1.9	0.023	0.0309
1500.0	2.16	3.34	24.00	1.06	0.02	36.00	100	0.0003	0.0107	1.9	0.033	0.0441
1750.0	2.52	3.90	24.00	1.24	0.02	36.00	100	0.0004	0.0143	1.9	0.045	0.0597
2000.0	2.88	4.46	24.00	1.42	0.03	36.00	100	0.0005	0.0183	1.9	0.059	0.0777
2250.0	3.24	5.01	24.00	1.60	0.04	36.00	100	0.0006	0.0228	1.9	0.075	0.0979
2500.0	3.60	5.57	24.00	1.77	0.05	36.00	100	0.0008	0.0277	1.9	0.093	0.1204
2750.0	3.96	6.13	24.00	1.95	0.06	36.00	100	0.0009	0.0330	1.9	0.112	0.1453
3000.0	4.32	6.68	24.00	2.13	0.07	36.00	100	0.0011	0.0388	1.9	0.134	0.1724
3250.0	4.68	7.24	24.00	2.31	0.08	36.00	100	0.0012	0.0450	1.9	0.157	0.2017
3500.0	5.04	7.80	24.00	2.48	0.10	36.00	100	0.0014	0.0516	1.9	0.182	0.2334
3750.0	5.40	8.36	24.00	2.66	0.11	36.00	100	0.0016	0.0586	1.9	0.209	0.2673
4000.0	5.76	8.91	24.00	2.84	0.12	36.00	100	0.0018	0.0661	1.9	0.237	0.3035
4250.0	6.12	9.47	24.00	3.01	0.14	36.00	100	0.0021	0.0739	1.9	0.268	0.3420
4500.0	6.48	10.03	24.00	3.19	0.16	36.00	100	0.0023	0.0822	1.9	0.301	0.3827
4750.0	6.84	10.58	24.00	3.37	0.18	36.00	100	0.0025	0.0909	1.9	0.335	0.4257
5000.0	7.20	11.14	24.00	3.55	0.20	36.00	100	0.0028	0.0999	1.9	0.371	0.4709
5250.0	7.56	11.70	24.00	3.72	0.22	36.00	100	0.0030	0.1094	1.9	0.409	0.5184
5500.0	7.92	12.25	24.00	3.90	0.24	36.00	100	0.0033	0.1192	1.9	0.449	0.5681
5750.0	8.28	12.81	24.00	4.08	0.26	36.00	100	0.0036	0.1294	1.9	0.491	0.6201
6000.0	8.64	13.37	24.00	4.26	0.28	36.00	100	0.0039	0.1400	1.9	0.534	0.6743
6250.0	9.00	13.93	24.00	4.43	0.31	36.00	100	0.0042	0.1510	1.9	0.580	0.7308
6500.0	9.36	14.48	24.00	4.61	0.33	36.00	100	0.0045	0.1624	1.9	0.627	0.7895
6750.0	9.72	15.04	24.00	4.79	0.36	36.00	100	0.0048	0.1742	1.9	0.676	0.8504
7000.0	10.08	15.60	24.00	4.96	0.38	36.00	100	0.0052	0.1863	1.9	0.727	0.9135
7250.0	10.44	16.15	24.00	5.14	0.41	36.00	100	0.0055	0.1988	1.9	0.780	0.9789
7500.0	10.80	16.71	24.00	5.32	0.44	36.00	100	0.0059	0.2117	1.9	0.835	1.0465
7750.0	11.16	17.27	24.00	5.50	0.47	36.00	100	0.0062	0.2250	1.9	0.891	1.1163
8000.0	11.52	17.83	24.00	5.67	0.50	36.00	100	0.0066	0.2386	1.9	0.950	1.1884
8250.0	11.88	18.38	24.00	5.85	0.53	36.00	100	0.0070	0.2526	1.9	1.010	1.2627
8500.0	12.24	18.94	24.00	6.03	0.56	36.00	100	0.0074	0.2669	1.9	1.072	1.3392
8750.0	12.60	19.50	24.00	6.21	0.60	36.00	100	0.0078	0.2817	1.9	1.136	1.4179
9000.0	12.96	20.05	24.00	6.38	0.63	36.00	100	0.0082	0.2967	1.9	1.202	1.4989
9250.0	13.32	20.61	24.00	6.56	0.67	36.00	100	0.0087	0.3122	1.9	1.270	1.5820
9500.0	13.68	21.17	24.00	6.74	0.70	36.00	100	0.0091	0.3280	1.9	1.339	1.6674
9750.0	14.04	21.72	24.00	6.92	0.74	36.00	100	0.0096	0.3442	1.9	1.411	1.7550
10000.0	14.40	22.28	24.00	7.09	0.78	36.00	100	0.0100	0.3607	1.9	1.484	1.8448

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To A Modified High Point

10250.0	14.76	22.84	24.00	7.27	0.82	36.00	100	0.0105	0.3776	1.9	1.559	1.9368
10500.0	15.12	23.40	24.00	7.45	0.86	36.00	100	0.0110	0.3948	1.9	1.636	2.0310
10750.0	15.48	23.95	24.00	7.62	0.90	36.00	100	0.0115	0.4124	1.9	1.715	2.1274
11000.0	15.84	24.51	24.00	7.80	0.95	36.00	100	0.0120	0.4303	1.9	1.796	2.2261
11250.0	16.20	25.07	24.00	7.98	0.99	36.00	100	0.0125	0.4486	1.9	1.878	2.3269
11500.0	16.56	25.62	24.00	8.16	1.03	36.00	100	0.0130	0.4672	1.9	1.963	2.4300
11750.0	16.92	26.18	24.00	8.33	1.08	36.00	100	0.0135	0.4862	1.9	2.049	2.5352
12000.0	17.28	26.74	24.00	8.51	1.12	36.00	100	0.0140	0.5056	1.9	2.137	2.6427
12250.0	17.64	27.30	24.00	8.69	1.17	36.00	100	0.0146	0.5252	1.9	2.227	2.7523
12500.0	18.00	27.85	24.00	8.87	1.22	36.00	100	0.0151	0.5453	1.9	2.319	2.8642
12750.0	18.36	28.41	24.00	9.04	1.27	36.00	100	0.0157	0.5656	1.9	2.413	2.9782
13000.0	18.72	28.97	24.00	9.22	1.32	36.00	100	0.0163	0.5863	1.9	2.508	3.0945
13250.0	19.08	29.52	24.00	9.40	1.37	36.00	100	0.0169	0.6074	1.9	2.606	3.2129
13500.0	19.44	30.08	24.00	9.57	1.42	36.00	100	0.0175	0.6288	1.9	2.705	3.3336
13750.0	19.80	30.64	24.00	9.75	1.48	36.00	100	0.0181	0.6505	1.9	2.806	3.4564
14000.0	20.16	31.19	24.00	9.93	1.53	36.00	100	0.0187	0.6726	1.9	2.909	3.5814
14250.0	20.52	31.75	24.00	10.11	1.59	36.00	100	0.0193	0.6950	1.9	3.014	3.7087
14500.0	20.88	32.31	24.00	10.28	1.64	36.00	100	0.0199	0.7178	1.9	3.120	3.8381
14750.0	21.24	32.87	24.00	10.46	1.70	36.00	100	0.0206	0.7408	1.9	3.229	3.9697
15000.0	21.60	33.42	24.00	10.64	1.76	36.00	100	0.0212	0.7643	1.9	3.339	4.1035
15250.0	21.96	33.98	24.00	10.82	1.82	36.00	100	0.0219	0.7880	1.9	3.451	4.2395
15500.0	22.32	34.54	24.00	10.99	1.88	36.00	100	0.0226	0.8121	1.9	3.566	4.3777
15750.0	22.68	35.09	24.00	11.17	1.94	36.00	100	0.0232	0.8365	1.9	3.681	4.5180
16000.0	23.04	35.65	24.00	11.35	2.00	36.00	100	0.0239	0.8613	1.9	3.799	4.6606

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	10260	120	0.0000	0.0000	4.5	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	10260	120	0.0000	0.0816	4.5	0.002	0.0838
500.0	0.72	1.11	23.85	0.36	0.00	10260	120	0.0000	0.2945	4.5	0.009	0.3035
750.0	1.08	1.67	23.85	0.54	0.00	10260	120	0.0001	0.6240	4.5	0.020	0.6443
1000.0	1.44	2.23	23.85	0.72	0.01	10260	120	0.0001	1.0631	4.5	0.036	1.0992
1250.0	1.80	2.79	23.85	0.90	0.01	10260	120	0.0002	1.6072	4.5	0.056	1.6635
1500.0	2.16	3.34	23.85	1.08	0.02	10260	120	0.0002	2.2527	4.5	0.081	2.3338
1750.0	2.52	3.90	23.85	1.26	0.02	10260	120	0.0003	2.9971	4.5	0.110	3.1074
2000.0	2.88	4.46	23.85	1.44	0.03	10260	120	0.0004	3.8379	4.5	0.144	3.9821
2250.0	3.24	5.01	23.85	1.62	0.04	10260	120	0.0005	4.7734	4.5	0.182	4.9559
2500.0	3.60	5.57	23.85	1.80	0.05	10260	120	0.0006	5.8019	4.5	0.225	6.0272
2750.0	3.96	6.13	23.85	1.98	0.06	10260	120	0.0007	6.9220	4.5	0.273	7.1946
3000.0	4.32	6.68	23.85	2.15	0.07	10260	120	0.0008	8.1324	4.5	0.324	8.4568
3250.0	4.68	7.24	23.85	2.33	0.08	10260	120	0.0009	9.4319	4.5	0.381	9.8126
3500.0	5.04	7.80	23.85	2.51	0.10	10260	120	0.0011	10.8194	4.5	0.442	11.2609
3750.0	5.40	8.36	23.85	2.69	0.11	10260	120	0.0012	12.2940	4.5	0.507	12.8009
4000.0	5.76	8.91	23.85	2.87	0.13	10260	120	0.0014	13.8549	4.5	0.577	14.4316
4250.0	6.12	9.47	23.85	3.05	0.14	10260	120	0.0015	15.5012	4.5	0.651	16.1522
4500.0	6.48	10.03	23.85	3.23	0.16	10260	120	0.0017	17.2321	4.5	0.730	17.9620
4750.0	6.84	10.58	23.85	3.41	0.18	10260	120	0.0019	19.0470	4.5	0.813	19.8602
5000.0	7.20	11.14	23.85	3.59	0.20	10260	120	0.0020	20.9451	4.5	0.901	21.8461
5250.0	7.56	11.70	23.85	3.77	0.22	10260	120	0.0022	22.9258	4.5	0.993	23.9192
5500.0	7.92	12.25	23.85	3.95	0.24	10260	120	0.0024	24.9885	4.5	1.090	26.0788
5750.0	8.28	12.81	23.85	4.13	0.26	10260	120	0.0026	27.1328	4.5	1.192	28.3244
6000.0	8.64	13.37	23.85	4.31	0.29	10260	120	0.0029	29.3579	4.5	1.298	30.6554
6250.0	9.00	13.93	23.85	4.49	0.31	10260	120	0.0031	31.6635	4.5	1.408	33.0714
6500.0	9.36	14.48	23.85	4.67	0.34	10260	120	0.0033	34.0490	4.5	1.523	35.5718
6750.0	9.72	15.04	23.85	4.85	0.36	10260	120	0.0036	36.5140	4.5	1.642	38.1562

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To A Modified High Point

7000.0	10.08	15.60	23.85	5.03	0.39	10260	120	0.0038	39.0581	4.5	1.766	40.8241
7250.0	10.44	16.15	23.85	5.21	0.42	10260	120	0.0041	41.6807	4.5	1.894	43.5752
7500.0	10.80	16.71	23.85	5.39	0.45	10260	120	0.0043	44.3816	4.5	2.027	46.4089
7750.0	11.16	17.27	23.85	5.57	0.48	10260	120	0.0046	47.1602	4.5	2.165	49.3250
8000.0	11.52	17.83	23.85	5.75	0.51	10260	120	0.0049	50.0163	4.5	2.307	52.3230
8250.0	11.88	18.38	23.85	5.93	0.55	10260	120	0.0052	52.9495	4.5	2.453	55.4026
8500.0	12.24	18.94	23.85	6.10	0.58	10260	120	0.0055	55.9594	4.5	2.604	58.5634
8750.0	12.60	19.50	23.85	6.28	0.61	10260	120	0.0058	59.0457	4.5	2.759	61.8051
9000.0	12.96	20.05	23.85	6.46	0.65	10260	120	0.0061	62.2080	4.5	2.919	65.1274
9250.0	13.32	20.61	23.85	6.64	0.69	10260	120	0.0064	65.4461	4.5	3.084	68.5299
9500.0	13.68	21.17	23.85	6.82	0.72	10260	120	0.0067	68.7596	4.5	3.253	72.0124
9750.0	14.04	21.72	23.85	7.00	0.76	10260	120	0.0070	72.1482	4.5	3.426	75.5745
10000.0	14.40	22.28	23.85	7.18	0.80	10260	120	0.0074	75.6117	4.5	3.604	79.2159
10250.0	14.76	22.84	23.85	7.36	0.84	10260	120	0.0077	79.1498	4.5	3.787	82.9365
10500.0	15.12	23.40	23.85	7.54	0.88	10260	120	0.0081	82.7621	4.5	3.974	86.7358
10750.0	15.48	23.95	23.85	7.72	0.93	10260	120	0.0084	86.4485	4.5	4.165	90.6137
11000.0	15.84	24.51	23.85	7.90	0.97	10260	120	0.0088	90.2087	4.5	4.361	94.5698
11250.0	16.20	25.07	23.85	8.08	1.01	10260	120	0.0092	94.0424	4.5	4.562	98.6040
11500.0	16.56	25.62	23.85	8.26	1.06	10260	120	0.0095	97.9493	4.5	4.767	102.7159
11750.0	16.92	26.18	23.85	8.44	1.11	10260	120	0.0099	101.9293	4.5	4.976	106.9054
12000.0	17.28	26.74	23.85	8.62	1.15	10260	120	0.0103	105.9822	4.5	5.190	111.1722
12250.0	17.64	27.30	23.85	8.80	1.20	10260	120	0.0107	110.1075	4.5	5.409	115.5161
12500.0	18.00	27.85	23.85	8.98	1.25	10260	120	0.0111	114.3053	4.5	5.632	119.9369
12750.0	18.36	28.41	23.85	9.16	1.30	10260	120	0.0116	118.5752	4.5	5.859	124.4343
13000.0	18.72	28.97	23.85	9.34	1.35	10260	120	0.0120	122.9171	4.5	6.091	129.0082
13250.0	19.08	29.52	23.85	9.52	1.41	10260	120	0.0124	127.3306	4.5	6.328	133.6583
13500.0	19.44	30.08	23.85	9.70	1.46	10260	120	0.0128	131.8157	4.5	6.569	138.3844
13750.0	19.80	30.64	23.85	9.88	1.51	10260	120	0.0133	136.3721	4.5	6.814	143.1864
14000.0	20.16	31.19	23.85	10.05	1.57	10260	120	0.0137	140.9997	4.5	7.064	148.0640
14250.0	20.52	31.75	23.85	10.23	1.63	10260	120	0.0142	145.6982	4.5	7.319	153.0170
14500.0	20.88	32.31	23.85	10.41	1.68	10260	120	0.0147	150.4675	4.5	7.578	158.0454
14750.0	21.24	32.87	23.85	10.59	1.74	10260	120	0.0151	155.3073	4.5	7.841	163.1488
15000.0	21.60	33.42	23.85	10.77	1.80	10260	120	0.0156	160.2175	4.5	8.110	168.3271
15250.0	21.96	33.98	23.85	10.95	1.86	10260	120	0.0161	165.1980	4.5	8.382	173.5801
15500.0	22.32	34.54	23.85	11.13	1.92	10260	120	0.0166	170.2485	4.5	8.659	178.9077
15750.0	22.68	35.09	23.85	11.31	1.99	10260	120	0.0171	175.3689	4.5	8.941	184.3097
16000.0	23.04	35.65	23.85	11.49	2.05	10260	120	0.0176	180.5591	4.5	9.227	189.7859

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	620	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	620	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	620	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	620	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	620	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	620	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	620	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	620	120	0.0003	0.1811	2.7	0.066	0.2473
2000.0	2.88	4.46	23.85	1.44	0.03	620	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	620	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	620	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	620	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	620	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	620	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	620	120	0.0011	0.6538	2.7	0.265	0.9187

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To A Modified High Point

3750.0	5.40	8.36	23.85	2.69	0.11	620	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	620	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	620	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	620	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	620	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	620	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	620	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	620	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	620	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	620	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	620	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	620	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	620	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	620	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	620	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	620	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	620	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	620	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	620	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	620	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	620	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	620	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	620	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	620	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	620	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	620	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	620	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	620	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	620	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	620	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	620	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	620	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	620	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	620	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	620	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	620	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	620	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	620	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	620	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	620	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	620	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	620	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	620	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	620	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	620	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	620	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	620	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	620	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	620	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	620	120	0.0176	10.9108	2.7	5.536	16.4469

FM System Curve – 25.14" (24" HDPE)

Diameter = 25.14 in

Area = 3.447132 ft^2

RH=D/4= 0.52375

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.14	0.00	0.00	625	100	0.0000	0.0000	0.6	0.000	0.0000
250.0	0.36	0.56	25.14	0.16	0.00	625	100	0.0000	0.0054	0.6	0.000	0.0056

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To A Modified High Point

500.0	0.72	1.11	25.14	0.32	0.00	625	100	0.0000	0.0195	0.6	0.001	0.0204
750.0	1.08	1.67	25.14	0.48	0.00	625	100	0.0001	0.0412	0.6	0.002	0.0434
1000.0	1.44	2.23	25.14	0.65	0.01	625	100	0.0001	0.0702	0.6	0.004	0.0741
1250.0	1.80	2.79	25.14	0.81	0.01	625	100	0.0002	0.1062	0.6	0.006	0.1123
1500.0	2.16	3.34	25.14	0.97	0.01	625	100	0.0002	0.1488	0.6	0.009	0.1576
1750.0	2.52	3.90	25.14	1.13	0.02	625	100	0.0003	0.1980	0.6	0.012	0.2099
2000.0	2.88	4.46	25.14	1.29	0.03	625	100	0.0004	0.2535	0.6	0.016	0.2691
2250.0	3.24	5.01	25.14	1.45	0.03	625	100	0.0005	0.3153	0.6	0.020	0.3350
2500.0	3.60	5.57	25.14	1.62	0.04	625	100	0.0006	0.3833	0.6	0.024	0.4076
2750.0	3.96	6.13	25.14	1.78	0.05	625	100	0.0007	0.4573	0.6	0.029	0.4867
3000.0	4.32	6.68	25.14	1.94	0.06	625	100	0.0009	0.5372	0.6	0.035	0.5723
3250.0	4.68	7.24	25.14	2.10	0.07	625	100	0.0010	0.6231	0.6	0.041	0.6642
3500.0	5.04	7.80	25.14	2.26	0.08	625	100	0.0011	0.7147	0.6	0.048	0.7624
3750.0	5.40	8.36	25.14	2.42	0.09	625	100	0.0013	0.8122	0.6	0.055	0.8669
4000.0	5.76	8.91	25.14	2.59	0.10	625	100	0.0015	0.9153	0.6	0.062	0.9776
4250.0	6.12	9.47	25.14	2.75	0.12	625	100	0.0016	1.0240	0.6	0.070	1.0943
4500.0	6.48	10.03	25.14	2.91	0.13	625	100	0.0018	1.1384	0.6	0.079	1.2172
4750.0	6.84	10.58	25.14	3.07	0.15	625	100	0.0020	1.2583	0.6	0.088	1.3461
5000.0	7.20	11.14	25.14	3.23	0.16	625	100	0.0022	1.3837	0.6	0.097	1.4810
5250.0	7.56	11.70	25.14	3.39	0.18	625	100	0.0024	1.5145	0.6	0.107	1.6218
5500.0	7.92	12.25	25.14	3.56	0.20	625	100	0.0026	1.6508	0.6	0.118	1.7685
5750.0	8.28	12.81	25.14	3.72	0.21	625	100	0.0029	1.7924	0.6	0.129	1.9211
6000.0	8.64	13.37	25.14	3.88	0.23	625	100	0.0031	1.9394	0.6	0.140	2.0796
6250.0	9.00	13.93	25.14	4.04	0.25	625	100	0.0033	2.0917	0.6	0.152	2.2438
6500.0	9.36	14.48	25.14	4.20	0.27	625	100	0.0036	2.2493	0.6	0.164	2.4138
6750.0	9.72	15.04	25.14	4.36	0.30	625	100	0.0039	2.4122	0.6	0.177	2.5895
7000.0	10.08	15.60	25.14	4.52	0.32	625	100	0.0041	2.5802	0.6	0.191	2.7710
7250.0	10.44	16.15	25.14	4.69	0.34	625	100	0.0044	2.7535	0.6	0.205	2.9581
7500.0	10.80	16.71	25.14	4.85	0.36	625	100	0.0047	2.9319	0.6	0.219	3.1509
7750.0	11.16	17.27	25.14	5.01	0.39	625	100	0.0050	3.1155	0.6	0.234	3.3493
8000.0	11.52	17.83	25.14	5.17	0.42	625	100	0.0053	3.3042	0.6	0.249	3.5533
8250.0	11.88	18.38	25.14	5.33	0.44	625	100	0.0056	3.4979	0.6	0.265	3.7629
8500.0	12.24	18.94	25.14	5.49	0.47	625	100	0.0059	3.6968	0.6	0.281	3.9780
8750.0	12.60	19.50	25.14	5.66	0.50	625	100	0.0062	3.9006	0.6	0.298	4.1987
9000.0	12.96	20.05	25.14	5.82	0.53	625	100	0.0066	4.1096	0.6	0.315	4.4249
9250.0	13.32	20.61	25.14	5.98	0.56	625	100	0.0069	4.3235	0.6	0.333	4.6565
9500.0	13.68	21.17	25.14	6.14	0.59	625	100	0.0073	4.5424	0.6	0.351	4.8937
9750.0	14.04	21.72	25.14	6.30	0.62	625	100	0.0076	4.7662	0.6	0.370	5.1363
10000.0	14.40	22.28	25.14	6.46	0.65	625	100	0.0080	4.9950	0.6	0.389	5.3843
10250.0	14.76	22.84	25.14	6.63	0.68	625	100	0.0084	5.2288	0.6	0.409	5.6377
10500.0	15.12	23.40	25.14	6.79	0.72	625	100	0.0087	5.4674	0.6	0.429	5.8966
10750.0	15.48	23.95	25.14	6.95	0.75	625	100	0.0091	5.7109	0.6	0.450	6.1608
11000.0	15.84	24.51	25.14	7.11	0.79	625	100	0.0095	5.9593	0.6	0.471	6.4303
11250.0	16.20	25.07	25.14	7.27	0.82	625	100	0.0099	6.2126	0.6	0.493	6.7052
11500.0	16.56	25.62	25.14	7.43	0.86	625	100	0.0104	6.4707	0.6	0.515	6.9855
11750.0	16.92	26.18	25.14	7.59	0.90	625	100	0.0108	6.7336	0.6	0.537	7.2710
12000.0	17.28	26.74	25.14	7.76	0.93	625	100	0.0112	7.0013	0.6	0.561	7.5619
12250.0	17.64	27.30	25.14	7.92	0.97	625	100	0.0116	7.2739	0.6	0.584	7.8580
12500.0	18.00	27.85	25.14	8.08	1.01	625	100	0.0121	7.5512	0.6	0.608	8.1594
12750.0	18.36	28.41	25.14	8.24	1.05	625	100	0.0125	7.8333	0.6	0.633	8.4661
13000.0	18.72	28.97	25.14	8.40	1.10	625	100	0.0130	8.1201	0.6	0.658	8.7779
13250.0	19.08	29.52	25.14	8.56	1.14	625	100	0.0135	8.4117	0.6	0.683	9.0951
13500.0	19.44	30.08	25.14	8.73	1.18	625	100	0.0139	8.7079	0.6	0.709	9.4174
13750.0	19.80	30.64	25.14	8.89	1.23	625	100	0.0144	9.0089	0.6	0.736	9.7449
14000.0	20.16	31.19	25.14	9.05	1.27	625	100	0.0149	9.3147	0.6	0.763	10.0776
14250.0	20.52	31.75	25.14	9.21	1.32	625	100	0.0154	9.6250	0.6	0.790	10.4155
14500.0	20.88	32.31	25.14	9.37	1.36	625	100	0.0159	9.9401	0.6	0.818	10.7585
14750.0	21.24	32.87	25.14	9.53	1.41	625	100	0.0164	10.2598	0.6	0.847	11.1067
15000.0	21.60	33.42	25.14	9.70	1.46	625	100	0.0169	10.5842	0.6	0.876	11.4601
15250.0	21.96	33.98	25.14	9.86	1.51	625	100	0.0175	10.9132	0.6	0.905	11.8185
15500.0	22.32	34.54	25.14	10.02	1.56	625	100	0.0180	11.2469	0.6	0.935	12.1821
15750.0	22.68	35.09	25.14	10.18	1.61	625	100	0.0185	11.5851	0.6	0.966	12.5508
16000.0	23.04	35.65	25.14	10.34	1.66	625	100	0.0191	11.9280	0.6	0.997	12.9245

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To A Modified High Point

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FM System Curve – 25.3" (30" HDPE)

Diameter = 25.3 in
Area = 3.491149 ft^2
RH=D/4= 0.527083
C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.30	0.00	0.00	2455	120	0.0000	0.0000	2.75	0.000	0.0000
250.0	0.36	0.56	25.30	0.16	0.00	2455	120	0.0000	0.0146	2.75	0.001	0.0157
500.0	0.72	1.11	25.30	0.32	0.00	2455	120	0.0000	0.0529	2.75	0.004	0.0572
750.0	1.08	1.67	25.30	0.48	0.00	2455	120	0.0000	0.1120	2.75	0.010	0.1218
1000.0	1.44	2.23	25.30	0.64	0.01	2455	120	0.0001	0.1908	2.75	0.017	0.2082
1250.0	1.80	2.79	25.30	0.80	0.01	2455	120	0.0001	0.2885	2.75	0.027	0.3157
1500.0	2.16	3.34	25.30	0.96	0.01	2455	120	0.0002	0.4044	2.75	0.039	0.4435
1750.0	2.52	3.90	25.30	1.12	0.02	2455	120	0.0002	0.5380	2.75	0.053	0.5912
2000.0	2.88	4.46	25.30	1.28	0.03	2455	120	0.0003	0.6889	2.75	0.070	0.7585
2250.0	3.24	5.01	25.30	1.44	0.03	2455	120	0.0003	0.8568	2.75	0.088	0.9449
2500.0	3.60	5.57	25.30	1.60	0.04	2455	120	0.0004	1.0414	2.75	0.109	1.1501
2750.0	3.96	6.13	25.30	1.76	0.05	2455	120	0.0005	1.2425	2.75	0.132	1.3740
3000.0	4.32	6.68	25.30	1.91	0.06	2455	120	0.0006	1.4597	2.75	0.157	1.6163
3250.0	4.68	7.24	25.30	2.07	0.07	2455	120	0.0007	1.6930	2.75	0.184	1.8767
3500.0	5.04	7.80	25.30	2.23	0.08	2455	120	0.0008	1.9420	2.75	0.213	2.1551
3750.0	5.40	8.36	25.30	2.39	0.09	2455	120	0.0009	2.2067	2.75	0.245	2.4513
4000.0	5.76	8.91	25.30	2.55	0.10	2455	120	0.0010	2.4869	2.75	0.278	2.7652
4250.0	6.12	9.47	25.30	2.71	0.11	2455	120	0.0011	2.7824	2.75	0.314	3.0966
4500.0	6.48	10.03	25.30	2.87	0.13	2455	120	0.0013	3.0931	2.75	0.352	3.4453
4750.0	6.84	10.58	25.30	3.03	0.14	2455	120	0.0014	3.4189	2.75	0.392	3.8113
5000.0	7.20	11.14	25.30	3.19	0.16	2455	120	0.0015	3.7596	2.75	0.435	4.1944
5250.0	7.56	11.70	25.30	3.35	0.17	2455	120	0.0017	4.1151	2.75	0.479	4.5945
5500.0	7.92	12.25	25.30	3.51	0.19	2455	120	0.0018	4.4854	2.75	0.526	5.0115
5750.0	8.28	12.81	25.30	3.67	0.21	2455	120	0.0020	4.8702	2.75	0.575	5.4453
6000.0	8.64	13.37	25.30	3.83	0.23	2455	120	0.0021	5.2696	2.75	0.626	5.8958
6250.0	9.00	13.93	25.30	3.99	0.25	2455	120	0.0023	5.6835	2.75	0.679	6.3629
6500.0	9.36	14.48	25.30	4.15	0.27	2455	120	0.0025	6.1117	2.75	0.735	6.8466
6750.0	9.72	15.04	25.30	4.31	0.29	2455	120	0.0027	6.5541	2.75	0.793	7.3467
7000.0	10.08	15.60	25.30	4.47	0.31	2455	120	0.0029	7.0108	2.75	0.852	7.8631
7250.0	10.44	16.15	25.30	4.63	0.33	2455	120	0.0030	7.4815	2.75	0.914	8.3958
7500.0	10.80	16.71	25.30	4.79	0.36	2455	120	0.0032	7.9663	2.75	0.978	8.9448
7750.0	11.16	17.27	25.30	4.95	0.38	2455	120	0.0034	8.4651	2.75	1.045	9.5098
8000.0	11.52	17.83	25.30	5.11	0.40	2455	120	0.0037	8.9778	2.75	1.113	10.0910
8250.0	11.88	18.38	25.30	5.27	0.43	2455	120	0.0039	9.5043	2.75	1.184	10.6881
8500.0	12.24	18.94	25.30	5.42	0.46	2455	120	0.0041	10.0445	2.75	1.257	11.3012
8750.0	12.60	19.50	25.30	5.58	0.48	2455	120	0.0043	10.5985	2.75	1.332	11.9302
9000.0	12.96	20.05	25.30	5.74	0.51	2455	120	0.0045	11.1661	2.75	1.409	12.5751
9250.0	13.32	20.61	25.30	5.90	0.54	2455	120	0.0048	11.7473	2.75	1.488	13.2356
9500.0	13.68	21.17	25.30	6.06	0.57	2455	120	0.0050	12.3421	2.75	1.570	13.9119
9750.0	14.04	21.72	25.30	6.22	0.60	2455	120	0.0053	12.9504	2.75	1.654	14.6039
10000.0	14.40	22.28	25.30	6.38	0.63	2455	120	0.0055	13.5720	2.75	1.739	15.3115
10250.0	14.76	22.84	25.30	6.54	0.66	2455	120	0.0058	14.2071	2.75	1.827	16.0346
10500.0	15.12	23.40	25.30	6.70	0.70	2455	120	0.0061	14.8555	2.75	1.918	16.7732
10750.0	15.48	23.95	25.30	6.86	0.73	2455	120	0.0063	15.5172	2.75	2.010	17.5273
11000.0	15.84	24.51	25.30	7.02	0.77	2455	120	0.0066	16.1921	2.75	2.105	18.2968
11250.0	16.20	25.07	25.30	7.18	0.80	2455	120	0.0069	16.8803	2.75	2.201	19.0817
11500.0	16.56	25.62	25.30	7.34	0.84	2455	120	0.0072	17.5816	2.75	2.300	19.8819
11750.0	16.92	26.18	25.30	7.50	0.87	2455	120	0.0075	18.2960	2.75	2.401	20.6975
12000.0	17.28	26.74	25.30	7.66	0.91	2455	120	0.0077	19.0234	2.75	2.505	21.5282
12250.0	17.64	27.30	25.30	7.82	0.95	2455	120	0.0081	19.7639	2.75	2.610	22.3741
12500.0	18.00	27.85	25.30	7.98	0.99	2455	120	0.0084	20.5174	2.75	2.718	23.2353
12750.0	18.36	28.41	25.30	8.14	1.03	2455	120	0.0087	21.2838	2.75	2.828	24.1115
13000.0	18.72	28.97	25.30	8.30	1.07	2455	120	0.0090	22.0632	2.75	2.940	25.0028
13250.0	19.08	29.52	25.30	8.46	1.11	2455	120	0.0093	22.8554	2.75	3.054	25.9092

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To A Modified High Point

13500.0	19.44	30.08	25.30	8.62	1.15	2455	120	0.0096	23.6605	2.75	3.170	26.8306
13750.0	19.80	30.64	25.30	8.78	1.20	2455	120	0.0100	24.4783	2.75	3.289	27.7669
14000.0	20.16	31.19	25.30	8.94	1.24	2455	120	0.0103	25.3090	2.75	3.409	28.7182
14250.0	20.52	31.75	25.30	9.09	1.28	2455	120	0.0107	26.1523	2.75	3.532	29.6844
14500.0	20.88	32.31	25.30	9.25	1.33	2455	120	0.0110	27.0084	2.75	3.657	30.6655
14750.0	21.24	32.87	25.30	9.41	1.38	2455	120	0.0114	27.8771	2.75	3.784	31.6615
15000.0	21.60	33.42	25.30	9.57	1.42	2455	120	0.0117	28.7585	2.75	3.914	32.6722
15250.0	21.96	33.98	25.30	9.73	1.47	2455	120	0.0121	29.6525	2.75	4.045	33.6977
15500.0	22.32	34.54	25.30	9.89	1.52	2455	120	0.0124	30.5590	2.75	4.179	34.7380
15750.0	22.68	35.09	25.30	10.05	1.57	2455	120	0.0128	31.4781	2.75	4.315	35.7930
16000.0	23.04	35.65	25.30	10.21	1.62	2455	120	0.0132	32.4097	2.75	4.453	36.8626

FM System Curve – 24”

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	1794	100	0.0000	0.0000	2.03	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	1794	100	0.0000	0.0194	2.03	0.001	0.0204
500.0	0.72	1.11	24.00	0.35	0.00	1794	100	0.0000	0.0700	2.03	0.004	0.0740
750.0	1.08	1.67	24.00	0.53	0.00	1794	100	0.0001	0.1483	2.03	0.009	0.1573
1000.0	1.44	2.23	24.00	0.71	0.01	1794	100	0.0001	0.2527	2.03	0.016	0.2686
1250.0	1.80	2.79	24.00	0.89	0.01	1794	100	0.0002	0.3821	2.03	0.025	0.4068
1500.0	2.16	3.34	24.00	1.06	0.02	1794	100	0.0003	0.5355	2.03	0.036	0.5712
1750.0	2.52	3.90	24.00	1.24	0.02	1794	100	0.0004	0.7124	2.03	0.049	0.7610
2000.0	2.88	4.46	24.00	1.42	0.03	1794	100	0.0005	0.9123	2.03	0.063	0.9758
2250.0	3.24	5.01	24.00	1.60	0.04	1794	100	0.0006	1.1347	2.03	0.080	1.2150
2500.0	3.60	5.57	24.00	1.77	0.05	1794	100	0.0008	1.3792	2.03	0.099	1.4783
2750.0	3.96	6.13	24.00	1.95	0.06	1794	100	0.0009	1.6455	2.03	0.120	1.7654
3000.0	4.32	6.68	24.00	2.13	0.07	1794	100	0.0011	1.9332	2.03	0.143	2.0759
3250.0	4.68	7.24	24.00	2.31	0.08	1794	100	0.0012	2.2421	2.03	0.167	2.4096
3500.0	5.04	7.80	24.00	2.48	0.10	1794	100	0.0014	2.5719	2.03	0.194	2.7662
3750.0	5.40	8.36	24.00	2.66	0.11	1794	100	0.0016	2.9225	2.03	0.223	3.1455
4000.0	5.76	8.91	24.00	2.84	0.12	1794	100	0.0018	3.2935	2.03	0.254	3.5472
4250.0	6.12	9.47	24.00	3.01	0.14	1794	100	0.0021	3.6849	2.03	0.286	3.9713
4500.0	6.48	10.03	24.00	3.19	0.16	1794	100	0.0023	4.0963	2.03	0.321	4.4174
4750.0	6.84	10.58	24.00	3.37	0.18	1794	100	0.0025	4.5277	2.03	0.358	4.8855
5000.0	7.20	11.14	24.00	3.55	0.20	1794	100	0.0028	4.9790	2.03	0.396	5.3754
5250.0	7.56	11.70	24.00	3.72	0.22	1794	100	0.0030	5.4498	2.03	0.437	5.8868
5500.0	7.92	12.25	24.00	3.90	0.24	1794	100	0.0033	5.9401	2.03	0.480	6.4198
5750.0	8.28	12.81	24.00	4.08	0.26	1794	100	0.0036	6.4499	2.03	0.524	6.9741
6000.0	8.64	13.37	24.00	4.26	0.28	1794	100	0.0039	6.9788	2.03	0.571	7.5496
6250.0	9.00	13.93	24.00	4.43	0.31	1794	100	0.0042	7.5269	2.03	0.619	8.1463
6500.0	9.36	14.48	24.00	4.61	0.33	1794	100	0.0045	8.0940	2.03	0.670	8.7639
6750.0	9.72	15.04	24.00	4.79	0.36	1794	100	0.0048	8.6799	2.03	0.722	9.4024
7000.0	10.08	15.60	24.00	4.96	0.38	1794	100	0.0052	9.2847	2.03	0.777	10.0616
7250.0	10.44	16.15	24.00	5.14	0.41	1794	100	0.0055	9.9081	2.03	0.833	10.7416
7500.0	10.80	16.71	24.00	5.32	0.44	1794	100	0.0059	10.5502	2.03	0.892	11.4421
7750.0	11.16	17.27	24.00	5.50	0.47	1794	100	0.0062	11.2107	2.03	0.952	12.1631
8000.0	11.52	17.83	24.00	5.67	0.50	1794	100	0.0066	11.8896	2.03	1.015	12.9044
8250.0	11.88	18.38	24.00	5.85	0.53	1794	100	0.0070	12.5869	2.03	1.079	13.6661
8500.0	12.24	18.94	24.00	6.03	0.56	1794	100	0.0074	13.3024	2.03	1.146	14.4480
8750.0	12.60	19.50	24.00	6.21	0.60	1794	100	0.0078	14.0360	2.03	1.214	15.2500
9000.0	12.96	20.05	24.00	6.38	0.63	1794	100	0.0082	14.7878	2.03	1.284	16.0721
9250.0	13.32	20.61	24.00	6.56	0.67	1794	100	0.0087	15.5575	2.03	1.357	16.9142
9500.0	13.68	21.17	24.00	6.74	0.70	1794	100	0.0091	16.3452	2.03	1.431	17.7762
9750.0	14.04	21.72	24.00	6.92	0.74	1794	100	0.0096	17.1507	2.03	1.507	18.6581
10000.0	14.40	22.28	24.00	7.09	0.78	1794	100	0.0100	17.9740	2.03	1.586	19.5597

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To A Modified High Point

10250.0	14.76	22.84	24.00	7.27	0.82	1794	100	0.0105	18.8151	2.03	1.666	20.4810
10500.0	15.12	23.40	24.00	7.45	0.86	1794	100	0.0110	19.6738	2.03	1.748	21.4220
10750.0	15.48	23.95	24.00	7.62	0.90	1794	100	0.0115	20.5501	2.03	1.832	22.3825
11000.0	15.84	24.51	24.00	7.80	0.95	1794	100	0.0120	21.4439	2.03	1.919	23.3626
11250.0	16.20	25.07	24.00	7.98	0.99	1794	100	0.0125	22.3553	2.03	2.007	24.3621
11500.0	16.56	25.62	24.00	8.16	1.03	1794	100	0.0130	23.2840	2.03	2.097	25.3810
11750.0	16.92	26.18	24.00	8.33	1.08	1794	100	0.0135	24.2301	2.03	2.189	26.4193
12000.0	17.28	26.74	24.00	8.51	1.12	1794	100	0.0140	25.1935	2.03	2.283	27.4769
12250.0	17.64	27.30	24.00	8.69	1.17	1794	100	0.0146	26.1742	2.03	2.379	28.5537
12500.0	18.00	27.85	24.00	8.87	1.22	1794	100	0.0151	27.1721	2.03	2.478	29.6496
12750.0	18.36	28.41	24.00	9.04	1.27	1794	100	0.0157	28.1871	2.03	2.578	30.7647
13000.0	18.72	28.97	24.00	9.22	1.32	1794	100	0.0163	29.2192	2.03	2.680	31.8989
13250.0	19.08	29.52	24.00	9.40	1.37	1794	100	0.0169	30.2684	2.03	2.784	33.0522
13500.0	19.44	30.08	24.00	9.57	1.42	1794	100	0.0175	31.3346	2.03	2.890	34.2244
13750.0	19.80	30.64	24.00	9.75	1.48	1794	100	0.0181	32.4177	2.03	2.998	35.4155
14000.0	20.16	31.19	24.00	9.93	1.53	1794	100	0.0187	33.5177	2.03	3.108	36.6256
14250.0	20.52	31.75	24.00	10.11	1.59	1794	100	0.0193	34.6346	2.03	3.220	37.8545
14500.0	20.88	32.31	24.00	10.28	1.64	1794	100	0.0199	35.7684	2.03	3.334	39.1022
14750.0	21.24	32.87	24.00	10.46	1.70	1794	100	0.0206	36.9189	2.03	3.450	40.3686
15000.0	21.60	33.42	24.00	10.64	1.76	1794	100	0.0212	38.0861	2.03	3.568	41.6538
15250.0	21.96	33.98	24.00	10.82	1.82	1794	100	0.0219	39.2700	2.03	3.688	42.9576
15500.0	22.32	34.54	24.00	10.99	1.88	1794	100	0.0226	40.4706	2.03	3.810	44.2801
15750.0	22.68	35.09	24.00	11.17	1.94	1794	100	0.0232	41.6878	2.03	3.933	45.6212
16000.0	23.04	35.65	24.00	11.35	2.00	1794	100	0.0239	42.9216	2.03	4.059	46.9808

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To A Modified High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	0.13
500.0	0.72	0.49
750.0	1.08	1.04
1000.0	1.44	1.78
1250.0	1.80	2.69
1500.0	2.16	3.78
1750.0	2.52	5.04
2000.0	2.88	6.47
2250.0	3.24	8.06
2500.0	3.60	9.80
2750.0	3.96	11.71
3000.0	4.32	13.77
3250.0	4.68	15.99
3500.0	5.04	18.36
3750.0	5.40	20.88
4000.0	5.76	23.55
4250.0	6.12	26.36
4500.0	6.48	29.33
4750.0	6.84	32.44
5000.0	7.20	35.69
5250.0	7.56	39.10
5500.0	7.92	42.64
5750.0	8.28	46.32
6000.0	8.64	50.15
6250.0	9.00	54.12
6500.0	9.36	58.23
6750.0	9.72	62.47
7000.0	10.08	66.86
7250.0	10.44	71.38
7500.0	10.80	76.04
7750.0	11.16	80.84
8000.0	11.52	85.77
8250.0	11.88	90.84
8500.0	12.24	96.04
8750.0	12.60	101.38
9000.0	12.96	106.85
9250.0	13.32	112.46
9500.0	13.68	118.20
9750.0	14.04	124.07
10000.0	14.40	130.07
10250.0	14.76	136.20
10500.0	15.12	142.47
10750.0	15.48	148.86
11000.0	15.84	155.39
11250.0	16.20	162.05
11500.0	16.56	168.83
11750.0	16.92	175.75
12000.0	17.28	182.79
12250.0	17.64	189.96
12500.0	18.00	197.26
12750.0	18.36	204.69
13000.0	18.72	212.24
13250.0	19.08	219.93
13500.0	19.44	227.73
13750.0	19.80	235.67
14000.0	20.16	243.73
14250.0	20.52	251.92
14500.0	20.88	260.23
14750.0	21.24	268.67
15000.0	21.60	277.24
15250.0	21.96	285.92
15500.0	22.32	294.74
15750.0	22.68	303.67
16000.0	23.04	312.74

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	32.88	37.38
250.0	0.36	33.01	37.51
500.0	0.72	33.37	37.87
750.0	1.08	33.92	38.42
1000.0	1.44	34.66	39.16
1250.0	1.80	35.57	40.07
1500.0	2.16	36.66	41.16
1750.0	2.52	37.92	42.42
2000.0	2.88	39.35	43.85
2250.0	3.24	40.94	45.44
2500.0	3.60	42.68	47.18
2750.0	3.96	44.59	49.09
3000.0	4.32	46.65	51.15
3250.0	4.68	48.87	53.37
3500.0	5.04	51.24	55.74
3750.0	5.40	53.76	58.26
4000.0	5.76	56.43	60.93
4250.0	6.12	59.24	63.74
4500.0	6.48	62.21	66.71
4750.0	6.84	65.32	69.82
5000.0	7.20	68.57	73.07
5250.0	7.56	71.98	76.48
5500.0	7.92	75.52	80.02
5750.0	8.28	79.20	83.70
6000.0	8.64	83.03	87.53
6250.0	9.00	87.00	91.50
6500.0	9.36	91.11	95.61
6750.0	9.72	95.35	99.85
7000.0	10.08	99.74	104.24
7250.0	10.44	104.26	108.76
7500.0	10.80	108.92	113.42
7750.0	11.16	113.72	118.22
8000.0	11.52	118.65	123.15
8250.0	11.88	123.72	128.22
8500.0	12.24	128.92	133.42
8750.0	12.60	134.26	138.76
9000.0	12.96	139.73	144.23
9250.0	13.32	145.34	149.84
9500.0	13.68	151.08	155.58
9750.0	14.04	156.95	161.45
10000.0	14.40	162.95	167.45
10250.0	14.76	169.08	173.58
10500.0	15.12	175.35	179.85
10750.0	15.48	181.74	186.24
11000.0	15.84	188.27	192.77
11250.0	16.20	194.93	199.43
11500.0	16.56	201.71	206.21
11750.0	16.92	208.63	213.13
12000.0	17.28	215.67	220.17
12250.0	17.64	222.84	227.34
12500.0	18.00	230.14	234.64
12750.0	18.36	237.57	242.07
13000.0	18.72	245.12	249.62
13250.0	19.08	252.81	257.31
13500.0	19.44	260.61	265.11
13750.0	19.80	268.55	273.05
14000.0	20.16	276.61	281.11
14250.0	20.52	284.80	289.30
14500.0	20.88	293.11	297.61
14750.0	21.24	301.55	306.05
15000.0	21.60	310.12	314.62
15250.0	21.96	318.80	323.30
15500.0	22.32	327.62	332.12
15750.0	22.68	336.55	341.05
16000.0	23.04	345.62	350.12

MIN Static Head = 32.88
MAX Static Head = 37.38

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To B Modified High Point

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FM System Curve – 24"

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To B Modified High Point

13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve – 24" (24" Parallel FM Portion)

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	36.00	100	0.0000	0.0000	1.9	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	36.00	100	0.0000	0.0004	1.9	0.001	0.0013
500.0	0.72	1.11	24.00	0.35	0.00	36.00	100	0.0000	0.0014	1.9	0.004	0.0051
750.0	1.08	1.67	24.00	0.53	0.00	36.00	100	0.0001	0.0030	1.9	0.008	0.0113
1000.0	1.44	2.23	24.00	0.71	0.01	36.00	100	0.0001	0.0051	1.9	0.015	0.0199
1250.0	1.80	2.79	24.00	0.89	0.01	36.00	100	0.0002	0.0077	1.9	0.023	0.0309
1500.0	2.16	3.34	24.00	1.06	0.02	36.00	100	0.0003	0.0107	1.9	0.033	0.0441
1750.0	2.52	3.90	24.00	1.24	0.02	36.00	100	0.0004	0.0143	1.9	0.045	0.0597
2000.0	2.88	4.46	24.00	1.42	0.03	36.00	100	0.0005	0.0183	1.9	0.059	0.0777
2250.0	3.24	5.01	24.00	1.60	0.04	36.00	100	0.0006	0.0228	1.9	0.075	0.0979
2500.0	3.60	5.57	24.00	1.77	0.05	36.00	100	0.0008	0.0277	1.9	0.093	0.1204
2750.0	3.96	6.13	24.00	1.95	0.06	36.00	100	0.0009	0.0330	1.9	0.112	0.1453
3000.0	4.32	6.68	24.00	2.13	0.07	36.00	100	0.0011	0.0388	1.9	0.134	0.1724
3250.0	4.68	7.24	24.00	2.31	0.08	36.00	100	0.0012	0.0450	1.9	0.157	0.2017
3500.0	5.04	7.80	24.00	2.48	0.10	36.00	100	0.0014	0.0516	1.9	0.182	0.2334
3750.0	5.40	8.36	24.00	2.66	0.11	36.00	100	0.0016	0.0586	1.9	0.209	0.2673
4000.0	5.76	8.91	24.00	2.84	0.12	36.00	100	0.0018	0.0661	1.9	0.237	0.3035
4250.0	6.12	9.47	24.00	3.01	0.14	36.00	100	0.0021	0.0739	1.9	0.268	0.3420
4500.0	6.48	10.03	24.00	3.19	0.16	36.00	100	0.0023	0.0822	1.9	0.301	0.3827
4750.0	6.84	10.58	24.00	3.37	0.18	36.00	100	0.0025	0.0909	1.9	0.335	0.4257
5000.0	7.20	11.14	24.00	3.55	0.20	36.00	100	0.0028	0.0999	1.9	0.371	0.4709
5250.0	7.56	11.70	24.00	3.72	0.22	36.00	100	0.0030	0.1094	1.9	0.409	0.5184
5500.0	7.92	12.25	24.00	3.90	0.24	36.00	100	0.0033	0.1192	1.9	0.449	0.5681
5750.0	8.28	12.81	24.00	4.08	0.26	36.00	100	0.0036	0.1294	1.9	0.491	0.6201
6000.0	8.64	13.37	24.00	4.26	0.28	36.00	100	0.0039	0.1400	1.9	0.534	0.6743
6250.0	9.00	13.93	24.00	4.43	0.31	36.00	100	0.0042	0.1510	1.9	0.580	0.7308
6500.0	9.36	14.48	24.00	4.61	0.33	36.00	100	0.0045	0.1624	1.9	0.627	0.7895
6750.0	9.72	15.04	24.00	4.79	0.36	36.00	100	0.0048	0.1742	1.9	0.676	0.8504
7000.0	10.08	15.60	24.00	4.96	0.38	36.00	100	0.0052	0.1863	1.9	0.727	0.9135
7250.0	10.44	16.15	24.00	5.14	0.41	36.00	100	0.0055	0.1988	1.9	0.780	0.9789
7500.0	10.80	16.71	24.00	5.32	0.44	36.00	100	0.0059	0.2117	1.9	0.835	1.0465
7750.0	11.16	17.27	24.00	5.50	0.47	36.00	100	0.0062	0.2250	1.9	0.891	1.1163
8000.0	11.52	17.83	24.00	5.67	0.50	36.00	100	0.0066	0.2386	1.9	0.950	1.1884
8250.0	11.88	18.38	24.00	5.85	0.53	36.00	100	0.0070	0.2526	1.9	1.010	1.2627
8500.0	12.24	18.94	24.00	6.03	0.56	36.00	100	0.0074	0.2669	1.9	1.072	1.3392
8750.0	12.60	19.50	24.00	6.21	0.60	36.00	100	0.0078	0.2817	1.9	1.136	1.4179
9000.0	12.96	20.05	24.00	6.38	0.63	36.00	100	0.0082	0.2967	1.9	1.202	1.4989
9250.0	13.32	20.61	24.00	6.56	0.67	36.00	100	0.0087	0.3122	1.9	1.270	1.5820
9500.0	13.68	21.17	24.00	6.74	0.70	36.00	100	0.0091	0.3280	1.9	1.339	1.6674
9750.0	14.04	21.72	24.00	6.92	0.74	36.00	100	0.0096	0.3442	1.9	1.411	1.7550
10000.0	14.40	22.28	24.00	7.09	0.78	36.00	100	0.0100	0.3607	1.9	1.484	1.8448

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To B Modified High Point

10250.0	14.76	22.84	24.00	7.27	0.82	36.00	100	0.0105	0.3776	1.9	1.559	1.9368
10500.0	15.12	23.40	24.00	7.45	0.86	36.00	100	0.0110	0.3948	1.9	1.636	2.0310
10750.0	15.48	23.95	24.00	7.62	0.90	36.00	100	0.0115	0.4124	1.9	1.715	2.1274
11000.0	15.84	24.51	24.00	7.80	0.95	36.00	100	0.0120	0.4303	1.9	1.796	2.2261
11250.0	16.20	25.07	24.00	7.98	0.99	36.00	100	0.0125	0.4486	1.9	1.878	2.3269
11500.0	16.56	25.62	24.00	8.16	1.03	36.00	100	0.0130	0.4672	1.9	1.963	2.4300
11750.0	16.92	26.18	24.00	8.33	1.08	36.00	100	0.0135	0.4862	1.9	2.049	2.5352
12000.0	17.28	26.74	24.00	8.51	1.12	36.00	100	0.0140	0.5056	1.9	2.137	2.6427
12250.0	17.64	27.30	24.00	8.69	1.17	36.00	100	0.0146	0.5252	1.9	2.227	2.7523
12500.0	18.00	27.85	24.00	8.87	1.22	36.00	100	0.0151	0.5453	1.9	2.319	2.8642
12750.0	18.36	28.41	24.00	9.04	1.27	36.00	100	0.0157	0.5656	1.9	2.413	2.9782
13000.0	18.72	28.97	24.00	9.22	1.32	36.00	100	0.0163	0.5863	1.9	2.508	3.0945
13250.0	19.08	29.52	24.00	9.40	1.37	36.00	100	0.0169	0.6074	1.9	2.606	3.2129
13500.0	19.44	30.08	24.00	9.57	1.42	36.00	100	0.0175	0.6288	1.9	2.705	3.3336
13750.0	19.80	30.64	24.00	9.75	1.48	36.00	100	0.0181	0.6505	1.9	2.806	3.4564
14000.0	20.16	31.19	24.00	9.93	1.53	36.00	100	0.0187	0.6726	1.9	2.909	3.5814
14250.0	20.52	31.75	24.00	10.11	1.59	36.00	100	0.0193	0.6950	1.9	3.014	3.7087
14500.0	20.88	32.31	24.00	10.28	1.64	36.00	100	0.0199	0.7178	1.9	3.120	3.8381
14750.0	21.24	32.87	24.00	10.46	1.70	36.00	100	0.0206	0.7408	1.9	3.229	3.9697
15000.0	21.60	33.42	24.00	10.64	1.76	36.00	100	0.0212	0.7643	1.9	3.339	4.1035
15250.0	21.96	33.98	24.00	10.82	1.82	36.00	100	0.0219	0.7880	1.9	3.451	4.2395
15500.0	22.32	34.54	24.00	10.99	1.88	36.00	100	0.0226	0.8121	1.9	3.566	4.3777
15750.0	22.68	35.09	24.00	11.17	1.94	36.00	100	0.0232	0.8365	1.9	3.681	4.5180
16000.0	23.04	35.65	24.00	11.35	2.00	36.00	100	0.0239	0.8613	1.9	3.799	4.6606

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	10260	120	0.0000	0.0000	4.5	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	10260	120	0.0000	0.0816	4.5	0.002	0.0838
500.0	0.72	1.11	23.85	0.36	0.00	10260	120	0.0000	0.2945	4.5	0.009	0.3035
750.0	1.08	1.67	23.85	0.54	0.00	10260	120	0.0001	0.6240	4.5	0.020	0.6443
1000.0	1.44	2.23	23.85	0.72	0.01	10260	120	0.0001	1.0631	4.5	0.036	1.0992
1250.0	1.80	2.79	23.85	0.90	0.01	10260	120	0.0002	1.6072	4.5	0.056	1.6635
1500.0	2.16	3.34	23.85	1.08	0.02	10260	120	0.0002	2.2527	4.5	0.081	2.3338
1750.0	2.52	3.90	23.85	1.26	0.02	10260	120	0.0003	2.9971	4.5	0.110	3.1074
2000.0	2.88	4.46	23.85	1.44	0.03	10260	120	0.0004	3.8379	4.5	0.144	3.9821
2250.0	3.24	5.01	23.85	1.62	0.04	10260	120	0.0005	4.7734	4.5	0.182	4.9559
2500.0	3.60	5.57	23.85	1.80	0.05	10260	120	0.0006	5.8019	4.5	0.225	6.0272
2750.0	3.96	6.13	23.85	1.98	0.06	10260	120	0.0007	6.9220	4.5	0.273	7.1946
3000.0	4.32	6.68	23.85	2.15	0.07	10260	120	0.0008	8.1324	4.5	0.324	8.4568
3250.0	4.68	7.24	23.85	2.33	0.08	10260	120	0.0009	9.4319	4.5	0.381	9.8126
3500.0	5.04	7.80	23.85	2.51	0.10	10260	120	0.0011	10.8194	4.5	0.442	11.2609
3750.0	5.40	8.36	23.85	2.69	0.11	10260	120	0.0012	12.2940	4.5	0.507	12.8009
4000.0	5.76	8.91	23.85	2.87	0.13	10260	120	0.0014	13.8549	4.5	0.577	14.4316
4250.0	6.12	9.47	23.85	3.05	0.14	10260	120	0.0015	15.5012	4.5	0.651	16.1522
4500.0	6.48	10.03	23.85	3.23	0.16	10260	120	0.0017	17.2321	4.5	0.730	17.9620
4750.0	6.84	10.58	23.85	3.41	0.18	10260	120	0.0019	19.0470	4.5	0.813	19.8602
5000.0	7.20	11.14	23.85	3.59	0.20	10260	120	0.0020	20.9451	4.5	0.901	21.8461
5250.0	7.56	11.70	23.85	3.77	0.22	10260	120	0.0022	22.9258	4.5	0.993	23.9192
5500.0	7.92	12.25	23.85	3.95	0.24	10260	120	0.0024	24.9885	4.5	1.090	26.0788
5750.0	8.28	12.81	23.85	4.13	0.26	10260	120	0.0026	27.1328	4.5	1.192	28.3244
6000.0	8.64	13.37	23.85	4.31	0.29	10260	120	0.0029	29.3579	4.5	1.298	30.6554
6250.0	9.00	13.93	23.85	4.49	0.31	10260	120	0.0031	31.6635	4.5	1.408	33.0714
6500.0	9.36	14.48	23.85	4.67	0.34	10260	120	0.0033	34.0490	4.5	1.523	35.5718
6750.0	9.72	15.04	23.85	4.85	0.36	10260	120	0.0036	36.5140	4.5	1.642	38.1562

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To B Modified High Point

7000.0	10.08	15.60	23.85	5.03	0.39	10260	120	0.0038	39.0581	4.5	1.766	40.8241
7250.0	10.44	16.15	23.85	5.21	0.42	10260	120	0.0041	41.6807	4.5	1.894	43.5752
7500.0	10.80	16.71	23.85	5.39	0.45	10260	120	0.0043	44.3816	4.5	2.027	46.4089
7750.0	11.16	17.27	23.85	5.57	0.48	10260	120	0.0046	47.1602	4.5	2.165	49.3250
8000.0	11.52	17.83	23.85	5.75	0.51	10260	120	0.0049	50.0163	4.5	2.307	52.3230
8250.0	11.88	18.38	23.85	5.93	0.55	10260	120	0.0052	52.9495	4.5	2.453	55.4026
8500.0	12.24	18.94	23.85	6.10	0.58	10260	120	0.0055	55.9594	4.5	2.604	58.5634
8750.0	12.60	19.50	23.85	6.28	0.61	10260	120	0.0058	59.0457	4.5	2.759	61.8051
9000.0	12.96	20.05	23.85	6.46	0.65	10260	120	0.0061	62.2080	4.5	2.919	65.1274
9250.0	13.32	20.61	23.85	6.64	0.69	10260	120	0.0064	65.4461	4.5	3.084	68.5299
9500.0	13.68	21.17	23.85	6.82	0.72	10260	120	0.0067	68.7596	4.5	3.253	72.0124
9750.0	14.04	21.72	23.85	7.00	0.76	10260	120	0.0070	72.1482	4.5	3.426	75.5745
10000.0	14.40	22.28	23.85	7.18	0.80	10260	120	0.0074	75.6117	4.5	3.604	79.2159
10250.0	14.76	22.84	23.85	7.36	0.84	10260	120	0.0077	79.1498	4.5	3.787	82.9365
10500.0	15.12	23.40	23.85	7.54	0.88	10260	120	0.0081	82.7621	4.5	3.974	86.7358
10750.0	15.48	23.95	23.85	7.72	0.93	10260	120	0.0084	86.4485	4.5	4.165	90.6137
11000.0	15.84	24.51	23.85	7.90	0.97	10260	120	0.0088	90.2087	4.5	4.361	94.5698
11250.0	16.20	25.07	23.85	8.08	1.01	10260	120	0.0092	94.0424	4.5	4.562	98.6040
11500.0	16.56	25.62	23.85	8.26	1.06	10260	120	0.0095	97.9493	4.5	4.767	102.7159
11750.0	16.92	26.18	23.85	8.44	1.11	10260	120	0.0099	101.9293	4.5	4.976	106.9054
12000.0	17.28	26.74	23.85	8.62	1.15	10260	120	0.0103	105.9822	4.5	5.190	111.1722
12250.0	17.64	27.30	23.85	8.80	1.20	10260	120	0.0107	110.1075	4.5	5.409	115.5161
12500.0	18.00	27.85	23.85	8.98	1.25	10260	120	0.0111	114.3053	4.5	5.632	119.9369
12750.0	18.36	28.41	23.85	9.16	1.30	10260	120	0.0116	118.5752	4.5	5.859	124.4343
13000.0	18.72	28.97	23.85	9.34	1.35	10260	120	0.0120	122.9171	4.5	6.091	129.0082
13250.0	19.08	29.52	23.85	9.52	1.41	10260	120	0.0124	127.3306	4.5	6.328	133.6583
13500.0	19.44	30.08	23.85	9.70	1.46	10260	120	0.0128	131.8157	4.5	6.569	138.3844
13750.0	19.80	30.64	23.85	9.88	1.51	10260	120	0.0133	136.3721	4.5	6.814	143.1864
14000.0	20.16	31.19	23.85	10.05	1.57	10260	120	0.0137	140.9997	4.5	7.064	148.0640
14250.0	20.52	31.75	23.85	10.23	1.63	10260	120	0.0142	145.6982	4.5	7.319	153.0170
14500.0	20.88	32.31	23.85	10.41	1.68	10260	120	0.0147	150.4675	4.5	7.578	158.0454
14750.0	21.24	32.87	23.85	10.59	1.74	10260	120	0.0151	155.3073	4.5	7.841	163.1488
15000.0	21.60	33.42	23.85	10.77	1.80	10260	120	0.0156	160.2175	4.5	8.110	168.3271
15250.0	21.96	33.98	23.85	10.95	1.86	10260	120	0.0161	165.1980	4.5	8.382	173.5801
15500.0	22.32	34.54	23.85	11.13	1.92	10260	120	0.0166	170.2485	4.5	8.659	178.9077
15750.0	22.68	35.09	23.85	11.31	1.99	10260	120	0.0171	175.3689	4.5	8.941	184.3097
16000.0	23.04	35.65	23.85	11.49	2.05	10260	120	0.0176	180.5591	4.5	9.227	189.7859

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	620	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	620	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	620	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	620	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	620	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	620	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	620	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	620	120	0.0003	0.1811	2.7	0.066	0.2473
2000.0	2.88	4.46	23.85	1.44	0.03	620	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	620	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	620	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	620	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	620	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	620	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	620	120	0.0011	0.6538	2.7	0.265	0.9187

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To B Modified High Point

3750.0	5.40	8.36	23.85	2.69	0.11	620	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	620	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	620	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	620	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	620	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	620	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	620	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	620	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	620	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	620	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	620	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	620	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	620	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	620	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	620	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	620	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	620	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	620	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	620	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	620	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	620	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	620	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	620	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	620	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	620	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	620	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	620	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	620	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	620	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	620	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	620	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	620	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	620	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	620	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	620	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	620	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	620	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	620	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	620	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	620	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	620	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	620	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	620	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	620	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	620	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	620	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	620	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	620	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	620	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	620	120	0.0176	10.9108	2.7	5.536	16.4469

FM System Curve – 25.14" (24" HDPE)

Diameter = 25.14 in

Area = 3.447132 ft^2

RH=D/4= 0.52375

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.14	0.00	0.00	625	100	0.0000	0.0000	0.6	0.000	0.0000
250.0	0.36	0.56	25.14	0.16	0.00	625	100	0.0000	0.0054	0.6	0.000	0.0056

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To B Modified High Point

500.0	0.72	1.11	25.14	0.32	0.00	625	100	0.0000	0.0195	0.6	0.001	0.0204
750.0	1.08	1.67	25.14	0.48	0.00	625	100	0.0001	0.0412	0.6	0.002	0.0434
1000.0	1.44	2.23	25.14	0.65	0.01	625	100	0.0001	0.0702	0.6	0.004	0.0741
1250.0	1.80	2.79	25.14	0.81	0.01	625	100	0.0002	0.1062	0.6	0.006	0.1123
1500.0	2.16	3.34	25.14	0.97	0.01	625	100	0.0002	0.1488	0.6	0.009	0.1576
1750.0	2.52	3.90	25.14	1.13	0.02	625	100	0.0003	0.1980	0.6	0.012	0.2099
2000.0	2.88	4.46	25.14	1.29	0.03	625	100	0.0004	0.2535	0.6	0.016	0.2691
2250.0	3.24	5.01	25.14	1.45	0.03	625	100	0.0005	0.3153	0.6	0.020	0.3350
2500.0	3.60	5.57	25.14	1.62	0.04	625	100	0.0006	0.3833	0.6	0.024	0.4076
2750.0	3.96	6.13	25.14	1.78	0.05	625	100	0.0007	0.4573	0.6	0.029	0.4867
3000.0	4.32	6.68	25.14	1.94	0.06	625	100	0.0009	0.5372	0.6	0.035	0.5723
3250.0	4.68	7.24	25.14	2.10	0.07	625	100	0.0010	0.6231	0.6	0.041	0.6642
3500.0	5.04	7.80	25.14	2.26	0.08	625	100	0.0011	0.7147	0.6	0.048	0.7624
3750.0	5.40	8.36	25.14	2.42	0.09	625	100	0.0013	0.8122	0.6	0.055	0.8669
4000.0	5.76	8.91	25.14	2.59	0.10	625	100	0.0015	0.9153	0.6	0.062	0.9776
4250.0	6.12	9.47	25.14	2.75	0.12	625	100	0.0016	1.0240	0.6	0.070	1.0943
4500.0	6.48	10.03	25.14	2.91	0.13	625	100	0.0018	1.1384	0.6	0.079	1.2172
4750.0	6.84	10.58	25.14	3.07	0.15	625	100	0.0020	1.2583	0.6	0.088	1.3461
5000.0	7.20	11.14	25.14	3.23	0.16	625	100	0.0022	1.3837	0.6	0.097	1.4810
5250.0	7.56	11.70	25.14	3.39	0.18	625	100	0.0024	1.5145	0.6	0.107	1.6218
5500.0	7.92	12.25	25.14	3.56	0.20	625	100	0.0026	1.6508	0.6	0.118	1.7685
5750.0	8.28	12.81	25.14	3.72	0.21	625	100	0.0029	1.7924	0.6	0.129	1.9211
6000.0	8.64	13.37	25.14	3.88	0.23	625	100	0.0031	1.9394	0.6	0.140	2.0796
6250.0	9.00	13.93	25.14	4.04	0.25	625	100	0.0033	2.0917	0.6	0.152	2.2438
6500.0	9.36	14.48	25.14	4.20	0.27	625	100	0.0036	2.2493	0.6	0.164	2.4138
6750.0	9.72	15.04	25.14	4.36	0.30	625	100	0.0039	2.4122	0.6	0.177	2.5895
7000.0	10.08	15.60	25.14	4.52	0.32	625	100	0.0041	2.5802	0.6	0.191	2.7710
7250.0	10.44	16.15	25.14	4.69	0.34	625	100	0.0044	2.7535	0.6	0.205	2.9581
7500.0	10.80	16.71	25.14	4.85	0.36	625	100	0.0047	2.9319	0.6	0.219	3.1509
7750.0	11.16	17.27	25.14	5.01	0.39	625	100	0.0050	3.1155	0.6	0.234	3.3493
8000.0	11.52	17.83	25.14	5.17	0.42	625	100	0.0053	3.3042	0.6	0.249	3.5533
8250.0	11.88	18.38	25.14	5.33	0.44	625	100	0.0056	3.4979	0.6	0.265	3.7629
8500.0	12.24	18.94	25.14	5.49	0.47	625	100	0.0059	3.6968	0.6	0.281	3.9780
8750.0	12.60	19.50	25.14	5.66	0.50	625	100	0.0062	3.9006	0.6	0.298	4.1987
9000.0	12.96	20.05	25.14	5.82	0.53	625	100	0.0066	4.1096	0.6	0.315	4.4249
9250.0	13.32	20.61	25.14	5.98	0.56	625	100	0.0069	4.3235	0.6	0.333	4.6565
9500.0	13.68	21.17	25.14	6.14	0.59	625	100	0.0073	4.5424	0.6	0.351	4.8937
9750.0	14.04	21.72	25.14	6.30	0.62	625	100	0.0076	4.7662	0.6	0.370	5.1363
10000.0	14.40	22.28	25.14	6.46	0.65	625	100	0.0080	4.9950	0.6	0.389	5.3843
10250.0	14.76	22.84	25.14	6.63	0.68	625	100	0.0084	5.2288	0.6	0.409	5.6377
10500.0	15.12	23.40	25.14	6.79	0.72	625	100	0.0087	5.4674	0.6	0.429	5.8966
10750.0	15.48	23.95	25.14	6.95	0.75	625	100	0.0091	5.7109	0.6	0.450	6.1608
11000.0	15.84	24.51	25.14	7.11	0.79	625	100	0.0095	5.9593	0.6	0.471	6.4303
11250.0	16.20	25.07	25.14	7.27	0.82	625	100	0.0099	6.2126	0.6	0.493	6.7052
11500.0	16.56	25.62	25.14	7.43	0.86	625	100	0.0104	6.4707	0.6	0.515	6.9855
11750.0	16.92	26.18	25.14	7.59	0.90	625	100	0.0108	6.7336	0.6	0.537	7.2710
12000.0	17.28	26.74	25.14	7.76	0.93	625	100	0.0112	7.0013	0.6	0.561	7.5619
12250.0	17.64	27.30	25.14	7.92	0.97	625	100	0.0116	7.2739	0.6	0.584	7.8580
12500.0	18.00	27.85	25.14	8.08	1.01	625	100	0.0121	7.5512	0.6	0.608	8.1594
12750.0	18.36	28.41	25.14	8.24	1.05	625	100	0.0125	7.8333	0.6	0.633	8.4661
13000.0	18.72	28.97	25.14	8.40	1.10	625	100	0.0130	8.1201	0.6	0.658	8.7779
13250.0	19.08	29.52	25.14	8.56	1.14	625	100	0.0135	8.4117	0.6	0.683	9.0951
13500.0	19.44	30.08	25.14	8.73	1.18	625	100	0.0139	8.7079	0.6	0.709	9.4174
13750.0	19.80	30.64	25.14	8.89	1.23	625	100	0.0144	9.0089	0.6	0.736	9.7449
14000.0	20.16	31.19	25.14	9.05	1.27	625	100	0.0149	9.3147	0.6	0.763	10.0776
14250.0	20.52	31.75	25.14	9.21	1.32	625	100	0.0154	9.6250	0.6	0.790	10.4155
14500.0	20.88	32.31	25.14	9.37	1.36	625	100	0.0159	9.9401	0.6	0.818	10.7585
14750.0	21.24	32.87	25.14	9.53	1.41	625	100	0.0164	10.2598	0.6	0.847	11.1067
15000.0	21.60	33.42	25.14	9.70	1.46	625	100	0.0169	10.5842	0.6	0.876	11.4601
15250.0	21.96	33.98	25.14	9.86	1.51	625	100	0.0175	10.9132	0.6	0.905	11.8185
15500.0	22.32	34.54	25.14	10.02	1.56	625	100	0.0180	11.2469	0.6	0.935	12.1821
15750.0	22.68	35.09	25.14	10.18	1.61	625	100	0.0185	11.5851	0.6	0.966	12.5508
16000.0	23.04	35.65	25.14	10.34	1.66	625	100	0.0191	11.9280	0.6	0.997	12.9245

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To B Modified High Point

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FM System Curve – 25.3" (30" HDPE)

Diameter = 25.3 in
Area = 3.491149 ft^2
RH=D/4= 0.527083
C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.30	0.00	0.00	2455	120	0.0000	0.0000	2.75	0.000	0.0000
250.0	0.36	0.56	25.30	0.16	0.00	2455	120	0.0000	0.0146	2.75	0.001	0.0157
500.0	0.72	1.11	25.30	0.32	0.00	2455	120	0.0000	0.0529	2.75	0.004	0.0572
750.0	1.08	1.67	25.30	0.48	0.00	2455	120	0.0000	0.1120	2.75	0.010	0.1218
1000.0	1.44	2.23	25.30	0.64	0.01	2455	120	0.0001	0.1908	2.75	0.017	0.2082
1250.0	1.80	2.79	25.30	0.80	0.01	2455	120	0.0001	0.2885	2.75	0.027	0.3157
1500.0	2.16	3.34	25.30	0.96	0.01	2455	120	0.0002	0.4044	2.75	0.039	0.4435
1750.0	2.52	3.90	25.30	1.12	0.02	2455	120	0.0002	0.5380	2.75	0.053	0.5912
2000.0	2.88	4.46	25.30	1.28	0.03	2455	120	0.0003	0.6889	2.75	0.070	0.7585
2250.0	3.24	5.01	25.30	1.44	0.03	2455	120	0.0003	0.8568	2.75	0.088	0.9449
2500.0	3.60	5.57	25.30	1.60	0.04	2455	120	0.0004	1.0414	2.75	0.109	1.1501
2750.0	3.96	6.13	25.30	1.76	0.05	2455	120	0.0005	1.2425	2.75	0.132	1.3740
3000.0	4.32	6.68	25.30	1.91	0.06	2455	120	0.0006	1.4597	2.75	0.157	1.6163
3250.0	4.68	7.24	25.30	2.07	0.07	2455	120	0.0007	1.6930	2.75	0.184	1.8767
3500.0	5.04	7.80	25.30	2.23	0.08	2455	120	0.0008	1.9420	2.75	0.213	2.1551
3750.0	5.40	8.36	25.30	2.39	0.09	2455	120	0.0009	2.2067	2.75	0.245	2.4513
4000.0	5.76	8.91	25.30	2.55	0.10	2455	120	0.0010	2.4869	2.75	0.278	2.7652
4250.0	6.12	9.47	25.30	2.71	0.11	2455	120	0.0011	2.7824	2.75	0.314	3.0966
4500.0	6.48	10.03	25.30	2.87	0.13	2455	120	0.0013	3.0931	2.75	0.352	3.4453
4750.0	6.84	10.58	25.30	3.03	0.14	2455	120	0.0014	3.4189	2.75	0.392	3.8113
5000.0	7.20	11.14	25.30	3.19	0.16	2455	120	0.0015	3.7596	2.75	0.435	4.1944
5250.0	7.56	11.70	25.30	3.35	0.17	2455	120	0.0017	4.1151	2.75	0.479	4.5945
5500.0	7.92	12.25	25.30	3.51	0.19	2455	120	0.0018	4.4854	2.75	0.526	5.0115
5750.0	8.28	12.81	25.30	3.67	0.21	2455	120	0.0020	4.8702	2.75	0.575	5.4453
6000.0	8.64	13.37	25.30	3.83	0.23	2455	120	0.0021	5.2696	2.75	0.626	5.8958
6250.0	9.00	13.93	25.30	3.99	0.25	2455	120	0.0023	5.6835	2.75	0.679	6.3629
6500.0	9.36	14.48	25.30	4.15	0.27	2455	120	0.0025	6.1117	2.75	0.735	6.8466
6750.0	9.72	15.04	25.30	4.31	0.29	2455	120	0.0027	6.5541	2.75	0.793	7.3467
7000.0	10.08	15.60	25.30	4.47	0.31	2455	120	0.0029	7.0108	2.75	0.852	7.8631
7250.0	10.44	16.15	25.30	4.63	0.33	2455	120	0.0030	7.4815	2.75	0.914	8.3958
7500.0	10.80	16.71	25.30	4.79	0.36	2455	120	0.0032	7.9663	2.75	0.978	8.9448
7750.0	11.16	17.27	25.30	4.95	0.38	2455	120	0.0034	8.4651	2.75	1.045	9.5098
8000.0	11.52	17.83	25.30	5.11	0.40	2455	120	0.0037	8.9778	2.75	1.113	10.0910
8250.0	11.88	18.38	25.30	5.27	0.43	2455	120	0.0039	9.5043	2.75	1.184	10.6881
8500.0	12.24	18.94	25.30	5.42	0.46	2455	120	0.0041	10.0445	2.75	1.257	11.3012
8750.0	12.60	19.50	25.30	5.58	0.48	2455	120	0.0043	10.5985	2.75	1.332	11.9302
9000.0	12.96	20.05	25.30	5.74	0.51	2455	120	0.0045	11.1661	2.75	1.409	12.5751
9250.0	13.32	20.61	25.30	5.90	0.54	2455	120	0.0048	11.7473	2.75	1.488	13.2356
9500.0	13.68	21.17	25.30	6.06	0.57	2455	120	0.0050	12.3421	2.75	1.570	13.9119
9750.0	14.04	21.72	25.30	6.22	0.60	2455	120	0.0053	12.9504	2.75	1.654	14.6039
10000.0	14.40	22.28	25.30	6.38	0.63	2455	120	0.0055	13.5720	2.75	1.739	15.3115
10250.0	14.76	22.84	25.30	6.54	0.66	2455	120	0.0058	14.2071	2.75	1.827	16.0346
10500.0	15.12	23.40	25.30	6.70	0.70	2455	120	0.0061	14.8555	2.75	1.918	16.7732
10750.0	15.48	23.95	25.30	6.86	0.73	2455	120	0.0063	15.5172	2.75	2.010	17.5273
11000.0	15.84	24.51	25.30	7.02	0.77	2455	120	0.0066	16.1921	2.75	2.105	18.2968
11250.0	16.20	25.07	25.30	7.18	0.80	2455	120	0.0069	16.8803	2.75	2.201	19.0817
11500.0	16.56	25.62	25.30	7.34	0.84	2455	120	0.0072	17.5816	2.75	2.300	19.8819
11750.0	16.92	26.18	25.30	7.50	0.87	2455	120	0.0075	18.2960	2.75	2.401	20.6975
12000.0	17.28	26.74	25.30	7.66	0.91	2455	120	0.0077	19.0234	2.75	2.505	21.5282
12250.0	17.64	27.30	25.30	7.82	0.95	2455	120	0.0081	19.7639	2.75	2.610	22.3741
12500.0	18.00	27.85	25.30	7.98	0.99	2455	120	0.0084	20.5174	2.75	2.718	23.2353
12750.0	18.36	28.41	25.30	8.14	1.03	2455	120	0.0087	21.2838	2.75	2.828	24.1115
13000.0	18.72	28.97	25.30	8.30	1.07	2455	120	0.0090	22.0632	2.75	2.940	25.0028
13250.0	19.08	29.52	25.30	8.46	1.11	2455	120	0.0093	22.8554	2.75	3.054	25.9092

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To B Modified High Point

13500.0	19.44	30.08	25.30	8.62	1.15	2455	120	0.0096	23.6605	2.75	3.170	26.8306
13750.0	19.80	30.64	25.30	8.78	1.20	2455	120	0.0100	24.4783	2.75	3.289	27.7669
14000.0	20.16	31.19	25.30	8.94	1.24	2455	120	0.0103	25.3090	2.75	3.409	28.7182
14250.0	20.52	31.75	25.30	9.09	1.28	2455	120	0.0107	26.1523	2.75	3.532	29.6844
14500.0	20.88	32.31	25.30	9.25	1.33	2455	120	0.0110	27.0084	2.75	3.657	30.6655
14750.0	21.24	32.87	25.30	9.41	1.38	2455	120	0.0114	27.8771	2.75	3.784	31.6615
15000.0	21.60	33.42	25.30	9.57	1.42	2455	120	0.0117	28.7585	2.75	3.914	32.6722
15250.0	21.96	33.98	25.30	9.73	1.47	2455	120	0.0121	29.6525	2.75	4.045	33.6977
15500.0	22.32	34.54	25.30	9.89	1.52	2455	120	0.0124	30.5590	2.75	4.179	34.7380
15750.0	22.68	35.09	25.30	10.05	1.57	2455	120	0.0128	31.4781	2.75	4.315	35.7930
16000.0	23.04	35.65	25.30	10.21	1.62	2455	120	0.0132	32.4097	2.75	4.453	36.8626

FM System Curve – 24”

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	5273	100	0.0000	0.0000	4.66	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	5273	100	0.0000	0.0570	4.66	0.002	0.0593
500.0	0.72	1.11	24.00	0.35	0.00	5273	100	0.0000	0.2058	4.66	0.009	0.2149
750.0	1.08	1.67	24.00	0.53	0.00	5273	100	0.0001	0.4360	4.66	0.020	0.4565
1000.0	1.44	2.23	24.00	0.71	0.01	5273	100	0.0001	0.7428	4.66	0.036	0.7792
1250.0	1.80	2.79	24.00	0.89	0.01	5273	100	0.0002	1.1229	4.66	0.057	1.1798
1500.0	2.16	3.34	24.00	1.06	0.02	5273	100	0.0003	1.5740	4.66	0.082	1.6559
1750.0	2.52	3.90	24.00	1.24	0.02	5273	100	0.0004	2.0941	4.66	0.111	2.2055
2000.0	2.88	4.46	24.00	1.42	0.03	5273	100	0.0005	2.6816	4.66	0.146	2.8272
2250.0	3.24	5.01	24.00	1.60	0.04	5273	100	0.0006	3.3352	4.66	0.184	3.5195
2500.0	3.60	5.57	24.00	1.77	0.05	5273	100	0.0008	4.0538	4.66	0.227	4.2813
2750.0	3.96	6.13	24.00	1.95	0.06	5273	100	0.0009	4.8364	4.66	0.275	5.1117
3000.0	4.32	6.68	24.00	2.13	0.07	5273	100	0.0011	5.6821	4.66	0.328	6.0097
3250.0	4.68	7.24	24.00	2.31	0.08	5273	100	0.0012	6.5901	4.66	0.384	6.9745
3500.0	5.04	7.80	24.00	2.48	0.10	5273	100	0.0014	7.5595	4.66	0.446	8.0054
3750.0	5.40	8.36	24.00	2.66	0.11	5273	100	0.0016	8.5899	4.66	0.512	9.1017
4000.0	5.76	8.91	24.00	2.84	0.12	5273	100	0.0018	9.6805	4.66	0.582	10.2628
4250.0	6.12	9.47	24.00	3.01	0.14	5273	100	0.0021	10.8307	4.66	0.657	11.4882
4500.0	6.48	10.03	24.00	3.19	0.16	5273	100	0.0023	12.0401	4.66	0.737	12.7772
4750.0	6.84	10.58	24.00	3.37	0.18	5273	100	0.0025	13.3081	4.66	0.821	14.1294
5000.0	7.20	11.14	24.00	3.55	0.20	5273	100	0.0028	14.6343	4.66	0.910	15.5443
5250.0	7.56	11.70	24.00	3.72	0.22	5273	100	0.0030	16.0183	4.66	1.003	17.0215
5500.0	7.92	12.25	24.00	3.90	0.24	5273	100	0.0033	17.4595	4.66	1.101	18.5606
5750.0	8.28	12.81	24.00	4.08	0.26	5273	100	0.0036	18.9577	4.66	1.203	20.1612
6000.0	8.64	13.37	24.00	4.26	0.28	5273	100	0.0039	20.5124	4.66	1.310	21.8228
6250.0	9.00	13.93	24.00	4.43	0.31	5273	100	0.0042	22.1233	4.66	1.422	23.5452
6500.0	9.36	14.48	24.00	4.61	0.33	5273	100	0.0045	23.7901	4.66	1.538	25.3280
6750.0	9.72	15.04	24.00	4.79	0.36	5273	100	0.0048	25.5124	4.66	1.658	27.1709
7000.0	10.08	15.60	24.00	4.96	0.38	5273	100	0.0052	27.2899	4.66	1.784	29.0735
7250.0	10.44	16.15	24.00	5.14	0.41	5273	100	0.0055	29.1224	4.66	1.913	31.0356
7500.0	10.80	16.71	24.00	5.32	0.44	5273	100	0.0059	31.0095	4.66	2.047	33.0569
7750.0	11.16	17.27	24.00	5.50	0.47	5273	100	0.0062	32.9509	4.66	2.186	35.1372
8000.0	11.52	17.83	24.00	5.67	0.50	5273	100	0.0066	34.9465	4.66	2.330	37.2760
8250.0	11.88	18.38	24.00	5.85	0.53	5273	100	0.0070	36.9959	4.66	2.477	39.4733
8500.0	12.24	18.94	24.00	6.03	0.56	5273	100	0.0074	39.0989	4.66	2.630	41.7288
8750.0	12.60	19.50	24.00	6.21	0.60	5273	100	0.0078	41.2553	4.66	2.787	44.0421
9000.0	12.96	20.05	24.00	6.38	0.63	5273	100	0.0082	43.4648	4.66	2.948	46.4132
9250.0	13.32	20.61	24.00	6.56	0.67	5273	100	0.0087	45.7273	4.66	3.114	48.8417
9500.0	13.68	21.17	24.00	6.74	0.70	5273	100	0.0091	48.0424	4.66	3.285	51.3275
9750.0	14.04	21.72	24.00	6.92	0.74	5273	100	0.0096	50.4101	4.66	3.460	53.8703
10000.0	14.40	22.28	24.00	7.09	0.78	5273	100	0.0100	52.8300	4.66	3.640	56.4700

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To B Modified High Point

10250.0	14.76	22.84	24.00	7.27	0.82	5273	100	0.0105	55.3021	4.66	3.824	59.1263
10500.0	15.12	23.40	24.00	7.45	0.86	5273	100	0.0110	57.8260	4.66	4.013	61.8391
10750.0	15.48	23.95	24.00	7.62	0.90	5273	100	0.0115	60.4017	4.66	4.206	64.6081
11000.0	15.84	24.51	24.00	7.80	0.95	5273	100	0.0120	63.0289	4.66	4.404	67.4333
11250.0	16.20	25.07	24.00	7.98	0.99	5273	100	0.0125	65.7075	4.66	4.607	70.3143
11500.0	16.56	25.62	24.00	8.16	1.03	5273	100	0.0130	68.4373	4.66	4.814	73.2512
11750.0	16.92	26.18	24.00	8.33	1.08	5273	100	0.0135	71.2182	4.66	5.025	76.2436
12000.0	17.28	26.74	24.00	8.51	1.12	5273	100	0.0140	74.0499	4.66	5.242	79.2914
12250.0	17.64	27.30	24.00	8.69	1.17	5273	100	0.0146	76.9323	4.66	5.462	82.3945
12500.0	18.00	27.85	24.00	8.87	1.22	5273	100	0.0151	79.8653	4.66	5.687	85.5527
12750.0	18.36	28.41	24.00	9.04	1.27	5273	100	0.0157	82.8487	4.66	5.917	88.7659
13000.0	18.72	28.97	24.00	9.22	1.32	5273	100	0.0163	85.8823	4.66	6.152	92.0338
13250.0	19.08	29.52	24.00	9.40	1.37	5273	100	0.0169	88.9661	4.66	6.390	95.3565
13500.0	19.44	30.08	24.00	9.57	1.42	5273	100	0.0175	92.0998	4.66	6.634	98.7336
13750.0	19.80	30.64	24.00	9.75	1.48	5273	100	0.0181	95.2834	4.66	6.882	102.1652
14000.0	20.16	31.19	24.00	9.93	1.53	5273	100	0.0187	98.5167	4.66	7.134	105.6510
14250.0	20.52	31.75	24.00	10.11	1.59	5273	100	0.0193	101.7996	4.66	7.391	109.1909
14500.0	20.88	32.31	24.00	10.28	1.64	5273	100	0.0199	105.1318	4.66	7.653	112.7848
14750.0	21.24	32.87	24.00	10.46	1.70	5273	100	0.0206	108.5135	4.66	7.919	116.4326
15000.0	21.60	33.42	24.00	10.64	1.76	5273	100	0.0212	111.9442	4.66	8.190	120.1341
15250.0	21.96	33.98	24.00	10.82	1.82	5273	100	0.0219	115.4241	4.66	8.465	123.8892
15500.0	22.32	34.54	24.00	10.99	1.88	5273	100	0.0226	118.9529	4.66	8.745	127.6979
15750.0	22.68	35.09	24.00	11.17	1.94	5273	100	0.0232	122.5305	4.66	9.029	131.5599
16000.0	23.04	35.65	24.00	11.35	2.00	5273	100	0.0239	126.1569	4.66	9.318	135.4751

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To B Modified High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	0.17
500.0	0.72	0.63
750.0	1.08	1.34
1000.0	1.44	2.29
1250.0	1.80	3.47
1500.0	2.16	4.87
1750.0	2.52	6.49
2000.0	2.88	8.32
2250.0	3.24	10.36
2500.0	3.60	12.61
2750.0	3.96	15.06
3000.0	4.32	17.71
3250.0	4.68	20.55
3500.0	5.04	23.60
3750.0	5.40	26.83
4000.0	5.76	30.26
4250.0	6.12	33.88
4500.0	6.48	37.69
4750.0	6.84	41.68
5000.0	7.20	45.86
5250.0	7.56	50.23
5500.0	7.92	54.78
5750.0	8.28	59.51
6000.0	8.64	64.42
6250.0	9.00	69.52
6500.0	9.36	74.79
6750.0	9.72	80.24
7000.0	10.08	85.87
7250.0	10.44	91.68
7500.0	10.80	97.66
7750.0	11.16	103.81
8000.0	11.52	110.14
8250.0	11.88	116.65
8500.0	12.24	123.32
8750.0	12.60	130.17
9000.0	12.96	137.19
9250.0	13.32	144.39
9500.0	13.68	151.75
9750.0	14.04	159.28
10000.0	14.40	166.98
10250.0	14.76	174.85
10500.0	15.12	182.88
10750.0	15.48	191.09
11000.0	15.84	199.46
11250.0	16.20	208.00
11500.0	16.56	216.70
11750.0	16.92	225.57
12000.0	17.28	234.60
12250.0	17.64	243.80
12500.0	18.00	253.16
12750.0	18.36	262.69
13000.0	18.72	272.38
13250.0	19.08	282.23
13500.0	19.44	292.24
13750.0	19.80	302.42
14000.0	20.16	312.76
14250.0	20.52	323.26
14500.0	20.88	333.92
14750.0	21.24	344.74
15000.0	21.60	355.72
15250.0	21.96	366.86
15500.0	22.32	378.16
15750.0	22.68	389.61
16000.0	23.04	401.23

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	31.35	35.85
250.0	0.36	31.52	36.02
500.0	0.72	31.98	36.48
750.0	1.08	32.69	37.19
1000.0	1.44	33.64	38.14
1250.0	1.80	34.82	39.32
1500.0	2.16	36.22	40.72
1750.0	2.52	37.84	42.34
2000.0	2.88	39.67	44.17
2250.0	3.24	41.71	46.21
2500.0	3.60	43.96	48.46
2750.0	3.96	46.41	50.91
3000.0	4.32	49.06	53.56
3250.0	4.68	51.90	56.40
3500.0	5.04	54.95	59.45
3750.0	5.40	58.18	62.68
4000.0	5.76	61.61	66.11
4250.0	6.12	65.23	69.73
4500.0	6.48	69.04	73.54
4750.0	6.84	73.03	77.53
5000.0	7.20	77.21	81.71
5250.0	7.56	81.58	86.08
5500.0	7.92	86.13	90.63
5750.0	8.28	90.86	95.36
6000.0	8.64	95.77	100.27
6250.0	9.00	100.87	105.37
6500.0	9.36	106.14	110.64
6750.0	9.72	111.59	116.09
7000.0	10.08	117.22	121.72
7250.0	10.44	123.03	127.53
7500.0	10.80	129.01	133.51
7750.0	11.16	135.16	139.66
8000.0	11.52	141.49	145.99
8250.0	11.88	148.00	152.50
8500.0	12.24	154.67	159.17
8750.0	12.60	161.52	166.02
9000.0	12.96	168.54	173.04
9250.0	13.32	175.74	180.24
9500.0	13.68	183.10	187.60
9750.0	14.04	190.63	195.13
10000.0	14.40	198.33	202.83
10250.0	14.76	206.20	210.70
10500.0	15.12	214.23	218.73
10750.0	15.48	222.44	226.94
11000.0	15.84	230.81	235.31
11250.0	16.20	239.35	243.85
11500.0	16.56	248.05	252.55
11750.0	16.92	256.92	261.42
12000.0	17.28	265.95	270.45
12250.0	17.64	275.15	279.65
12500.0	18.00	284.51	289.01
12750.0	18.36	294.04	298.54
13000.0	18.72	303.73	308.23
13250.0	19.08	313.58	318.08
13500.0	19.44	323.59	328.09
13750.0	19.80	333.77	338.27
14000.0	20.16	344.11	348.61
14250.0	20.52	354.61	359.11
14500.0	20.88	365.27	369.77
14750.0	21.24	376.09	380.59
15000.0	21.60	387.07	391.57
15250.0	21.96	398.21	402.71
15500.0	22.32	409.51	414.01
15750.0	22.68	420.96	425.46
16000.0	23.04	432.58	437.08

MIN Static Head = 31.35
MAX Static Head = 35.85

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To C Modified High Point

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FM System Curve – 24"

Diameter = 24 in
Area = 3.141593 ft^2
RH=D/4= 0.5
C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071
13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To C Modified High Point

13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve – 24" (24" Parallel FM Portion)

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	36.00	100	0.0000	0.0000	1.9	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	36.00	100	0.0000	0.0004	1.9	0.001	0.0013
500.0	0.72	1.11	24.00	0.35	0.00	36.00	100	0.0000	0.0014	1.9	0.004	0.0051
750.0	1.08	1.67	24.00	0.53	0.00	36.00	100	0.0001	0.0030	1.9	0.008	0.0113
1000.0	1.44	2.23	24.00	0.71	0.01	36.00	100	0.0001	0.0051	1.9	0.015	0.0199
1250.0	1.80	2.79	24.00	0.89	0.01	36.00	100	0.0002	0.0077	1.9	0.023	0.0309
1500.0	2.16	3.34	24.00	1.06	0.02	36.00	100	0.0003	0.0107	1.9	0.033	0.0441
1750.0	2.52	3.90	24.00	1.24	0.02	36.00	100	0.0004	0.0143	1.9	0.045	0.0597
2000.0	2.88	4.46	24.00	1.42	0.03	36.00	100	0.0005	0.0183	1.9	0.059	0.0777
2250.0	3.24	5.01	24.00	1.60	0.04	36.00	100	0.0006	0.0228	1.9	0.075	0.0979
2500.0	3.60	5.57	24.00	1.77	0.05	36.00	100	0.0008	0.0277	1.9	0.093	0.1204
2750.0	3.96	6.13	24.00	1.95	0.06	36.00	100	0.0009	0.0330	1.9	0.112	0.1453
3000.0	4.32	6.68	24.00	2.13	0.07	36.00	100	0.0011	0.0388	1.9	0.134	0.1724
3250.0	4.68	7.24	24.00	2.31	0.08	36.00	100	0.0012	0.0450	1.9	0.157	0.2017
3500.0	5.04	7.80	24.00	2.48	0.10	36.00	100	0.0014	0.0516	1.9	0.182	0.2334
3750.0	5.40	8.36	24.00	2.66	0.11	36.00	100	0.0016	0.0586	1.9	0.209	0.2673
4000.0	5.76	8.91	24.00	2.84	0.12	36.00	100	0.0018	0.0661	1.9	0.237	0.3035
4250.0	6.12	9.47	24.00	3.01	0.14	36.00	100	0.0021	0.0739	1.9	0.268	0.3420
4500.0	6.48	10.03	24.00	3.19	0.16	36.00	100	0.0023	0.0822	1.9	0.301	0.3827
4750.0	6.84	10.58	24.00	3.37	0.18	36.00	100	0.0025	0.0909	1.9	0.335	0.4257
5000.0	7.20	11.14	24.00	3.55	0.20	36.00	100	0.0028	0.0999	1.9	0.371	0.4709
5250.0	7.56	11.70	24.00	3.72	0.22	36.00	100	0.0030	0.1094	1.9	0.409	0.5184
5500.0	7.92	12.25	24.00	3.90	0.24	36.00	100	0.0033	0.1192	1.9	0.449	0.5681
5750.0	8.28	12.81	24.00	4.08	0.26	36.00	100	0.0036	0.1294	1.9	0.491	0.6201
6000.0	8.64	13.37	24.00	4.26	0.28	36.00	100	0.0039	0.1400	1.9	0.534	0.6743
6250.0	9.00	13.93	24.00	4.43	0.31	36.00	100	0.0042	0.1510	1.9	0.580	0.7308
6500.0	9.36	14.48	24.00	4.61	0.33	36.00	100	0.0045	0.1624	1.9	0.627	0.7895
6750.0	9.72	15.04	24.00	4.79	0.36	36.00	100	0.0048	0.1742	1.9	0.676	0.8504
7000.0	10.08	15.60	24.00	4.96	0.38	36.00	100	0.0052	0.1863	1.9	0.727	0.9135
7250.0	10.44	16.15	24.00	5.14	0.41	36.00	100	0.0055	0.1988	1.9	0.780	0.9789
7500.0	10.80	16.71	24.00	5.32	0.44	36.00	100	0.0059	0.2117	1.9	0.835	1.0465
7750.0	11.16	17.27	24.00	5.50	0.47	36.00	100	0.0062	0.2250	1.9	0.891	1.1163
8000.0	11.52	17.83	24.00	5.67	0.50	36.00	100	0.0066	0.2386	1.9	0.950	1.1884
8250.0	11.88	18.38	24.00	5.85	0.53	36.00	100	0.0070	0.2526	1.9	1.010	1.2627
8500.0	12.24	18.94	24.00	6.03	0.56	36.00	100	0.0074	0.2669	1.9	1.072	1.3392
8750.0	12.60	19.50	24.00	6.21	0.60	36.00	100	0.0078	0.2817	1.9	1.136	1.4179
9000.0	12.96	20.05	24.00	6.38	0.63	36.00	100	0.0082	0.2967	1.9	1.202	1.4989
9250.0	13.32	20.61	24.00	6.56	0.67	36.00	100	0.0087	0.3122	1.9	1.270	1.5820
9500.0	13.68	21.17	24.00	6.74	0.70	36.00	100	0.0091	0.3280	1.9	1.339	1.6674
9750.0	14.04	21.72	24.00	6.92	0.74	36.00	100	0.0096	0.3442	1.9	1.411	1.7550
10000.0	14.40	22.28	24.00	7.09	0.78	36.00	100	0.0100	0.3607	1.9	1.484	1.8448
10250.0	14.76	22.84	24.00	7.27	0.82	36.00	100	0.0105	0.3776	1.9	1.559	1.9368
10500.0	15.12	23.40	24.00	7.45	0.86	36.00	100	0.0110	0.3948	1.9	1.636	2.0310

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To C Modified High Point

10750.0	15.48	23.95	24.00	7.62	0.90	36.00	100	0.0115	0.4124	1.9	1.715	2.1274
11000.0	15.84	24.51	24.00	7.80	0.95	36.00	100	0.0120	0.4303	1.9	1.796	2.2261
11250.0	16.20	25.07	24.00	7.98	0.99	36.00	100	0.0125	0.4486	1.9	1.878	2.3269
11500.0	16.56	25.62	24.00	8.16	1.03	36.00	100	0.0130	0.4672	1.9	1.963	2.4300
11750.0	16.92	26.18	24.00	8.33	1.08	36.00	100	0.0135	0.4862	1.9	2.049	2.5352
12000.0	17.28	26.74	24.00	8.51	1.12	36.00	100	0.0140	0.5056	1.9	2.137	2.6427
12250.0	17.64	27.30	24.00	8.69	1.17	36.00	100	0.0146	0.5252	1.9	2.227	2.7523
12500.0	18.00	27.85	24.00	8.87	1.22	36.00	100	0.0151	0.5453	1.9	2.319	2.8642
12750.0	18.36	28.41	24.00	9.04	1.27	36.00	100	0.0157	0.5656	1.9	2.413	2.9782
13000.0	18.72	28.97	24.00	9.22	1.32	36.00	100	0.0163	0.5863	1.9	2.508	3.0945
13250.0	19.08	29.52	24.00	9.40	1.37	36.00	100	0.0169	0.6074	1.9	2.606	3.2129
13500.0	19.44	30.08	24.00	9.57	1.42	36.00	100	0.0175	0.6288	1.9	2.705	3.3336
13750.0	19.80	30.64	24.00	9.75	1.48	36.00	100	0.0181	0.6505	1.9	2.806	3.4564
14000.0	20.16	31.19	24.00	9.93	1.53	36.00	100	0.0187	0.6726	1.9	2.909	3.5814
14250.0	20.52	31.75	24.00	10.11	1.59	36.00	100	0.0193	0.6950	1.9	3.014	3.7087
14500.0	20.88	32.31	24.00	10.28	1.64	36.00	100	0.0199	0.7178	1.9	3.120	3.8381
14750.0	21.24	32.87	24.00	10.46	1.70	36.00	100	0.0206	0.7408	1.9	3.229	3.9697
15000.0	21.60	33.42	24.00	10.64	1.76	36.00	100	0.0212	0.7643	1.9	3.339	4.1035
15250.0	21.96	33.98	24.00	10.82	1.82	36.00	100	0.0219	0.7880	1.9	3.451	4.2395
15500.0	22.32	34.54	24.00	10.99	1.88	36.00	100	0.0226	0.8121	1.9	3.566	4.3777
15750.0	22.68	35.09	24.00	11.17	1.94	36.00	100	0.0232	0.8365	1.9	3.681	4.5180
16000.0	23.04	35.65	24.00	11.35	2.00	36.00	100	0.0239	0.8613	1.9	3.799	4.6606

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	10260	120	0.0000	0.0000	4.5	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	10260	120	0.0000	0.0816	4.5	0.002	0.0838
500.0	0.72	1.11	23.85	0.36	0.00	10260	120	0.0000	0.2945	4.5	0.009	0.3035
750.0	1.08	1.67	23.85	0.54	0.00	10260	120	0.0001	0.6240	4.5	0.020	0.6443
1000.0	1.44	2.23	23.85	0.72	0.01	10260	120	0.0001	1.0631	4.5	0.036	1.0992
1250.0	1.80	2.79	23.85	0.90	0.01	10260	120	0.0002	1.6072	4.5	0.056	1.6635
1500.0	2.16	3.34	23.85	1.08	0.02	10260	120	0.0002	2.2527	4.5	0.081	2.3338
1750.0	2.52	3.90	23.85	1.26	0.02	10260	120	0.0003	2.9971	4.5	0.110	3.1074
2000.0	2.88	4.46	23.85	1.44	0.03	10260	120	0.0004	3.8379	4.5	0.144	3.9821
2250.0	3.24	5.01	23.85	1.62	0.04	10260	120	0.0005	4.7734	4.5	0.182	4.9559
2500.0	3.60	5.57	23.85	1.80	0.05	10260	120	0.0006	5.8019	4.5	0.225	6.0272
2750.0	3.96	6.13	23.85	1.98	0.06	10260	120	0.0007	6.9220	4.5	0.273	7.1946
3000.0	4.32	6.68	23.85	2.15	0.07	10260	120	0.0008	8.1324	4.5	0.324	8.4568
3250.0	4.68	7.24	23.85	2.33	0.08	10260	120	0.0009	9.4319	4.5	0.381	9.8126
3500.0	5.04	7.80	23.85	2.51	0.10	10260	120	0.0011	10.8194	4.5	0.442	11.2609
3750.0	5.40	8.36	23.85	2.69	0.11	10260	120	0.0012	12.2940	4.5	0.507	12.8009
4000.0	5.76	8.91	23.85	2.87	0.13	10260	120	0.0014	13.8549	4.5	0.577	14.4316
4250.0	6.12	9.47	23.85	3.05	0.14	10260	120	0.0015	15.5012	4.5	0.651	16.1522
4500.0	6.48	10.03	23.85	3.23	0.16	10260	120	0.0017	17.2321	4.5	0.730	17.9620
4750.0	6.84	10.58	23.85	3.41	0.18	10260	120	0.0019	19.0470	4.5	0.813	19.8602
5000.0	7.20	11.14	23.85	3.59	0.20	10260	120	0.0020	20.9451	4.5	0.901	21.8461
5250.0	7.56	11.70	23.85	3.77	0.22	10260	120	0.0022	22.9258	4.5	0.993	23.9192
5500.0	7.92	12.25	23.85	3.95	0.24	10260	120	0.0024	24.9885	4.5	1.090	26.0788
5750.0	8.28	12.81	23.85	4.13	0.26	10260	120	0.0026	27.1328	4.5	1.192	28.3244
6000.0	8.64	13.37	23.85	4.31	0.29	10260	120	0.0029	29.3579	4.5	1.298	30.6554
6250.0	9.00	13.93	23.85	4.49	0.31	10260	120	0.0031	31.6635	4.5	1.408	33.0714
6500.0	9.36	14.48	23.85	4.67	0.34	10260	120	0.0033	34.0490	4.5	1.523	35.5718
6750.0	9.72	15.04	23.85	4.85	0.36	10260	120	0.0036	36.5140	4.5	1.642	38.1562
7000.0	10.08	15.60	23.85	5.03	0.39	10260	120	0.0038	39.0581	4.5	1.766	40.8241
7250.0	10.44	16.15	23.85	5.21	0.42	10260	120	0.0041	41.6807	4.5	1.894	43.5752
7500.0	10.80	16.71	23.85	5.39	0.45	10260	120	0.0043	44.3816	4.5	2.027	46.4089

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To C Modified High Point

7750.0	11.16	17.27	23.85	5.57	0.48	10260	120	0.0046	47.1602	4.5	2.165	49.3250
8000.0	11.52	17.83	23.85	5.75	0.51	10260	120	0.0049	50.0163	4.5	2.307	52.3230
8250.0	11.88	18.38	23.85	5.93	0.55	10260	120	0.0052	52.9495	4.5	2.453	55.4026
8500.0	12.24	18.94	23.85	6.10	0.58	10260	120	0.0055	55.9594	4.5	2.604	58.5634
8750.0	12.60	19.50	23.85	6.28	0.61	10260	120	0.0058	59.0457	4.5	2.759	61.8051
9000.0	12.96	20.05	23.85	6.46	0.65	10260	120	0.0061	62.2080	4.5	2.919	65.1274
9250.0	13.32	20.61	23.85	6.64	0.69	10260	120	0.0064	65.4461	4.5	3.084	68.5299
9500.0	13.68	21.17	23.85	6.82	0.72	10260	120	0.0067	68.7596	4.5	3.253	72.0124
9750.0	14.04	21.72	23.85	7.00	0.76	10260	120	0.0070	72.1482	4.5	3.426	75.5745
10000.0	14.40	22.28	23.85	7.18	0.80	10260	120	0.0074	75.6117	4.5	3.604	79.2159
10250.0	14.76	22.84	23.85	7.36	0.84	10260	120	0.0077	79.1498	4.5	3.787	82.9365
10500.0	15.12	23.40	23.85	7.54	0.88	10260	120	0.0081	82.7621	4.5	3.974	86.7358
10750.0	15.48	23.95	23.85	7.72	0.93	10260	120	0.0084	86.4485	4.5	4.165	90.6137
11000.0	15.84	24.51	23.85	7.90	0.97	10260	120	0.0088	90.2087	4.5	4.361	94.5698
11250.0	16.20	25.07	23.85	8.08	1.01	10260	120	0.0092	94.0424	4.5	4.562	98.6040
11500.0	16.56	25.62	23.85	8.26	1.06	10260	120	0.0095	97.9493	4.5	4.767	102.7159
11750.0	16.92	26.18	23.85	8.44	1.11	10260	120	0.0099	101.9293	4.5	4.976	106.9054
12000.0	17.28	26.74	23.85	8.62	1.15	10260	120	0.0103	105.9822	4.5	5.190	111.1722
12250.0	17.64	27.30	23.85	8.80	1.20	10260	120	0.0107	110.1075	4.5	5.409	115.5161
12500.0	18.00	27.85	23.85	8.98	1.25	10260	120	0.0111	114.3053	4.5	5.632	119.9369
12750.0	18.36	28.41	23.85	9.16	1.30	10260	120	0.0116	118.5752	4.5	5.859	124.4343
13000.0	18.72	28.97	23.85	9.34	1.35	10260	120	0.0120	122.9171	4.5	6.091	129.0082
13250.0	19.08	29.52	23.85	9.52	1.41	10260	120	0.0124	127.3306	4.5	6.328	133.6583
13500.0	19.44	30.08	23.85	9.70	1.46	10260	120	0.0128	131.8157	4.5	6.569	138.3844
13750.0	19.80	30.64	23.85	9.88	1.51	10260	120	0.0133	136.3721	4.5	6.814	143.1864
14000.0	20.16	31.19	23.85	10.05	1.57	10260	120	0.0137	140.9997	4.5	7.064	148.0640
14250.0	20.52	31.75	23.85	10.23	1.63	10260	120	0.0142	145.6982	4.5	7.319	153.0170
14500.0	20.88	32.31	23.85	10.41	1.68	10260	120	0.0147	150.4675	4.5	7.578	158.0454
14750.0	21.24	32.87	23.85	10.59	1.74	10260	120	0.0151	155.3073	4.5	7.841	163.1488
15000.0	21.60	33.42	23.85	10.77	1.80	10260	120	0.0156	160.2175	4.5	8.110	168.3271
15250.0	21.96	33.98	23.85	10.95	1.86	10260	120	0.0161	165.1980	4.5	8.382	173.5801
15500.0	22.32	34.54	23.85	11.13	1.92	10260	120	0.0166	170.2485	4.5	8.659	178.9077
15750.0	22.68	35.09	23.85	11.31	1.99	10260	120	0.0171	175.3689	4.5	8.941	184.3097
16000.0	23.04	35.65	23.85	11.49	2.05	10260	120	0.0176	180.5591	4.5	9.227	189.7859

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	620	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	620	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	620	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	620	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	620	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	620	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	620	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	620	120	0.0003	0.1811	2.7	0.066	0.2473
2000.0	2.88	4.46	23.85	1.44	0.03	620	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	620	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	620	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	620	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	620	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	620	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	620	120	0.0011	0.6538	2.7	0.265	0.9187
3750.0	5.40	8.36	23.85	2.69	0.11	620	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	620	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	620	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	620	120	0.0017	1.0413	2.7	0.438	1.4792

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To C Modified High Point

4750.0	6.84	10.58	23.85	3.41	0.18	620	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	620	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	620	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	620	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	620	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	620	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	620	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	620	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	620	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	620	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	620	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	620	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	620	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	620	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	620	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	620	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	620	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	620	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	620	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	620	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	620	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	620	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	620	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	620	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	620	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	620	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	620	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	620	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	620	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	620	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	620	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	620	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	620	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	620	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	620	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	620	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	620	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	620	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	620	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	620	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	620	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	620	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	620	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	620	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	620	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	620	120	0.0176	10.9108	2.7	5.536	16.4469

FM System Curve – 25.14" (24" HDPE)

Diameter = 25.14 in
Area = 3.447132 ft^2
RH=D/4= 0.52375
C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.14	0.00	0.00	625	100	0.0000	0.0000	0.6	0.000	0.0000
250.0	0.36	0.56	25.14	0.16	0.00	625	100	0.0000	0.0054	0.6	0.000	0.0056
500.0	0.72	1.11	25.14	0.32	0.00	625	100	0.0000	0.0195	0.6	0.001	0.0204
750.0	1.08	1.67	25.14	0.48	0.00	625	100	0.0001	0.0412	0.6	0.002	0.0434
1000.0	1.44	2.23	25.14	0.65	0.01	625	100	0.0001	0.0702	0.6	0.004	0.0741
1250.0	1.80	2.79	25.14	0.81	0.01	625	100	0.0002	0.1062	0.6	0.006	0.1123
1500.0	2.16	3.34	25.14	0.97	0.01	625	100	0.0002	0.1488	0.6	0.009	0.1576

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To C Modified High Point

1750.0	2.52	3.90	25.14	1.13	0.02	625	100	0.0003	0.1980	0.6	0.012	0.2099
2000.0	2.88	4.46	25.14	1.29	0.03	625	100	0.0004	0.2535	0.6	0.016	0.2691
2250.0	3.24	5.01	25.14	1.45	0.03	625	100	0.0005	0.3153	0.6	0.020	0.3350
2500.0	3.60	5.57	25.14	1.62	0.04	625	100	0.0006	0.3833	0.6	0.024	0.4076
2750.0	3.96	6.13	25.14	1.78	0.05	625	100	0.0007	0.4573	0.6	0.029	0.4867
3000.0	4.32	6.68	25.14	1.94	0.06	625	100	0.0009	0.5372	0.6	0.035	0.5723
3250.0	4.68	7.24	25.14	2.10	0.07	625	100	0.0010	0.6231	0.6	0.041	0.6642
3500.0	5.04	7.80	25.14	2.26	0.08	625	100	0.0011	0.7147	0.6	0.048	0.7624
3750.0	5.40	8.36	25.14	2.42	0.09	625	100	0.0013	0.8122	0.6	0.055	0.8669
4000.0	5.76	8.91	25.14	2.59	0.10	625	100	0.0015	0.9153	0.6	0.062	0.9776
4250.0	6.12	9.47	25.14	2.75	0.12	625	100	0.0016	1.0240	0.6	0.070	1.0943
4500.0	6.48	10.03	25.14	2.91	0.13	625	100	0.0018	1.1384	0.6	0.079	1.2172
4750.0	6.84	10.58	25.14	3.07	0.15	625	100	0.0020	1.2583	0.6	0.088	1.3461
5000.0	7.20	11.14	25.14	3.23	0.16	625	100	0.0022	1.3837	0.6	0.097	1.4810
5250.0	7.56	11.70	25.14	3.39	0.18	625	100	0.0024	1.5145	0.6	0.107	1.6218
5500.0	7.92	12.25	25.14	3.56	0.20	625	100	0.0026	1.6508	0.6	0.118	1.7685
5750.0	8.28	12.81	25.14	3.72	0.21	625	100	0.0029	1.7924	0.6	0.129	1.9211
6000.0	8.64	13.37	25.14	3.88	0.23	625	100	0.0031	1.9394	0.6	0.140	2.0796
6250.0	9.00	13.93	25.14	4.04	0.25	625	100	0.0033	2.0917	0.6	0.152	2.2438
6500.0	9.36	14.48	25.14	4.20	0.27	625	100	0.0036	2.2493	0.6	0.164	2.4138
6750.0	9.72	15.04	25.14	4.36	0.30	625	100	0.0039	2.4122	0.6	0.177	2.5895
7000.0	10.08	15.60	25.14	4.52	0.32	625	100	0.0041	2.5802	0.6	0.191	2.7710
7250.0	10.44	16.15	25.14	4.69	0.34	625	100	0.0044	2.7535	0.6	0.205	2.9581
7500.0	10.80	16.71	25.14	4.85	0.36	625	100	0.0047	2.9319	0.6	0.219	3.1509
7750.0	11.16	17.27	25.14	5.01	0.39	625	100	0.0050	3.1155	0.6	0.234	3.3493
8000.0	11.52	17.83	25.14	5.17	0.42	625	100	0.0053	3.3042	0.6	0.249	3.5533
8250.0	11.88	18.38	25.14	5.33	0.44	625	100	0.0056	3.4979	0.6	0.265	3.7629
8500.0	12.24	18.94	25.14	5.49	0.47	625	100	0.0059	3.6968	0.6	0.281	3.9780
8750.0	12.60	19.50	25.14	5.66	0.50	625	100	0.0062	3.9006	0.6	0.298	4.1987
9000.0	12.96	20.05	25.14	5.82	0.53	625	100	0.0066	4.1096	0.6	0.315	4.4249
9250.0	13.32	20.61	25.14	5.98	0.56	625	100	0.0069	4.3235	0.6	0.333	4.6565
9500.0	13.68	21.17	25.14	6.14	0.59	625	100	0.0073	4.5424	0.6	0.351	4.8937
9750.0	14.04	21.72	25.14	6.30	0.62	625	100	0.0076	4.7662	0.6	0.370	5.1363
10000.0	14.40	22.28	25.14	6.46	0.65	625	100	0.0080	4.9950	0.6	0.389	5.3843
10250.0	14.76	22.84	25.14	6.63	0.68	625	100	0.0084	5.2288	0.6	0.409	5.6377
10500.0	15.12	23.40	25.14	6.79	0.72	625	100	0.0087	5.4674	0.6	0.429	5.8966
10750.0	15.48	23.95	25.14	6.95	0.75	625	100	0.0091	5.7109	0.6	0.450	6.1608
11000.0	15.84	24.51	25.14	7.11	0.79	625	100	0.0095	5.9593	0.6	0.471	6.4303
11250.0	16.20	25.07	25.14	7.27	0.82	625	100	0.0099	6.2126	0.6	0.493	6.7052
11500.0	16.56	25.62	25.14	7.43	0.86	625	100	0.0104	6.4707	0.6	0.515	6.9855
11750.0	16.92	26.18	25.14	7.59	0.90	625	100	0.0108	6.7336	0.6	0.537	7.2710
12000.0	17.28	26.74	25.14	7.76	0.93	625	100	0.0112	7.0013	0.6	0.561	7.5619
12250.0	17.64	27.30	25.14	7.92	0.97	625	100	0.0116	7.2739	0.6	0.584	7.8580
12500.0	18.00	27.85	25.14	8.08	1.01	625	100	0.0121	7.5512	0.6	0.608	8.1594
12750.0	18.36	28.41	25.14	8.24	1.05	625	100	0.0125	7.8333	0.6	0.633	8.4661
13000.0	18.72	28.97	25.14	8.40	1.10	625	100	0.0130	8.1201	0.6	0.658	8.7779
13250.0	19.08	29.52	25.14	8.56	1.14	625	100	0.0135	8.4117	0.6	0.683	9.0951
13500.0	19.44	30.08	25.14	8.73	1.18	625	100	0.0139	8.7079	0.6	0.709	9.4174
13750.0	19.80	30.64	25.14	8.89	1.23	625	100	0.0144	9.0089	0.6	0.736	9.7449
14000.0	20.16	31.19	25.14	9.05	1.27	625	100	0.0149	9.3147	0.6	0.763	10.0776
14250.0	20.52	31.75	25.14	9.21	1.32	625	100	0.0154	9.6250	0.6	0.790	10.4155
14500.0	20.88	32.31	25.14	9.37	1.36	625	100	0.0159	9.9401	0.6	0.818	10.7585
14750.0	21.24	32.87	25.14	9.53	1.41	625	100	0.0164	10.2598	0.6	0.847	11.1067
15000.0	21.60	33.42	25.14	9.70	1.46	625	100	0.0169	10.5842	0.6	0.876	11.4601
15250.0	21.96	33.98	25.14	9.86	1.51	625	100	0.0175	10.9132	0.6	0.905	11.8185
15500.0	22.32	34.54	25.14	10.02	1.56	625	100	0.0180	11.2469	0.6	0.935	12.1821
15750.0	22.68	35.09	25.14	10.18	1.61	625	100	0.0185	11.5851	0.6	0.966	12.5508
16000.0	23.04	35.65	25.14	10.34	1.66	625	100	0.0191	11.9280	0.6	0.997	12.9245

FM System Curve – 25.3" (30" HDPE)

Diameter = 25.3 in

Area = 3.491149 ft^2

RH=D/4= 0.527083

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To C Modified High Point

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.30	0.00	0.00	2455	120	0.0000	0.0000	2.75	0.000	0.0000
250.0	0.36	0.56	25.30	0.16	0.00	2455	120	0.0000	0.0146	2.75	0.001	0.0157
500.0	0.72	1.11	25.30	0.32	0.00	2455	120	0.0000	0.0529	2.75	0.004	0.0572
750.0	1.08	1.67	25.30	0.48	0.00	2455	120	0.0000	0.1120	2.75	0.010	0.1218
1000.0	1.44	2.23	25.30	0.64	0.01	2455	120	0.0001	0.1908	2.75	0.017	0.2082
1250.0	1.80	2.79	25.30	0.80	0.01	2455	120	0.0001	0.2885	2.75	0.027	0.3157
1500.0	2.16	3.34	25.30	0.96	0.01	2455	120	0.0002	0.4044	2.75	0.039	0.4435
1750.0	2.52	3.90	25.30	1.12	0.02	2455	120	0.0002	0.5380	2.75	0.053	0.5912
2000.0	2.88	4.46	25.30	1.28	0.03	2455	120	0.0003	0.6889	2.75	0.070	0.7585
2250.0	3.24	5.01	25.30	1.44	0.03	2455	120	0.0003	0.8568	2.75	0.088	0.9449
2500.0	3.60	5.57	25.30	1.60	0.04	2455	120	0.0004	1.0414	2.75	0.109	1.1501
2750.0	3.96	6.13	25.30	1.76	0.05	2455	120	0.0005	1.2425	2.75	0.132	1.3740
3000.0	4.32	6.68	25.30	1.91	0.06	2455	120	0.0006	1.4597	2.75	0.157	1.6163
3250.0	4.68	7.24	25.30	2.07	0.07	2455	120	0.0007	1.6930	2.75	0.184	1.8767
3500.0	5.04	7.80	25.30	2.23	0.08	2455	120	0.0008	1.9420	2.75	0.213	2.1551
3750.0	5.40	8.36	25.30	2.39	0.09	2455	120	0.0009	2.2067	2.75	0.245	2.4513
4000.0	5.76	8.91	25.30	2.55	0.10	2455	120	0.0010	2.4869	2.75	0.278	2.7652
4250.0	6.12	9.47	25.30	2.71	0.11	2455	120	0.0011	2.7824	2.75	0.314	3.0966
4500.0	6.48	10.03	25.30	2.87	0.13	2455	120	0.0013	3.0931	2.75	0.352	3.4453
4750.0	6.84	10.58	25.30	3.03	0.14	2455	120	0.0014	3.4189	2.75	0.392	3.8113
5000.0	7.20	11.14	25.30	3.19	0.16	2455	120	0.0015	3.7596	2.75	0.435	4.1944
5250.0	7.56	11.70	25.30	3.35	0.17	2455	120	0.0017	4.1151	2.75	0.479	4.5945
5500.0	7.92	12.25	25.30	3.51	0.19	2455	120	0.0018	4.4854	2.75	0.526	5.0115
5750.0	8.28	12.81	25.30	3.67	0.21	2455	120	0.0020	4.8702	2.75	0.575	5.4453
6000.0	8.64	13.37	25.30	3.83	0.23	2455	120	0.0021	5.2696	2.75	0.626	5.8958
6250.0	9.00	13.93	25.30	3.99	0.25	2455	120	0.0023	5.6835	2.75	0.679	6.3629
6500.0	9.36	14.48	25.30	4.15	0.27	2455	120	0.0025	6.1117	2.75	0.735	6.8466
6750.0	9.72	15.04	25.30	4.31	0.29	2455	120	0.0027	6.5541	2.75	0.793	7.3467
7000.0	10.08	15.60	25.30	4.47	0.31	2455	120	0.0029	7.0108	2.75	0.852	7.8631
7250.0	10.44	16.15	25.30	4.63	0.33	2455	120	0.0030	7.4815	2.75	0.914	8.3958
7500.0	10.80	16.71	25.30	4.79	0.36	2455	120	0.0032	7.9663	2.75	0.978	8.9448
7750.0	11.16	17.27	25.30	4.95	0.38	2455	120	0.0034	8.4651	2.75	1.045	9.5098
8000.0	11.52	17.83	25.30	5.11	0.40	2455	120	0.0037	8.9778	2.75	1.113	10.0910
8250.0	11.88	18.38	25.30	5.27	0.43	2455	120	0.0039	9.5043	2.75	1.184	10.6881
8500.0	12.24	18.94	25.30	5.42	0.46	2455	120	0.0041	10.0445	2.75	1.257	11.3012
8750.0	12.60	19.50	25.30	5.58	0.48	2455	120	0.0043	10.5985	2.75	1.332	11.9302
9000.0	12.96	20.05	25.30	5.74	0.51	2455	120	0.0045	11.1661	2.75	1.409	12.5751
9250.0	13.32	20.61	25.30	5.90	0.54	2455	120	0.0048	11.7473	2.75	1.488	13.2356
9500.0	13.68	21.17	25.30	6.06	0.57	2455	120	0.0050	12.3421	2.75	1.570	13.9119
9750.0	14.04	21.72	25.30	6.22	0.60	2455	120	0.0053	12.9504	2.75	1.654	14.6039
10000.0	14.40	22.28	25.30	6.38	0.63	2455	120	0.0055	13.5720	2.75	1.739	15.3115
10250.0	14.76	22.84	25.30	6.54	0.66	2455	120	0.0058	14.2071	2.75	1.827	16.0346
10500.0	15.12	23.40	25.30	6.70	0.70	2455	120	0.0061	14.8555	2.75	1.918	16.7732
10750.0	15.48	23.95	25.30	6.86	0.73	2455	120	0.0063	15.5172	2.75	2.010	17.5273
11000.0	15.84	24.51	25.30	7.02	0.77	2455	120	0.0066	16.1921	2.75	2.105	18.2968
11250.0	16.20	25.07	25.30	7.18	0.80	2455	120	0.0069	16.8803	2.75	2.201	19.0817
11500.0	16.56	25.62	25.30	7.34	0.84	2455	120	0.0072	17.5816	2.75	2.300	19.8819
11750.0	16.92	26.18	25.30	7.50	0.87	2455	120	0.0075	18.2960	2.75	2.401	20.6975
12000.0	17.28	26.74	25.30	7.66	0.91	2455	120	0.0077	19.0234	2.75	2.505	21.5282
12250.0	17.64	27.30	25.30	7.82	0.95	2455	120	0.0081	19.7639	2.75	2.610	22.3741
12500.0	18.00	27.85	25.30	7.98	0.99	2455	120	0.0084	20.5174	2.75	2.718	23.2353
12750.0	18.36	28.41	25.30	8.14	1.03	2455	120	0.0087	21.2838	2.75	2.828	24.1115
13000.0	18.72	28.97	25.30	8.30	1.07	2455	120	0.0090	22.0632	2.75	2.940	25.0028
13250.0	19.08	29.52	25.30	8.46	1.11	2455	120	0.0093	22.8554	2.75	3.054	25.9092

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To C Modified High Point

13500.0	19.44	30.08	25.30	8.62	1.15	2455	120	0.0096	23.6605	2.75	3.170	26.8306
13750.0	19.80	30.64	25.30	8.78	1.20	2455	120	0.0100	24.4783	2.75	3.289	27.7669
14000.0	20.16	31.19	25.30	8.94	1.24	2455	120	0.0103	25.3090	2.75	3.409	28.7182
14250.0	20.52	31.75	25.30	9.09	1.28	2455	120	0.0107	26.1523	2.75	3.532	29.6844
14500.0	20.88	32.31	25.30	9.25	1.33	2455	120	0.0110	27.0084	2.75	3.657	30.6655
14750.0	21.24	32.87	25.30	9.41	1.38	2455	120	0.0114	27.8771	2.75	3.784	31.6615
15000.0	21.60	33.42	25.30	9.57	1.42	2455	120	0.0117	28.7585	2.75	3.914	32.6722
15250.0	21.96	33.98	25.30	9.73	1.47	2455	120	0.0121	29.6525	2.75	4.045	33.6977
15500.0	22.32	34.54	25.30	9.89	1.52	2455	120	0.0124	30.5590	2.75	4.179	34.7380
15750.0	22.68	35.09	25.30	10.05	1.57	2455	120	0.0128	31.4781	2.75	4.315	35.7930
16000.0	23.04	35.65	25.30	10.21	1.62	2455	120	0.0132	32.4097	2.75	4.453	36.8626

FM System Curve – 24”

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	10158	100	0.0000	0.0000	7.16	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	10158	100	0.0000	0.1098	7.16	0.003	0.1133
500.0	0.72	1.11	24.00	0.35	0.00	10158	100	0.0000	0.3964	7.16	0.014	0.4104
750.0	1.08	1.67	24.00	0.53	0.00	10158	100	0.0001	0.8399	7.16	0.031	0.8714
1000.0	1.44	2.23	24.00	0.71	0.01	10158	100	0.0001	1.4310	7.16	0.056	1.4869
1250.0	1.80	2.79	24.00	0.89	0.01	10158	100	0.0002	2.1633	7.16	0.087	2.2506
1500.0	2.16	3.34	24.00	1.06	0.02	10158	100	0.0003	3.0322	7.16	0.126	3.1580
1750.0	2.52	3.90	24.00	1.24	0.02	10158	100	0.0004	4.0340	7.16	0.171	4.2053
2000.0	2.88	4.46	24.00	1.42	0.03	10158	100	0.0005	5.1658	7.16	0.224	5.3895
2250.0	3.24	5.01	24.00	1.60	0.04	10158	100	0.0006	6.4250	7.16	0.283	6.7081
2500.0	3.60	5.57	24.00	1.77	0.05	10158	100	0.0008	7.8094	7.16	0.350	8.1589
2750.0	3.96	6.13	24.00	1.95	0.06	10158	100	0.0009	9.3170	7.16	0.423	9.7399
3000.0	4.32	6.68	24.00	2.13	0.07	10158	100	0.0011	10.9461	7.16	0.503	11.4495
3250.0	4.68	7.24	24.00	2.31	0.08	10158	100	0.0012	12.6952	7.16	0.591	13.2859
3500.0	5.04	7.80	24.00	2.48	0.10	10158	100	0.0014	14.5628	7.16	0.685	15.2479
3750.0	5.40	8.36	24.00	2.66	0.11	10158	100	0.0016	16.5477	7.16	0.786	17.3342
4000.0	5.76	8.91	24.00	2.84	0.12	10158	100	0.0018	18.6486	7.16	0.895	19.5434
4250.0	6.12	9.47	24.00	3.01	0.14	10158	100	0.0021	20.8645	7.16	1.010	21.8747
4500.0	6.48	10.03	24.00	3.19	0.16	10158	100	0.0023	23.1943	7.16	1.133	24.3268
4750.0	6.84	10.58	24.00	3.37	0.18	10158	100	0.0025	25.6370	7.16	1.262	26.8989
5000.0	7.20	11.14	24.00	3.55	0.20	10158	100	0.0028	28.1919	7.16	1.398	29.5900
5250.0	7.56	11.70	24.00	3.72	0.22	10158	100	0.0030	30.8579	7.16	1.541	32.3994
5500.0	7.92	12.25	24.00	3.90	0.24	10158	100	0.0033	33.6343	7.16	1.692	35.3261
5750.0	8.28	12.81	24.00	4.08	0.26	10158	100	0.0036	36.5204	7.16	1.849	38.3695
6000.0	8.64	13.37	24.00	4.26	0.28	10158	100	0.0039	39.5155	7.16	2.013	41.5289
6250.0	9.00	13.93	24.00	4.43	0.31	10158	100	0.0042	42.6188	7.16	2.185	44.8034
6500.0	9.36	14.48	24.00	4.61	0.33	10158	100	0.0045	45.8297	7.16	2.363	48.1926
6750.0	9.72	15.04	24.00	4.79	0.36	10158	100	0.0048	49.1475	7.16	2.548	51.6957
7000.0	10.08	15.60	24.00	4.96	0.38	10158	100	0.0052	52.5718	7.16	2.740	55.3122
7250.0	10.44	16.15	24.00	5.14	0.41	10158	100	0.0055	56.1018	7.16	2.940	59.0415
7500.0	10.80	16.71	24.00	5.32	0.44	10158	100	0.0059	59.7372	7.16	3.146	62.8831
7750.0	11.16	17.27	24.00	5.50	0.47	10158	100	0.0062	63.4772	7.16	3.359	66.8363
8000.0	11.52	17.83	24.00	5.67	0.50	10158	100	0.0066	67.3215	7.16	3.579	70.9008
8250.0	11.88	18.38	24.00	5.85	0.53	10158	100	0.0070	71.2695	7.16	3.807	75.0761
8500.0	12.24	18.94	24.00	6.03	0.56	10158	100	0.0074	75.3208	7.16	4.041	79.3615
8750.0	12.60	19.50	24.00	6.21	0.60	10158	100	0.0078	79.4749	7.16	4.282	83.7568
9000.0	12.96	20.05	24.00	6.38	0.63	10158	100	0.0082	83.7314	7.16	4.530	88.2615
9250.0	13.32	20.61	24.00	6.56	0.67	10158	100	0.0087	88.0898	7.16	4.785	92.8751
9500.0	13.68	21.17	24.00	6.74	0.70	10158	100	0.0091	92.5498	7.16	5.047	97.5972
9750.0	14.04	21.72	24.00	6.92	0.74	10158	100	0.0096	97.1108	7.16	5.317	102.4274
10000.0	14.40	22.28	24.00	7.09	0.78	10158	100	0.0100	101.7727	7.16	5.593	107.3654
10250.0	14.76	22.84	24.00	7.27	0.82	10158	100	0.0105	106.5349	7.16	5.876	112.4107

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To C Modified High Point

10500.0	15.12	23.40	24.00	7.45	0.86	10158	100	0.0110	111.3971	7.16	6.166	117.5630
10750.0	15.48	23.95	24.00	7.62	0.90	10158	100	0.0115	116.3589	7.16	6.463	122.8220
11000.0	15.84	24.51	24.00	7.80	0.95	10158	100	0.0120	121.4201	7.16	6.767	128.1872
11250.0	16.20	25.07	24.00	7.98	0.99	10158	100	0.0125	126.5802	7.16	7.078	133.6584
11500.0	16.56	25.62	24.00	8.16	1.03	10158	100	0.0130	131.8389	7.16	7.396	139.2353
11750.0	16.92	26.18	24.00	8.33	1.08	10158	100	0.0135	137.1960	7.16	7.721	144.9174
12000.0	17.28	26.74	24.00	8.51	1.12	10158	100	0.0140	142.6510	7.16	8.053	150.7045
12250.0	17.64	27.30	24.00	8.69	1.17	10158	100	0.0146	148.2038	7.16	8.393	156.5963
12500.0	18.00	27.85	24.00	8.87	1.22	10158	100	0.0151	153.8539	7.16	8.739	162.5925
12750.0	18.36	28.41	24.00	9.04	1.27	10158	100	0.0157	159.6012	7.16	9.092	168.6928
13000.0	18.72	28.97	24.00	9.22	1.32	10158	100	0.0163	165.4452	7.16	9.452	174.8969
13250.0	19.08	29.52	24.00	9.40	1.37	10158	100	0.0169	171.3859	7.16	9.819	181.2046
13500.0	19.44	30.08	24.00	9.57	1.42	10158	100	0.0175	177.4228	7.16	10.193	187.6155
13750.0	19.80	30.64	24.00	9.75	1.48	10158	100	0.0181	183.5557	7.16	10.574	194.1294
14000.0	20.16	31.19	24.00	9.93	1.53	10158	100	0.0187	189.7843	7.16	10.962	200.7460
14250.0	20.52	31.75	24.00	10.11	1.59	10158	100	0.0193	196.1085	7.16	11.357	207.4651
14500.0	20.88	32.31	24.00	10.28	1.64	10158	100	0.0199	202.5278	7.16	11.759	214.2865
14750.0	21.24	32.87	24.00	10.46	1.70	10158	100	0.0206	209.0422	7.16	12.168	221.2098
15000.0	21.60	33.42	24.00	10.64	1.76	10158	100	0.0212	215.6514	7.16	12.584	228.2349
15250.0	21.96	33.98	24.00	10.82	1.82	10158	100	0.0219	222.3550	7.16	13.007	235.3615
15500.0	22.32	34.54	24.00	10.99	1.88	10158	100	0.0226	229.1530	7.16	13.436	242.5894
15750.0	22.68	35.09	24.00	11.17	1.94	10158	100	0.0232	236.0450	7.16	13.873	249.9184
16000.0	23.04	35.65	24.00	11.35	2.00	10158	100	0.0239	243.0308	7.16	14.317	257.3482

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To C Modified High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	0.23
500.0	0.72	0.83
750.0	1.08	1.75
1000.0	1.44	3.00
1250.0	1.80	4.54
1500.0	2.16	6.37
1750.0	2.52	8.49
2000.0	2.88	10.88
2250.0	3.24	13.55
2500.0	3.60	16.48
2750.0	3.96	19.68
3000.0	4.32	23.15
3250.0	4.68	26.86
3500.0	5.04	30.84
3750.0	5.40	35.06
4000.0	5.76	39.54
4250.0	6.12	44.27
4500.0	6.48	49.24
4750.0	6.84	54.45
5000.0	7.20	59.91
5250.0	7.56	65.61
5500.0	7.92	71.54
5750.0	8.28	77.72
6000.0	8.64	84.13
6250.0	9.00	90.78
6500.0	9.36	97.66
6750.0	9.72	104.77
7000.0	10.08	112.11
7250.0	10.44	119.68
7500.0	10.80	127.48
7750.0	11.16	135.51
8000.0	11.52	143.77
8250.0	11.88	152.25
8500.0	12.24	160.96
8750.0	12.60	169.89
9000.0	12.96	179.04
9250.0	13.32	188.42
9500.0	13.68	198.02
9750.0	14.04	207.84
10000.0	14.40	217.87
10250.0	14.76	228.13
10500.0	15.12	238.61
10750.0	15.48	249.30
11000.0	15.84	260.21
11250.0	16.20	271.34
11500.0	16.56	282.68
11750.0	16.92	294.24
12000.0	17.28	306.02
12250.0	17.64	318.00
12500.0	18.00	330.20
12750.0	18.36	342.62
13000.0	18.72	355.24
13250.0	19.08	368.08
13500.0	19.44	381.13
13750.0	19.80	394.38
14000.0	20.16	407.85
14250.0	20.52	421.53
14500.0	20.88	435.42
14750.0	21.24	449.51
15000.0	21.60	463.82
15250.0	21.96	478.33
15500.0	22.32	493.05
15750.0	22.68	507.97
16000.0	23.04	523.10

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	24.85	29.35
250.0	0.36	25.08	29.58
500.0	0.72	25.68	30.18
750.0	1.08	26.60	31.10
1000.0	1.44	27.85	32.35
1250.0	1.80	29.39	33.89
1500.0	2.16	31.22	35.72
1750.0	2.52	33.34	37.84
2000.0	2.88	35.73	40.23
2250.0	3.24	38.40	42.90
2500.0	3.60	41.33	45.83
2750.0	3.96	44.53	49.03
3000.0	4.32	48.00	52.50
3250.0	4.68	51.71	56.21
3500.0	5.04	55.69	60.19
3750.0	5.40	59.91	64.41
4000.0	5.76	64.39	68.89
4250.0	6.12	69.12	73.62
4500.0	6.48	74.09	78.59
4750.0	6.84	79.30	83.80
5000.0	7.20	84.76	89.26
5250.0	7.56	90.46	94.96
5500.0	7.92	96.39	100.89
5750.0	8.28	102.57	107.07
6000.0	8.64	108.98	113.48
6250.0	9.00	115.63	120.13
6500.0	9.36	122.51	127.01
6750.0	9.72	129.62	134.12
7000.0	10.08	136.96	141.46
7250.0	10.44	144.53	149.03
7500.0	10.80	152.33	156.83
7750.0	11.16	160.36	164.86
8000.0	11.52	168.62	173.12
8250.0	11.88	177.10	181.60
8500.0	12.24	185.81	190.31
8750.0	12.60	194.74	199.24
9000.0	12.96	203.89	208.39
9250.0	13.32	213.27	217.77
9500.0	13.68	222.87	227.37
9750.0	14.04	232.69	237.19
10000.0	14.40	242.72	247.22
10250.0	14.76	252.98	257.48
10500.0	15.12	263.46	267.96
10750.0	15.48	274.15	278.65
11000.0	15.84	285.06	289.56
11250.0	16.20	296.19	300.69
11500.0	16.56	307.53	312.03
11750.0	16.92	319.09	323.59
12000.0	17.28	330.87	335.37
12250.0	17.64	342.85	347.35
12500.0	18.00	355.05	359.55
12750.0	18.36	367.47	371.97
13000.0	18.72	380.09	384.59
13250.0	19.08	392.93	397.43
13500.0	19.44	405.98	410.48
13750.0	19.80	419.23	423.73
14000.0	20.16	432.70	437.20
14250.0	20.52	446.38	450.88
14500.0	20.88	460.27	464.77
14750.0	21.24	474.36	478.86
15000.0	21.60	488.67	493.17
15250.0	21.96	503.18	507.68
15500.0	22.32	517.90	522.40
15750.0	22.68	532.82	537.32
16000.0	23.04	547.95	552.45

MIN Static Head = 24.85
MAX Static Head = 29.35

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To D Modified High Point

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FM System Curve – 24"

Diameter = 24 in
Area = 3.141593 ft^2
RH=D/4= 0.5
C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To D Modified High Point

13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711
14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve – 24" (24" Parallel FM Portion)

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	36.00	100	0.0000	0.0000	1.9	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	36.00	100	0.0000	0.0004	1.9	0.001	0.0013
500.0	0.72	1.11	24.00	0.35	0.00	36.00	100	0.0000	0.0014	1.9	0.004	0.0051
750.0	1.08	1.67	24.00	0.53	0.00	36.00	100	0.0001	0.0030	1.9	0.008	0.0113
1000.0	1.44	2.23	24.00	0.71	0.01	36.00	100	0.0001	0.0051	1.9	0.015	0.0199
1250.0	1.80	2.79	24.00	0.89	0.01	36.00	100	0.0002	0.0077	1.9	0.023	0.0309
1500.0	2.16	3.34	24.00	1.06	0.02	36.00	100	0.0003	0.0107	1.9	0.033	0.0441
1750.0	2.52	3.90	24.00	1.24	0.02	36.00	100	0.0004	0.0143	1.9	0.045	0.0597
2000.0	2.88	4.46	24.00	1.42	0.03	36.00	100	0.0005	0.0183	1.9	0.059	0.0777
2250.0	3.24	5.01	24.00	1.60	0.04	36.00	100	0.0006	0.0228	1.9	0.075	0.0979
2500.0	3.60	5.57	24.00	1.77	0.05	36.00	100	0.0008	0.0277	1.9	0.093	0.1204
2750.0	3.96	6.13	24.00	1.95	0.06	36.00	100	0.0009	0.0330	1.9	0.112	0.1453
3000.0	4.32	6.68	24.00	2.13	0.07	36.00	100	0.0011	0.0388	1.9	0.134	0.1724
3250.0	4.68	7.24	24.00	2.31	0.08	36.00	100	0.0012	0.0450	1.9	0.157	0.2017
3500.0	5.04	7.80	24.00	2.48	0.10	36.00	100	0.0014	0.0516	1.9	0.182	0.2334
3750.0	5.40	8.36	24.00	2.66	0.11	36.00	100	0.0016	0.0586	1.9	0.209	0.2673
4000.0	5.76	8.91	24.00	2.84	0.12	36.00	100	0.0018	0.0661	1.9	0.237	0.3035
4250.0	6.12	9.47	24.00	3.01	0.14	36.00	100	0.0021	0.0739	1.9	0.268	0.3420
4500.0	6.48	10.03	24.00	3.19	0.16	36.00	100	0.0023	0.0822	1.9	0.301	0.3827
4750.0	6.84	10.58	24.00	3.37	0.18	36.00	100	0.0025	0.0909	1.9	0.335	0.4257
5000.0	7.20	11.14	24.00	3.55	0.20	36.00	100	0.0028	0.0999	1.9	0.371	0.4709
5250.0	7.56	11.70	24.00	3.72	0.22	36.00	100	0.0030	0.1094	1.9	0.409	0.5184
5500.0	7.92	12.25	24.00	3.90	0.24	36.00	100	0.0033	0.1192	1.9	0.449	0.5681
5750.0	8.28	12.81	24.00	4.08	0.26	36.00	100	0.0036	0.1294	1.9	0.491	0.6201
6000.0	8.64	13.37	24.00	4.26	0.28	36.00	100	0.0039	0.1400	1.9	0.534	0.6743
6250.0	9.00	13.93	24.00	4.43	0.31	36.00	100	0.0042	0.1510	1.9	0.580	0.7308
6500.0	9.36	14.48	24.00	4.61	0.33	36.00	100	0.0045	0.1624	1.9	0.627	0.7895
6750.0	9.72	15.04	24.00	4.79	0.36	36.00	100	0.0048	0.1742	1.9	0.676	0.8504
7000.0	10.08	15.60	24.00	4.96	0.38	36.00	100	0.0052	0.1863	1.9	0.727	0.9135
7250.0	10.44	16.15	24.00	5.14	0.41	36.00	100	0.0055	0.1988	1.9	0.780	0.9789
7500.0	10.80	16.71	24.00	5.32	0.44	36.00	100	0.0059	0.2117	1.9	0.835	1.0465
7750.0	11.16	17.27	24.00	5.50	0.47	36.00	100	0.0062	0.2250	1.9	0.891	1.1163
8000.0	11.52	17.83	24.00	5.67	0.50	36.00	100	0.0066	0.2386	1.9	0.950	1.1884
8250.0	11.88	18.38	24.00	5.85	0.53	36.00	100	0.0070	0.2526	1.9	1.010	1.2627
8500.0	12.24	18.94	24.00	6.03	0.56	36.00	100	0.0074	0.2669	1.9	1.072	1.3392
8750.0	12.60	19.50	24.00	6.21	0.60	36.00	100	0.0078	0.2817	1.9	1.136	1.4179
9000.0	12.96	20.05	24.00	6.38	0.63	36.00	100	0.0082	0.2967	1.9	1.202	1.4989
9250.0	13.32	20.61	24.00	6.56	0.67	36.00	100	0.0087	0.3122	1.9	1.270	1.5820
9500.0	13.68	21.17	24.00	6.74	0.70	36.00	100	0.0091	0.3280	1.9	1.339	1.6674
9750.0	14.04	21.72	24.00	6.92	0.74	36.00	100	0.0096	0.3442	1.9	1.411	1.7550
10000.0	14.40	22.28	24.00	7.09	0.78	36.00	100	0.0100	0.3607	1.9	1.484	1.8448
10250.0	14.76	22.84	24.00	7.27	0.82	36.00	100	0.0105	0.3776	1.9	1.559	1.9368

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To D Modified High Point

10500.0	15.12	23.40	24.00	7.45	0.86	36.00	100	0.0110	0.3948	1.9	1.636	2.0310
10750.0	15.48	23.95	24.00	7.62	0.90	36.00	100	0.0115	0.4124	1.9	1.715	2.1274
11000.0	15.84	24.51	24.00	7.80	0.95	36.00	100	0.0120	0.4303	1.9	1.796	2.2261
11250.0	16.20	25.07	24.00	7.98	0.99	36.00	100	0.0125	0.4486	1.9	1.878	2.3269
11500.0	16.56	25.62	24.00	8.16	1.03	36.00	100	0.0130	0.4672	1.9	1.963	2.4300
11750.0	16.92	26.18	24.00	8.33	1.08	36.00	100	0.0135	0.4862	1.9	2.049	2.5352
12000.0	17.28	26.74	24.00	8.51	1.12	36.00	100	0.0140	0.5056	1.9	2.137	2.6427
12250.0	17.64	27.30	24.00	8.69	1.17	36.00	100	0.0146	0.5252	1.9	2.227	2.7523
12500.0	18.00	27.85	24.00	8.87	1.22	36.00	100	0.0151	0.5453	1.9	2.319	2.8642
12750.0	18.36	28.41	24.00	9.04	1.27	36.00	100	0.0157	0.5656	1.9	2.413	2.9782
13000.0	18.72	28.97	24.00	9.22	1.32	36.00	100	0.0163	0.5863	1.9	2.508	3.0945
13250.0	19.08	29.52	24.00	9.40	1.37	36.00	100	0.0169	0.6074	1.9	2.606	3.2129
13500.0	19.44	30.08	24.00	9.57	1.42	36.00	100	0.0175	0.6288	1.9	2.705	3.3336
13750.0	19.80	30.64	24.00	9.75	1.48	36.00	100	0.0181	0.6505	1.9	2.806	3.4564
14000.0	20.16	31.19	24.00	9.93	1.53	36.00	100	0.0187	0.6726	1.9	2.909	3.5814
14250.0	20.52	31.75	24.00	10.11	1.59	36.00	100	0.0193	0.6950	1.9	3.014	3.7087
14500.0	20.88	32.31	24.00	10.28	1.64	36.00	100	0.0199	0.7178	1.9	3.120	3.8381
14750.0	21.24	32.87	24.00	10.46	1.70	36.00	100	0.0206	0.7408	1.9	3.229	3.9697
15000.0	21.60	33.42	24.00	10.64	1.76	36.00	100	0.0212	0.7643	1.9	3.339	4.1035
15250.0	21.96	33.98	24.00	10.82	1.82	36.00	100	0.0219	0.7880	1.9	3.451	4.2395
15500.0	22.32	34.54	24.00	10.99	1.88	36.00	100	0.0226	0.8121	1.9	3.566	4.3777
15750.0	22.68	35.09	24.00	11.17	1.94	36.00	100	0.0232	0.8365	1.9	3.681	4.5180
16000.0	23.04	35.65	24.00	11.35	2.00	36.00	100	0.0239	0.8613	1.9	3.799	4.6606

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	10260	120	0.0000	0.0000	4.5	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	10260	120	0.0000	0.0816	4.5	0.002	0.0838
500.0	0.72	1.11	23.85	0.36	0.00	10260	120	0.0000	0.2945	4.5	0.009	0.3035
750.0	1.08	1.67	23.85	0.54	0.00	10260	120	0.0001	0.6240	4.5	0.020	0.6443
1000.0	1.44	2.23	23.85	0.72	0.01	10260	120	0.0001	1.0631	4.5	0.036	1.0992
1250.0	1.80	2.79	23.85	0.90	0.01	10260	120	0.0002	1.6072	4.5	0.056	1.6635
1500.0	2.16	3.34	23.85	1.08	0.02	10260	120	0.0002	2.2527	4.5	0.081	2.3338
1750.0	2.52	3.90	23.85	1.26	0.02	10260	120	0.0003	2.9971	4.5	0.110	3.1074
2000.0	2.88	4.46	23.85	1.44	0.03	10260	120	0.0004	3.8379	4.5	0.144	3.9821
2250.0	3.24	5.01	23.85	1.62	0.04	10260	120	0.0005	4.7734	4.5	0.182	4.9559
2500.0	3.60	5.57	23.85	1.80	0.05	10260	120	0.0006	5.8019	4.5	0.225	6.0272
2750.0	3.96	6.13	23.85	1.98	0.06	10260	120	0.0007	6.9220	4.5	0.273	7.1946
3000.0	4.32	6.68	23.85	2.15	0.07	10260	120	0.0008	8.1324	4.5	0.324	8.4568
3250.0	4.68	7.24	23.85	2.33	0.08	10260	120	0.0009	9.4319	4.5	0.381	9.8126
3500.0	5.04	7.80	23.85	2.51	0.10	10260	120	0.0011	10.8194	4.5	0.442	11.2609
3750.0	5.40	8.36	23.85	2.69	0.11	10260	120	0.0012	12.2940	4.5	0.507	12.8009
4000.0	5.76	8.91	23.85	2.87	0.13	10260	120	0.0014	13.8549	4.5	0.577	14.4316
4250.0	6.12	9.47	23.85	3.05	0.14	10260	120	0.0015	15.5012	4.5	0.651	16.1522
4500.0	6.48	10.03	23.85	3.23	0.16	10260	120	0.0017	17.2321	4.5	0.730	17.9620
4750.0	6.84	10.58	23.85	3.41	0.18	10260	120	0.0019	19.0470	4.5	0.813	19.8602
5000.0	7.20	11.14	23.85	3.59	0.20	10260	120	0.0020	20.9451	4.5	0.901	21.8461
5250.0	7.56	11.70	23.85	3.77	0.22	10260	120	0.0022	22.9258	4.5	0.993	23.9192
5500.0	7.92	12.25	23.85	3.95	0.24	10260	120	0.0024	24.9885	4.5	1.090	26.0788
5750.0	8.28	12.81	23.85	4.13	0.26	10260	120	0.0026	27.1328	4.5	1.192	28.3244
6000.0	8.64	13.37	23.85	4.31	0.29	10260	120	0.0029	29.3579	4.5	1.298	30.6554
6250.0	9.00	13.93	23.85	4.49	0.31	10260	120	0.0031	31.6635	4.5	1.408	33.0714
6500.0	9.36	14.48	23.85	4.67	0.34	10260	120	0.0033	34.0490	4.5	1.523	35.5718
6750.0	9.72	15.04	23.85	4.85	0.36	10260	120	0.0036	36.5140	4.5	1.642	38.1562
7000.0	10.08	15.60	23.85	5.03	0.39	10260	120	0.0038	39.0581	4.5	1.766	40.8241
7250.0	10.44	16.15	23.85	5.21	0.42	10260	120	0.0041	41.6807	4.5	1.894	43.5752

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To D Modified High Point

7500.0	10.80	16.71	23.85	5.39	0.45	10260	120	0.0043	44.3816	4.5	2.027	46.4089
7750.0	11.16	17.27	23.85	5.57	0.48	10260	120	0.0046	47.1602	4.5	2.165	49.3250
8000.0	11.52	17.83	23.85	5.75	0.51	10260	120	0.0049	50.0163	4.5	2.307	52.3230
8250.0	11.88	18.38	23.85	5.93	0.55	10260	120	0.0052	52.9495	4.5	2.453	55.4026
8500.0	12.24	18.94	23.85	6.10	0.58	10260	120	0.0055	55.9594	4.5	2.604	58.5634
8750.0	12.60	19.50	23.85	6.28	0.61	10260	120	0.0058	59.0457	4.5	2.759	61.8051
9000.0	12.96	20.05	23.85	6.46	0.65	10260	120	0.0061	62.2080	4.5	2.919	65.1274
9250.0	13.32	20.61	23.85	6.64	0.69	10260	120	0.0064	65.4461	4.5	3.084	68.5299
9500.0	13.68	21.17	23.85	6.82	0.72	10260	120	0.0067	68.7596	4.5	3.253	72.0124
9750.0	14.04	21.72	23.85	7.00	0.76	10260	120	0.0070	72.1482	4.5	3.426	75.5745
10000.0	14.40	22.28	23.85	7.18	0.80	10260	120	0.0074	75.6117	4.5	3.604	79.2159
10250.0	14.76	22.84	23.85	7.36	0.84	10260	120	0.0077	79.1498	4.5	3.787	82.9365
10500.0	15.12	23.40	23.85	7.54	0.88	10260	120	0.0081	82.7621	4.5	3.974	86.7358
10750.0	15.48	23.95	23.85	7.72	0.93	10260	120	0.0084	86.4485	4.5	4.165	90.6137
11000.0	15.84	24.51	23.85	7.90	0.97	10260	120	0.0088	90.2087	4.5	4.361	94.5698
11250.0	16.20	25.07	23.85	8.08	1.01	10260	120	0.0092	94.0424	4.5	4.562	98.6040
11500.0	16.56	25.62	23.85	8.26	1.06	10260	120	0.0095	97.9493	4.5	4.767	102.7159
11750.0	16.92	26.18	23.85	8.44	1.11	10260	120	0.0099	101.9293	4.5	4.976	106.9054
12000.0	17.28	26.74	23.85	8.62	1.15	10260	120	0.0103	105.9822	4.5	5.190	111.1722
12250.0	17.64	27.30	23.85	8.80	1.20	10260	120	0.0107	110.1075	4.5	5.409	115.5161
12500.0	18.00	27.85	23.85	8.98	1.25	10260	120	0.0111	114.3053	4.5	5.632	119.9369
12750.0	18.36	28.41	23.85	9.16	1.30	10260	120	0.0116	118.5752	4.5	5.859	124.4343
13000.0	18.72	28.97	23.85	9.34	1.35	10260	120	0.0120	122.9171	4.5	6.091	129.0082
13250.0	19.08	29.52	23.85	9.52	1.41	10260	120	0.0124	127.3306	4.5	6.328	133.6583
13500.0	19.44	30.08	23.85	9.70	1.46	10260	120	0.0128	131.8157	4.5	6.569	138.3844
13750.0	19.80	30.64	23.85	9.88	1.51	10260	120	0.0133	136.3721	4.5	6.814	143.1864
14000.0	20.16	31.19	23.85	10.05	1.57	10260	120	0.0137	140.9997	4.5	7.064	148.0640
14250.0	20.52	31.75	23.85	10.23	1.63	10260	120	0.0142	145.6982	4.5	7.319	153.0170
14500.0	20.88	32.31	23.85	10.41	1.68	10260	120	0.0147	150.4675	4.5	7.578	158.0454
14750.0	21.24	32.87	23.85	10.59	1.74	10260	120	0.0151	155.3073	4.5	7.841	163.1488
15000.0	21.60	33.42	23.85	10.77	1.80	10260	120	0.0156	160.2175	4.5	8.110	168.3271
15250.0	21.96	33.98	23.85	10.95	1.86	10260	120	0.0161	165.1980	4.5	8.382	173.5801
15500.0	22.32	34.54	23.85	11.13	1.92	10260	120	0.0166	170.2485	4.5	8.659	178.9077
15750.0	22.68	35.09	23.85	11.31	1.99	10260	120	0.0171	175.3689	4.5	8.941	184.3097
16000.0	23.04	35.65	23.85	11.49	2.05	10260	120	0.0176	180.5591	4.5	9.227	189.7859

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	620	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	620	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	620	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	620	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	620	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	620	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	620	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	620	120	0.0003	0.1811	2.7	0.066	0.2473
2000.0	2.88	4.46	23.85	1.44	0.03	620	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	620	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	620	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	620	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	620	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	620	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	620	120	0.0011	0.6538	2.7	0.265	0.9187
3750.0	5.40	8.36	23.85	2.69	0.11	620	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	620	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	620	120	0.0015	0.9367	2.7	0.391	1.3273

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To D Modified High Point

4500.0	6.48	10.03	23.85	3.23	0.16	620	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	620	120	0.0019	1.1510	2.7	0.488	1.6389
5000.0	7.20	11.14	23.85	3.59	0.20	620	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	620	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	620	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	620	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	620	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	620	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	620	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	620	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	620	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	620	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	620	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	620	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	620	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	620	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	620	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	620	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	620	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	620	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	620	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	620	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	620	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	620	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	620	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	620	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	620	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	620	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	620	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	620	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	620	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	620	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	620	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	620	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	620	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	620	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	620	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	620	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	620	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	620	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	620	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	620	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	620	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	620	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	620	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	620	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	620	120	0.0176	10.9108	2.7	5.536	16.4469

FM System Curve – 25.14" (24" HDPE)

Diameter = 25.14 in
Area = 3.447132 ft^2
RH=D/4= 0.52375
C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.14	0.00	0.00	625	100	0.0000	0.0000	0.6	0.000	0.0000
250.0	0.36	0.56	25.14	0.16	0.00	625	100	0.0000	0.0054	0.6	0.000	0.0056
500.0	0.72	1.11	25.14	0.32	0.00	625	100	0.0000	0.0195	0.6	0.001	0.0204
750.0	1.08	1.67	25.14	0.48	0.00	625	100	0.0001	0.0412	0.6	0.002	0.0434
1000.0	1.44	2.23	25.14	0.65	0.01	625	100	0.0001	0.0702	0.6	0.004	0.0741
1250.0	1.80	2.79	25.14	0.81	0.01	625	100	0.0002	0.1062	0.6	0.006	0.1123

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To D Modified High Point

1500.0	2.16	3.34	25.14	0.97	0.01	625	100	0.0002	0.1488	0.6	0.009	0.1576
1750.0	2.52	3.90	25.14	1.13	0.02	625	100	0.0003	0.1980	0.6	0.012	0.2099
2000.0	2.88	4.46	25.14	1.29	0.03	625	100	0.0004	0.2535	0.6	0.016	0.2691
2250.0	3.24	5.01	25.14	1.45	0.03	625	100	0.0005	0.3153	0.6	0.020	0.3350
2500.0	3.60	5.57	25.14	1.62	0.04	625	100	0.0006	0.3833	0.6	0.024	0.4076
2750.0	3.96	6.13	25.14	1.78	0.05	625	100	0.0007	0.4573	0.6	0.029	0.4867
3000.0	4.32	6.68	25.14	1.94	0.06	625	100	0.0009	0.5372	0.6	0.035	0.5723
3250.0	4.68	7.24	25.14	2.10	0.07	625	100	0.0010	0.6231	0.6	0.041	0.6642
3500.0	5.04	7.80	25.14	2.26	0.08	625	100	0.0011	0.7147	0.6	0.048	0.7624
3750.0	5.40	8.36	25.14	2.42	0.09	625	100	0.0013	0.8122	0.6	0.055	0.8669
4000.0	5.76	8.91	25.14	2.59	0.10	625	100	0.0015	0.9153	0.6	0.062	0.9776
4250.0	6.12	9.47	25.14	2.75	0.12	625	100	0.0016	1.0240	0.6	0.070	1.0943
4500.0	6.48	10.03	25.14	2.91	0.13	625	100	0.0018	1.1384	0.6	0.079	1.2172
4750.0	6.84	10.58	25.14	3.07	0.15	625	100	0.0020	1.2583	0.6	0.088	1.3461
5000.0	7.20	11.14	25.14	3.23	0.16	625	100	0.0022	1.3837	0.6	0.097	1.4810
5250.0	7.56	11.70	25.14	3.39	0.18	625	100	0.0024	1.5145	0.6	0.107	1.6218
5500.0	7.92	12.25	25.14	3.56	0.20	625	100	0.0026	1.6508	0.6	0.118	1.7685
5750.0	8.28	12.81	25.14	3.72	0.21	625	100	0.0029	1.7924	0.6	0.129	1.9211
6000.0	8.64	13.37	25.14	3.88	0.23	625	100	0.0031	1.9394	0.6	0.140	2.0796
6250.0	9.00	13.93	25.14	4.04	0.25	625	100	0.0033	2.0917	0.6	0.152	2.2438
6500.0	9.36	14.48	25.14	4.20	0.27	625	100	0.0036	2.2493	0.6	0.164	2.4138
6750.0	9.72	15.04	25.14	4.36	0.30	625	100	0.0039	2.4122	0.6	0.177	2.5895
7000.0	10.08	15.60	25.14	4.52	0.32	625	100	0.0041	2.5802	0.6	0.191	2.7710
7250.0	10.44	16.15	25.14	4.69	0.34	625	100	0.0044	2.7535	0.6	0.205	2.9581
7500.0	10.80	16.71	25.14	4.85	0.36	625	100	0.0047	2.9319	0.6	0.219	3.1509
7750.0	11.16	17.27	25.14	5.01	0.39	625	100	0.0050	3.1155	0.6	0.234	3.3493
8000.0	11.52	17.83	25.14	5.17	0.42	625	100	0.0053	3.3042	0.6	0.249	3.5533
8250.0	11.88	18.38	25.14	5.33	0.44	625	100	0.0056	3.4979	0.6	0.265	3.7629
8500.0	12.24	18.94	25.14	5.49	0.47	625	100	0.0059	3.6968	0.6	0.281	3.9780
8750.0	12.60	19.50	25.14	5.66	0.50	625	100	0.0062	3.9006	0.6	0.298	4.1987
9000.0	12.96	20.05	25.14	5.82	0.53	625	100	0.0066	4.1096	0.6	0.315	4.4249
9250.0	13.32	20.61	25.14	5.98	0.56	625	100	0.0069	4.3235	0.6	0.333	4.6565
9500.0	13.68	21.17	25.14	6.14	0.59	625	100	0.0073	4.5424	0.6	0.351	4.8937
9750.0	14.04	21.72	25.14	6.30	0.62	625	100	0.0076	4.7662	0.6	0.370	5.1363
10000.0	14.40	22.28	25.14	6.46	0.65	625	100	0.0080	4.9950	0.6	0.389	5.3843
10250.0	14.76	22.84	25.14	6.63	0.68	625	100	0.0084	5.2288	0.6	0.409	5.6377
10500.0	15.12	23.40	25.14	6.79	0.72	625	100	0.0087	5.4674	0.6	0.429	5.8966
10750.0	15.48	23.95	25.14	6.95	0.75	625	100	0.0091	5.7109	0.6	0.450	6.1608
11000.0	15.84	24.51	25.14	7.11	0.79	625	100	0.0095	5.9593	0.6	0.471	6.4303
11250.0	16.20	25.07	25.14	7.27	0.82	625	100	0.0099	6.2126	0.6	0.493	6.7052
11500.0	16.56	25.62	25.14	7.43	0.86	625	100	0.0104	6.4707	0.6	0.515	6.9855
11750.0	16.92	26.18	25.14	7.59	0.90	625	100	0.0108	6.7336	0.6	0.537	7.2710
12000.0	17.28	26.74	25.14	7.76	0.93	625	100	0.0112	7.0013	0.6	0.561	7.5619
12250.0	17.64	27.30	25.14	7.92	0.97	625	100	0.0116	7.2739	0.6	0.584	7.8580
12500.0	18.00	27.85	25.14	8.08	1.01	625	100	0.0121	7.5512	0.6	0.608	8.1594
12750.0	18.36	28.41	25.14	8.24	1.05	625	100	0.0125	7.8333	0.6	0.633	8.4661
13000.0	18.72	28.97	25.14	8.40	1.10	625	100	0.0130	8.1201	0.6	0.658	8.7779
13250.0	19.08	29.52	25.14	8.56	1.14	625	100	0.0135	8.4117	0.6	0.683	9.0951
13500.0	19.44	30.08	25.14	8.73	1.18	625	100	0.0139	8.7079	0.6	0.709	9.4174
13750.0	19.80	30.64	25.14	8.89	1.23	625	100	0.0144	9.0089	0.6	0.736	9.7449
14000.0	20.16	31.19	25.14	9.05	1.27	625	100	0.0149	9.3147	0.6	0.763	10.0776
14250.0	20.52	31.75	25.14	9.21	1.32	625	100	0.0154	9.6250	0.6	0.790	10.4155
14500.0	20.88	32.31	25.14	9.37	1.36	625	100	0.0159	9.9401	0.6	0.818	10.7585
14750.0	21.24	32.87	25.14	9.53	1.41	625	100	0.0164	10.2598	0.6	0.847	11.1067
15000.0	21.60	33.42	25.14	9.70	1.46	625	100	0.0169	10.5842	0.6	0.876	11.4601
15250.0	21.96	33.98	25.14	9.86	1.51	625	100	0.0175	10.9132	0.6	0.905	11.8185
15500.0	22.32	34.54	25.14	10.02	1.56	625	100	0.0180	11.2469	0.6	0.935	12.1821
15750.0	22.68	35.09	25.14	10.18	1.61	625	100	0.0185	11.5851	0.6	0.966	12.5508
16000.0	23.04	35.65	25.14	10.34	1.66	625	100	0.0191	11.9280	0.6	0.997	12.9245

FM System Curve – 25.3" (30" HDPE)

Diameter = 25.3 in

Area = 3.491149 ft^2

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To D Modified High Point

RH=D/4= 0.527083
C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.30	0.00	0.00	2455	120	0.0000	0.0000	2.75	0.000	0.0000
250.0	0.36	0.56	25.30	0.16	0.00	2455	120	0.0000	0.0146	2.75	0.001	0.0157
500.0	0.72	1.11	25.30	0.32	0.00	2455	120	0.0000	0.0529	2.75	0.004	0.0572
750.0	1.08	1.67	25.30	0.48	0.00	2455	120	0.0000	0.1120	2.75	0.010	0.1218
1000.0	1.44	2.23	25.30	0.64	0.01	2455	120	0.0001	0.1908	2.75	0.017	0.2082
1250.0	1.80	2.79	25.30	0.80	0.01	2455	120	0.0001	0.2885	2.75	0.027	0.3157
1500.0	2.16	3.34	25.30	0.96	0.01	2455	120	0.0002	0.4044	2.75	0.039	0.4435
1750.0	2.52	3.90	25.30	1.12	0.02	2455	120	0.0002	0.5380	2.75	0.053	0.5912
2000.0	2.88	4.46	25.30	1.28	0.03	2455	120	0.0003	0.6889	2.75	0.070	0.7585
2250.0	3.24	5.01	25.30	1.44	0.03	2455	120	0.0003	0.8568	2.75	0.088	0.9449
2500.0	3.60	5.57	25.30	1.60	0.04	2455	120	0.0004	1.0414	2.75	0.109	1.1501
2750.0	3.96	6.13	25.30	1.76	0.05	2455	120	0.0005	1.2425	2.75	0.132	1.3740
3000.0	4.32	6.68	25.30	1.91	0.06	2455	120	0.0006	1.4597	2.75	0.157	1.6163
3250.0	4.68	7.24	25.30	2.07	0.07	2455	120	0.0007	1.6930	2.75	0.184	1.8767
3500.0	5.04	7.80	25.30	2.23	0.08	2455	120	0.0008	1.9420	2.75	0.213	2.1551
3750.0	5.40	8.36	25.30	2.39	0.09	2455	120	0.0009	2.2067	2.75	0.245	2.4513
4000.0	5.76	8.91	25.30	2.55	0.10	2455	120	0.0010	2.4869	2.75	0.278	2.7652
4250.0	6.12	9.47	25.30	2.71	0.11	2455	120	0.0011	2.7824	2.75	0.314	3.0966
4500.0	6.48	10.03	25.30	2.87	0.13	2455	120	0.0013	3.0931	2.75	0.352	3.4453
4750.0	6.84	10.58	25.30	3.03	0.14	2455	120	0.0014	3.4189	2.75	0.392	3.8113
5000.0	7.20	11.14	25.30	3.19	0.16	2455	120	0.0015	3.7596	2.75	0.435	4.1944
5250.0	7.56	11.70	25.30	3.35	0.17	2455	120	0.0017	4.1151	2.75	0.479	4.5945
5500.0	7.92	12.25	25.30	3.51	0.19	2455	120	0.0018	4.4854	2.75	0.526	5.0115
5750.0	8.28	12.81	25.30	3.67	0.21	2455	120	0.0020	4.8702	2.75	0.575	5.4453
6000.0	8.64	13.37	25.30	3.83	0.23	2455	120	0.0021	5.2696	2.75	0.626	5.8958
6250.0	9.00	13.93	25.30	3.99	0.25	2455	120	0.0023	5.6835	2.75	0.679	6.3629
6500.0	9.36	14.48	25.30	4.15	0.27	2455	120	0.0025	6.1117	2.75	0.735	6.8466
6750.0	9.72	15.04	25.30	4.31	0.29	2455	120	0.0027	6.5541	2.75	0.793	7.3467
7000.0	10.08	15.60	25.30	4.47	0.31	2455	120	0.0029	7.0108	2.75	0.852	7.8631
7250.0	10.44	16.15	25.30	4.63	0.33	2455	120	0.0030	7.4815	2.75	0.914	8.3958
7500.0	10.80	16.71	25.30	4.79	0.36	2455	120	0.0032	7.9663	2.75	0.978	8.9448
7750.0	11.16	17.27	25.30	4.95	0.38	2455	120	0.0034	8.4651	2.75	1.045	9.5098
8000.0	11.52	17.83	25.30	5.11	0.40	2455	120	0.0037	8.9778	2.75	1.113	10.0910
8250.0	11.88	18.38	25.30	5.27	0.43	2455	120	0.0039	9.5043	2.75	1.184	10.6881
8500.0	12.24	18.94	25.30	5.42	0.46	2455	120	0.0041	10.0445	2.75	1.257	11.3012
8750.0	12.60	19.50	25.30	5.58	0.48	2455	120	0.0043	10.5985	2.75	1.332	11.9302
9000.0	12.96	20.05	25.30	5.74	0.51	2455	120	0.0045	11.1661	2.75	1.409	12.5751
9250.0	13.32	20.61	25.30	5.90	0.54	2455	120	0.0048	11.7473	2.75	1.488	13.2356
9500.0	13.68	21.17	25.30	6.06	0.57	2455	120	0.0050	12.3421	2.75	1.570	13.9119
9750.0	14.04	21.72	25.30	6.22	0.60	2455	120	0.0053	12.9504	2.75	1.654	14.6039
10000.0	14.40	22.28	25.30	6.38	0.63	2455	120	0.0055	13.5720	2.75	1.739	15.3115
10250.0	14.76	22.84	25.30	6.54	0.66	2455	120	0.0058	14.2071	2.75	1.827	16.0346
10500.0	15.12	23.40	25.30	6.70	0.70	2455	120	0.0061	14.8555	2.75	1.918	16.7732
10750.0	15.48	23.95	25.30	6.86	0.73	2455	120	0.0063	15.5172	2.75	2.010	17.5273
11000.0	15.84	24.51	25.30	7.02	0.77	2455	120	0.0066	16.1921	2.75	2.105	18.2968
11250.0	16.20	25.07	25.30	7.18	0.80	2455	120	0.0069	16.8803	2.75	2.201	19.0817
11500.0	16.56	25.62	25.30	7.34	0.84	2455	120	0.0072	17.5816	2.75	2.300	19.8819
11750.0	16.92	26.18	25.30	7.50	0.87	2455	120	0.0075	18.2960	2.75	2.401	20.6975
12000.0	17.28	26.74	25.30	7.66	0.91	2455	120	0.0077	19.0234	2.75	2.505	21.5282
12250.0	17.64	27.30	25.30	7.82	0.95	2455	120	0.0081	19.7639	2.75	2.610	22.3741
12500.0	18.00	27.85	25.30	7.98	0.99	2455	120	0.0084	20.5174	2.75	2.718	23.2353
12750.0	18.36	28.41	25.30	8.14	1.03	2455	120	0.0087	21.2838	2.75	2.828	24.1115
13000.0	18.72	28.97	25.30	8.30	1.07	2455	120	0.0090	22.0632	2.75	2.940	25.0028
13250.0	19.08	29.52	25.30	8.46	1.11	2455	120	0.0093	22.8554	2.75	3.054	25.9092

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To D Modified High Point

13500.0	19.44	30.08	25.30	8.62	1.15	2455	120	0.0096	23.6605	2.75	3.170	26.8306
13750.0	19.80	30.64	25.30	8.78	1.20	2455	120	0.0100	24.4783	2.75	3.289	27.7669
14000.0	20.16	31.19	25.30	8.94	1.24	2455	120	0.0103	25.3090	2.75	3.409	28.7182
14250.0	20.52	31.75	25.30	9.09	1.28	2455	120	0.0107	26.1523	2.75	3.532	29.6844
14500.0	20.88	32.31	25.30	9.25	1.33	2455	120	0.0110	27.0084	2.75	3.657	30.6655
14750.0	21.24	32.87	25.30	9.41	1.38	2455	120	0.0114	27.8771	2.75	3.784	31.6615
15000.0	21.60	33.42	25.30	9.57	1.42	2455	120	0.0117	28.7585	2.75	3.914	32.6722
15250.0	21.96	33.98	25.30	9.73	1.47	2455	120	0.0121	29.6525	2.75	4.045	33.6977
15500.0	22.32	34.54	25.30	9.89	1.52	2455	120	0.0124	30.5590	2.75	4.179	34.7380
15750.0	22.68	35.09	25.30	10.05	1.57	2455	120	0.0128	31.4781	2.75	4.315	35.7930
16000.0	23.04	35.65	25.30	10.21	1.62	2455	120	0.0132	32.4097	2.75	4.453	36.8626

FM System Curve – 24”

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	12682	100	0.0000	0.0000	8.16	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	12682	100	0.0000	0.1371	8.16	0.004	0.1411
500.0	0.72	1.11	24.00	0.35	0.00	12682	100	0.0000	0.4949	8.16	0.016	0.5108
750.0	1.08	1.67	24.00	0.53	0.00	12682	100	0.0001	1.0486	8.16	0.036	1.0845
1000.0	1.44	2.23	24.00	0.71	0.01	12682	100	0.0001	1.7865	8.16	0.064	1.8503
1250.0	1.80	2.79	24.00	0.89	0.01	12682	100	0.0002	2.7008	8.16	0.100	2.8004
1500.0	2.16	3.34	24.00	1.06	0.02	12682	100	0.0003	3.7856	8.16	0.143	3.9290
1750.0	2.52	3.90	24.00	1.24	0.02	12682	100	0.0004	5.0364	8.16	0.195	5.2316
2000.0	2.88	4.46	24.00	1.42	0.03	12682	100	0.0005	6.4494	8.16	0.255	6.7043
2250.0	3.24	5.01	24.00	1.60	0.04	12682	100	0.0006	8.0214	8.16	0.323	8.3441
2500.0	3.60	5.57	24.00	1.77	0.05	12682	100	0.0008	9.7498	8.16	0.398	10.1482
2750.0	3.96	6.13	24.00	1.95	0.06	12682	100	0.0009	11.6320	8.16	0.482	12.1140
3000.0	4.32	6.68	24.00	2.13	0.07	12682	100	0.0011	13.6659	8.16	0.574	14.2396
3250.0	4.68	7.24	24.00	2.31	0.08	12682	100	0.0012	15.8496	8.16	0.673	16.5228
3500.0	5.04	7.80	24.00	2.48	0.10	12682	100	0.0014	18.1813	8.16	0.781	18.9621
3750.0	5.40	8.36	24.00	2.66	0.11	12682	100	0.0016	20.6593	8.16	0.896	21.5557
4000.0	5.76	8.91	24.00	2.84	0.12	12682	100	0.0018	23.2823	8.16	1.020	24.3021
4250.0	6.12	9.47	24.00	3.01	0.14	12682	100	0.0021	26.0488	8.16	1.151	27.2000
4500.0	6.48	10.03	24.00	3.19	0.16	12682	100	0.0023	28.9574	8.16	1.291	30.2481
4750.0	6.84	10.58	24.00	3.37	0.18	12682	100	0.0025	32.0072	8.16	1.438	33.4453
5000.0	7.20	11.14	24.00	3.55	0.20	12682	100	0.0028	35.1968	8.16	1.593	36.7903
5250.0	7.56	11.70	24.00	3.72	0.22	12682	100	0.0030	38.5253	8.16	1.757	40.2821
5500.0	7.92	12.25	24.00	3.90	0.24	12682	100	0.0033	41.9916	8.16	1.928	43.9197
5750.0	8.28	12.81	24.00	4.08	0.26	12682	100	0.0036	45.5948	8.16	2.107	47.7022
6000.0	8.64	13.37	24.00	4.26	0.28	12682	100	0.0039	49.3341	8.16	2.295	51.6286
6250.0	9.00	13.93	24.00	4.43	0.31	12682	100	0.0042	53.2084	8.16	2.490	55.6982
6500.0	9.36	14.48	24.00	4.61	0.33	12682	100	0.0045	57.2172	8.16	2.693	59.9101
6750.0	9.72	15.04	24.00	4.79	0.36	12682	100	0.0048	61.3594	8.16	2.904	64.2635
7000.0	10.08	15.60	24.00	4.96	0.38	12682	100	0.0052	65.6345	8.16	3.123	68.7577
7250.0	10.44	16.15	24.00	5.14	0.41	12682	100	0.0055	70.0417	8.16	3.350	73.3919
7500.0	10.80	16.71	24.00	5.32	0.44	12682	100	0.0059	74.5803	8.16	3.585	78.1656
7750.0	11.16	17.27	24.00	5.50	0.47	12682	100	0.0062	79.2497	8.16	3.828	83.0779
8000.0	11.52	17.83	24.00	5.67	0.50	12682	100	0.0066	84.0492	8.16	4.079	88.1284
8250.0	11.88	18.38	24.00	5.85	0.53	12682	100	0.0070	88.9782	8.16	4.338	93.3163
8500.0	12.24	18.94	24.00	6.03	0.56	12682	100	0.0074	94.0361	8.16	4.605	98.6412
8750.0	12.60	19.50	24.00	6.21	0.60	12682	100	0.0078	99.2224	8.16	4.880	104.1023
9000.0	12.96	20.05	24.00	6.38	0.63	12682	100	0.0082	104.5365	8.16	5.163	109.6993
9250.0	13.32	20.61	24.00	6.56	0.67	12682	100	0.0087	109.9778	8.16	5.454	115.4314
9500.0	13.68	21.17	24.00	6.74	0.70	12682	100	0.0091	115.5460	8.16	5.752	121.2983
9750.0	14.04	21.72	24.00	6.92	0.74	12682	100	0.0096	121.2404	8.16	6.059	127.2995
10000.0	14.40	22.28	24.00	7.09	0.78	12682	100	0.0100	127.0605	8.16	6.374	133.4344
10250.0	14.76	22.84	24.00	7.27	0.82	12682	100	0.0105	133.0060	8.16	6.696	139.7025

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To D Modified High Point

10500.0	15.12	23.40	24.00	7.45	0.86	12682	100	0.0110	139.0764	8.16	7.027	146.1035
10750.0	15.48	23.95	24.00	7.62	0.90	12682	100	0.0115	145.2711	8.16	7.366	152.6368
11000.0	15.84	24.51	24.00	7.80	0.95	12682	100	0.0120	151.5898	8.16	7.712	159.3021
11250.0	16.20	25.07	24.00	7.98	0.99	12682	100	0.0125	158.0321	8.16	8.067	166.0989
11500.0	16.56	25.62	24.00	8.16	1.03	12682	100	0.0130	164.5975	8.16	8.429	173.0268
11750.0	16.92	26.18	24.00	8.33	1.08	12682	100	0.0135	171.2856	8.16	8.800	180.0854
12000.0	17.28	26.74	24.00	8.51	1.12	12682	100	0.0140	178.0961	8.16	9.178	187.2744
12250.0	17.64	27.30	24.00	8.69	1.17	12682	100	0.0146	185.0286	8.16	9.565	194.5933
12500.0	18.00	27.85	24.00	8.87	1.22	12682	100	0.0151	192.0826	8.16	9.959	202.0417
12750.0	18.36	28.41	24.00	9.04	1.27	12682	100	0.0157	199.2579	8.16	10.361	209.6193
13000.0	18.72	28.97	24.00	9.22	1.32	12682	100	0.0163	206.5541	8.16	10.772	217.3258
13250.0	19.08	29.52	24.00	9.40	1.37	12682	100	0.0169	213.9708	8.16	11.190	225.1608
13500.0	19.44	30.08	24.00	9.57	1.42	12682	100	0.0175	221.5077	8.16	11.616	233.1240
13750.0	19.80	30.64	24.00	9.75	1.48	12682	100	0.0181	229.1645	8.16	12.050	241.2150
14000.0	20.16	31.19	24.00	9.93	1.53	12682	100	0.0187	236.9408	8.16	12.493	249.4335
14250.0	20.52	31.75	24.00	10.11	1.59	12682	100	0.0193	244.8363	8.16	12.943	257.7791
14500.0	20.88	32.31	24.00	10.28	1.64	12682	100	0.0199	252.8508	8.16	13.401	266.2517
14750.0	21.24	32.87	24.00	10.46	1.70	12682	100	0.0206	260.9838	8.16	13.867	274.8508
15000.0	21.60	33.42	24.00	10.64	1.76	12682	100	0.0212	269.2351	8.16	14.341	283.5762
15250.0	21.96	33.98	24.00	10.82	1.82	12682	100	0.0219	277.6045	8.16	14.823	292.4276
15500.0	22.32	34.54	24.00	10.99	1.88	12682	100	0.0226	286.0916	8.16	15.313	301.4046
15750.0	22.68	35.09	24.00	11.17	1.94	12682	100	0.0232	294.6961	8.16	15.811	310.5071
16000.0	23.04	35.65	24.00	11.35	2.00	12682	100	0.0239	303.4177	8.16	16.317	319.7347

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To D Modified High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	0.26
500.0	0.72	0.93
750.0	1.08	1.97
1000.0	1.44	3.36
1250.0	1.80	5.09
1500.0	2.16	7.14
1750.0	2.52	9.51
2000.0	2.88	12.20
2250.0	3.24	15.19
2500.0	3.60	18.47
2750.0	3.96	22.06
3000.0	4.32	25.94
3250.0	4.68	30.10
3500.0	5.04	34.55
3750.0	5.40	39.29
4000.0	5.76	44.30
4250.0	6.12	49.59
4500.0	6.48	55.16
4750.0	6.84	61.00
5000.0	7.20	67.11
5250.0	7.56	73.49
5500.0	7.92	80.14
5750.0	8.28	87.05
6000.0	8.64	94.23
6250.0	9.00	101.67
6500.0	9.36	109.37
6750.0	9.72	117.33
7000.0	10.08	125.55
7250.0	10.44	134.03
7500.0	10.80	142.77
7750.0	11.16	151.75
8000.0	11.52	161.00
8250.0	11.88	170.49
8500.0	12.24	180.24
8750.0	12.60	190.23
9000.0	12.96	200.48
9250.0	13.32	210.98
9500.0	13.68	221.72
9750.0	14.04	232.71
10000.0	14.40	243.94
10250.0	14.76	255.42
10500.0	15.12	267.15
10750.0	15.48	279.12
11000.0	15.84	291.33
11250.0	16.20	303.78
11500.0	16.56	316.48
11750.0	16.92	329.41
12000.0	17.28	342.59
12250.0	17.64	356.00
12500.0	18.00	369.65
12750.0	18.36	383.54
13000.0	18.72	397.67
13250.0	19.08	412.03
13500.0	19.44	426.63
13750.0	19.80	441.47
14000.0	20.16	456.54
14250.0	20.52	471.84
14500.0	20.88	487.38
14750.0	21.24	503.15
15000.0	21.60	519.16
15250.0	21.96	535.39
15500.0	22.32	551.86
15750.0	22.68	568.56
16000.0	23.04	585.49

Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	24.18	28.68
250.0	0.36	24.44	28.94
500.0	0.72	25.11	29.61
750.0	1.08	26.15	30.65
1000.0	1.44	27.54	32.04
1250.0	1.80	29.27	33.77
1500.0	2.16	31.32	35.82
1750.0	2.52	33.69	38.19
2000.0	2.88	36.38	40.88
2250.0	3.24	39.37	43.87
2500.0	3.60	42.65	47.15
2750.0	3.96	46.24	50.74
3000.0	4.32	50.12	54.62
3250.0	4.68	54.28	58.78
3500.0	5.04	58.73	63.23
3750.0	5.40	63.47	67.97
4000.0	5.76	68.48	72.98
4250.0	6.12	73.77	78.27
4500.0	6.48	79.34	83.84
4750.0	6.84	85.18	89.68
5000.0	7.20	91.29	95.79
5250.0	7.56	97.67	102.17
5500.0	7.92	104.32	108.82
5750.0	8.28	111.23	115.73
6000.0	8.64	118.41	122.91
6250.0	9.00	125.85	130.35
6500.0	9.36	133.55	138.05
6750.0	9.72	141.51	146.01
7000.0	10.08	149.73	154.23
7250.0	10.44	158.21	162.71
7500.0	10.80	166.95	171.45
7750.0	11.16	175.93	180.43
8000.0	11.52	185.18	189.68
8250.0	11.88	194.67	199.17
8500.0	12.24	204.42	208.92
8750.0	12.60	214.41	218.91
9000.0	12.96	224.66	229.16
9250.0	13.32	235.16	239.66
9500.0	13.68	245.90	250.40
9750.0	14.04	256.89	261.39
10000.0	14.40	268.12	272.62
10250.0	14.76	279.60	284.10
10500.0	15.12	291.33	295.83
10750.0	15.48	303.30	307.80
11000.0	15.84	315.51	320.01
11250.0	16.20	327.96	332.46
11500.0	16.56	340.66	345.16
11750.0	16.92	353.59	358.09
12000.0	17.28	366.77	371.27
12250.0	17.64	380.18	384.68
12500.0	18.00	393.83	398.33
12750.0	18.36	407.72	412.22
13000.0	18.72	421.85	426.35
13250.0	19.08	436.21	440.71
13500.0	19.44	450.81	455.31
13750.0	19.80	465.65	470.15
14000.0	20.16	480.72	485.22
14250.0	20.52	496.02	500.52
14500.0	20.88	511.56	516.06
14750.0	21.24	527.33	531.83
15000.0	21.60	543.34	547.84
15250.0	21.96	559.57	564.07
15500.0	22.32	576.04	580.54
15750.0	22.68	592.74	597.24
16000.0	23.04	609.67	614.17

MIN Static Head = 24.18
MAX Static Head = 26.68

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To E Modified High Point

FM System Curve – 24"

Diameter = 24 in
Area = 3.141593 ft^2
RH=D/4= 0.5
C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	57.50	100	0.0000	0.0000	1.85	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	57.50	100	0.0000	0.0006	1.85	0.001	0.0015
500.0	0.72	1.11	24.00	0.35	0.00	57.50	100	0.0000	0.0022	1.85	0.004	0.0059
750.0	1.08	1.67	24.00	0.53	0.00	57.50	100	0.0001	0.0048	1.85	0.008	0.0129
1000.0	1.44	2.23	24.00	0.71	0.01	57.50	100	0.0001	0.0081	1.85	0.014	0.0226
1250.0	1.80	2.79	24.00	0.89	0.01	57.50	100	0.0002	0.0122	1.85	0.023	0.0348
1500.0	2.16	3.34	24.00	1.06	0.02	57.50	100	0.0003	0.0172	1.85	0.033	0.0497
1750.0	2.52	3.90	24.00	1.24	0.02	57.50	100	0.0004	0.0228	1.85	0.044	0.0671
2000.0	2.88	4.46	24.00	1.42	0.03	57.50	100	0.0005	0.0292	1.85	0.058	0.0870
2250.0	3.24	5.01	24.00	1.60	0.04	57.50	100	0.0006	0.0364	1.85	0.073	0.1095
2500.0	3.60	5.57	24.00	1.77	0.05	57.50	100	0.0008	0.0442	1.85	0.090	0.1345
2750.0	3.96	6.13	24.00	1.95	0.06	57.50	100	0.0009	0.0527	1.85	0.109	0.1620
3000.0	4.32	6.68	24.00	2.13	0.07	57.50	100	0.0011	0.0620	1.85	0.130	0.1920
3250.0	4.68	7.24	24.00	2.31	0.08	57.50	100	0.0012	0.0719	1.85	0.153	0.2245
3500.0	5.04	7.80	24.00	2.48	0.10	57.50	100	0.0014	0.0824	1.85	0.177	0.2595
3750.0	5.40	8.36	24.00	2.66	0.11	57.50	100	0.0016	0.0937	1.85	0.203	0.2969
4000.0	5.76	8.91	24.00	2.84	0.12	57.50	100	0.0018	0.1056	1.85	0.231	0.3368
4250.0	6.12	9.47	24.00	3.01	0.14	57.50	100	0.0021	0.1181	1.85	0.261	0.3791
4500.0	6.48	10.03	24.00	3.19	0.16	57.50	100	0.0023	0.1313	1.85	0.293	0.4239
4750.0	6.84	10.58	24.00	3.37	0.18	57.50	100	0.0025	0.1451	1.85	0.326	0.4712
5000.0	7.20	11.14	24.00	3.55	0.20	57.50	100	0.0028	0.1596	1.85	0.361	0.5208
5250.0	7.56	11.70	24.00	3.72	0.22	57.50	100	0.0030	0.1747	1.85	0.398	0.5730
5500.0	7.92	12.25	24.00	3.90	0.24	57.50	100	0.0033	0.1904	1.85	0.437	0.6275
5750.0	8.28	12.81	24.00	4.08	0.26	57.50	100	0.0036	0.2067	1.85	0.478	0.6845
6000.0	8.64	13.37	24.00	4.26	0.28	57.50	100	0.0039	0.2237	1.85	0.520	0.7439
6250.0	9.00	13.93	24.00	4.43	0.31	57.50	100	0.0042	0.2412	1.85	0.564	0.8057
6500.0	9.36	14.48	24.00	4.61	0.33	57.50	100	0.0045	0.2594	1.85	0.611	0.8700
6750.0	9.72	15.04	24.00	4.79	0.36	57.50	100	0.0048	0.2782	1.85	0.658	0.9366
7000.0	10.08	15.60	24.00	4.96	0.38	57.50	100	0.0052	0.2976	1.85	0.708	1.0057
7250.0	10.44	16.15	24.00	5.14	0.41	57.50	100	0.0055	0.3176	1.85	0.760	1.0771
7500.0	10.80	16.71	24.00	5.32	0.44	57.50	100	0.0059	0.3381	1.85	0.813	1.1510
7750.0	11.16	17.27	24.00	5.50	0.47	57.50	100	0.0062	0.3593	1.85	0.868	1.2272
8000.0	11.52	17.83	24.00	5.67	0.50	57.50	100	0.0066	0.3811	1.85	0.925	1.3059
8250.0	11.88	18.38	24.00	5.85	0.53	57.50	100	0.0070	0.4034	1.85	0.984	1.3870
8500.0	12.24	18.94	24.00	6.03	0.56	57.50	100	0.0074	0.4264	1.85	1.044	1.4704
8750.0	12.60	19.50	24.00	6.21	0.60	57.50	100	0.0078	0.4499	1.85	1.106	1.5562
9000.0	12.96	20.05	24.00	6.38	0.63	57.50	100	0.0082	0.4740	1.85	1.170	1.6445
9250.0	13.32	20.61	24.00	6.56	0.67	57.50	100	0.0087	0.4986	1.85	1.236	1.7351
9500.0	13.68	21.17	24.00	6.74	0.70	57.50	100	0.0091	0.5239	1.85	1.304	1.8280
9750.0	14.04	21.72	24.00	6.92	0.74	57.50	100	0.0096	0.5497	1.85	1.374	1.9234
10000.0	14.40	22.28	24.00	7.09	0.78	57.50	100	0.0100	0.5761	1.85	1.445	2.0211
10250.0	14.76	22.84	24.00	7.27	0.82	57.50	100	0.0105	0.6030	1.85	1.518	2.1212
10500.0	15.12	23.40	24.00	7.45	0.86	57.50	100	0.0110	0.6306	1.85	1.593	2.2237
10750.0	15.48	23.95	24.00	7.62	0.90	57.50	100	0.0115	0.6587	1.85	1.670	2.3286
11000.0	15.84	24.51	24.00	7.80	0.95	57.50	100	0.0120	0.6873	1.85	1.749	2.4358
11250.0	16.20	25.07	24.00	7.98	0.99	57.50	100	0.0125	0.7165	1.85	1.829	2.5454
11500.0	16.56	25.62	24.00	8.16	1.03	57.50	100	0.0130	0.7463	1.85	1.911	2.6574
11750.0	16.92	26.18	24.00	8.33	1.08	57.50	100	0.0135	0.7766	1.85	1.995	2.7717
12000.0	17.28	26.74	24.00	8.51	1.12	57.50	100	0.0140	0.8075	1.85	2.081	2.8883
12250.0	17.64	27.30	24.00	8.69	1.17	57.50	100	0.0146	0.8389	1.85	2.168	3.0074
12500.0	18.00	27.85	24.00	8.87	1.22	57.50	100	0.0151	0.8709	1.85	2.258	3.1288
12750.0	18.36	28.41	24.00	9.04	1.27	57.50	100	0.0157	0.9034	1.85	2.349	3.2525
13000.0	18.72	28.97	24.00	9.22	1.32	57.50	100	0.0163	0.9365	1.85	2.442	3.3786
13250.0	19.08	29.52	24.00	9.40	1.37	57.50	100	0.0169	0.9701	1.85	2.537	3.5071
13500.0	19.44	30.08	24.00	9.57	1.42	57.50	100	0.0175	1.0043	1.85	2.634	3.6379
13750.0	19.80	30.64	24.00	9.75	1.48	57.50	100	0.0181	1.0390	1.85	2.732	3.7711

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To E Modified High Point

14000.0	20.16	31.19	24.00	9.93	1.53	57.50	100	0.0187	1.0743	1.85	2.832	3.9066
14250.0	20.52	31.75	24.00	10.11	1.59	57.50	100	0.0193	1.1101	1.85	2.934	4.0444
14500.0	20.88	32.31	24.00	10.28	1.64	57.50	100	0.0199	1.1464	1.85	3.038	4.1846
14750.0	21.24	32.87	24.00	10.46	1.70	57.50	100	0.0206	1.1833	1.85	3.144	4.3272
15000.0	21.60	33.42	24.00	10.64	1.76	57.50	100	0.0212	1.2207	1.85	3.251	4.4721
15250.0	21.96	33.98	24.00	10.82	1.82	57.50	100	0.0219	1.2587	1.85	3.361	4.6193
15500.0	22.32	34.54	24.00	10.99	1.88	57.50	100	0.0226	1.2971	1.85	3.472	4.7688
15750.0	22.68	35.09	24.00	11.17	1.94	57.50	100	0.0232	1.3361	1.85	3.585	4.9208
16000.0	23.04	35.65	24.00	11.35	2.00	57.50	100	0.0239	1.3757	1.85	3.699	5.0750

FM System Curve – 24" (24" Parallel FM Portion)

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	36.00	100	0.0000	0.0000	1.9	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	36.00	100	0.0000	0.0004	1.9	0.001	0.0013
500.0	0.72	1.11	24.00	0.35	0.00	36.00	100	0.0000	0.0014	1.9	0.004	0.0051
750.0	1.08	1.67	24.00	0.53	0.00	36.00	100	0.0001	0.0030	1.9	0.008	0.0113
1000.0	1.44	2.23	24.00	0.71	0.01	36.00	100	0.0001	0.0051	1.9	0.015	0.0199
1250.0	1.80	2.79	24.00	0.89	0.01	36.00	100	0.0002	0.0077	1.9	0.023	0.0309
1500.0	2.16	3.34	24.00	1.06	0.02	36.00	100	0.0003	0.0107	1.9	0.033	0.0441
1750.0	2.52	3.90	24.00	1.24	0.02	36.00	100	0.0004	0.0143	1.9	0.045	0.0597
2000.0	2.88	4.46	24.00	1.42	0.03	36.00	100	0.0005	0.0183	1.9	0.059	0.0777
2250.0	3.24	5.01	24.00	1.60	0.04	36.00	100	0.0006	0.0228	1.9	0.075	0.0979
2500.0	3.60	5.57	24.00	1.77	0.05	36.00	100	0.0008	0.0277	1.9	0.093	0.1204
2750.0	3.96	6.13	24.00	1.95	0.06	36.00	100	0.0009	0.0330	1.9	0.112	0.1453
3000.0	4.32	6.68	24.00	2.13	0.07	36.00	100	0.0011	0.0388	1.9	0.134	0.1724
3250.0	4.68	7.24	24.00	2.31	0.08	36.00	100	0.0012	0.0450	1.9	0.157	0.2017
3500.0	5.04	7.80	24.00	2.48	0.10	36.00	100	0.0014	0.0516	1.9	0.182	0.2334
3750.0	5.40	8.36	24.00	2.66	0.11	36.00	100	0.0016	0.0586	1.9	0.209	0.2673
4000.0	5.76	8.91	24.00	2.84	0.12	36.00	100	0.0018	0.0661	1.9	0.237	0.3035
4250.0	6.12	9.47	24.00	3.01	0.14	36.00	100	0.0021	0.0739	1.9	0.268	0.3420
4500.0	6.48	10.03	24.00	3.19	0.16	36.00	100	0.0023	0.0822	1.9	0.301	0.3827
4750.0	6.84	10.58	24.00	3.37	0.18	36.00	100	0.0025	0.0909	1.9	0.335	0.4257
5000.0	7.20	11.14	24.00	3.55	0.20	36.00	100	0.0028	0.0999	1.9	0.371	0.4709
5250.0	7.56	11.70	24.00	3.72	0.22	36.00	100	0.0030	0.1094	1.9	0.409	0.5184
5500.0	7.92	12.25	24.00	3.90	0.24	36.00	100	0.0033	0.1192	1.9	0.449	0.5681
5750.0	8.28	12.81	24.00	4.08	0.26	36.00	100	0.0036	0.1294	1.9	0.491	0.6201
6000.0	8.64	13.37	24.00	4.26	0.28	36.00	100	0.0039	0.1400	1.9	0.534	0.6743
6250.0	9.00	13.93	24.00	4.43	0.31	36.00	100	0.0042	0.1510	1.9	0.580	0.7308
6500.0	9.36	14.48	24.00	4.61	0.33	36.00	100	0.0045	0.1624	1.9	0.627	0.7895
6750.0	9.72	15.04	24.00	4.79	0.36	36.00	100	0.0048	0.1742	1.9	0.676	0.8504
7000.0	10.08	15.60	24.00	4.96	0.38	36.00	100	0.0052	0.1863	1.9	0.727	0.9135
7250.0	10.44	16.15	24.00	5.14	0.41	36.00	100	0.0055	0.1988	1.9	0.780	0.9789
7500.0	10.80	16.71	24.00	5.32	0.44	36.00	100	0.0059	0.2117	1.9	0.835	1.0465
7750.0	11.16	17.27	24.00	5.50	0.47	36.00	100	0.0062	0.2250	1.9	0.891	1.1163
8000.0	11.52	17.83	24.00	5.67	0.50	36.00	100	0.0066	0.2386	1.9	0.950	1.1884
8250.0	11.88	18.38	24.00	5.85	0.53	36.00	100	0.0070	0.2526	1.9	1.010	1.2627
8500.0	12.24	18.94	24.00	6.03	0.56	36.00	100	0.0074	0.2669	1.9	1.072	1.3392
8750.0	12.60	19.50	24.00	6.21	0.60	36.00	100	0.0078	0.2817	1.9	1.136	1.4179
9000.0	12.96	20.05	24.00	6.38	0.63	36.00	100	0.0082	0.2967	1.9	1.202	1.4989
9250.0	13.32	20.61	24.00	6.56	0.67	36.00	100	0.0087	0.3122	1.9	1.270	1.5820
9500.0	13.68	21.17	24.00	6.74	0.70	36.00	100	0.0091	0.3280	1.9	1.339	1.6674
9750.0	14.04	21.72	24.00	6.92	0.74	36.00	100	0.0096	0.3442	1.9	1.411	1.7550
10000.0	14.40	22.28	24.00	7.09	0.78	36.00	100	0.0100	0.3607	1.9	1.484	1.8448
10250.0	14.76	22.84	24.00	7.27	0.82	36.00	100	0.0105	0.3776	1.9	1.559	1.9368
10500.0	15.12	23.40	24.00	7.45	0.86	36.00	100	0.0110	0.3948	1.9	1.636	2.0310
10750.0	15.48	23.95	24.00	7.62	0.90	36.00	100	0.0115	0.4124	1.9	1.715	2.1274

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To E Modified High Point

11000.0	15.84	24.51	24.00	7.80	0.95	36.00	100	0.0120	0.4303	1.9	1.796	2.2261
11250.0	16.20	25.07	24.00	7.98	0.99	36.00	100	0.0125	0.4486	1.9	1.878	2.3269
11500.0	16.56	25.62	24.00	8.16	1.03	36.00	100	0.0130	0.4672	1.9	1.963	2.4300
11750.0	16.92	26.18	24.00	8.33	1.08	36.00	100	0.0135	0.4862	1.9	2.049	2.5352
12000.0	17.28	26.74	24.00	8.51	1.12	36.00	100	0.0140	0.5056	1.9	2.137	2.6427
12250.0	17.64	27.30	24.00	8.69	1.17	36.00	100	0.0146	0.5252	1.9	2.227	2.7523
12500.0	18.00	27.85	24.00	8.87	1.22	36.00	100	0.0151	0.5453	1.9	2.319	2.8642
12750.0	18.36	28.41	24.00	9.04	1.27	36.00	100	0.0157	0.5656	1.9	2.413	2.9782
13000.0	18.72	28.97	24.00	9.22	1.32	36.00	100	0.0163	0.5863	1.9	2.508	3.0945
13250.0	19.08	29.52	24.00	9.40	1.37	36.00	100	0.0169	0.6074	1.9	2.606	3.2129
13500.0	19.44	30.08	24.00	9.57	1.42	36.00	100	0.0175	0.6288	1.9	2.705	3.3336
13750.0	19.80	30.64	24.00	9.75	1.48	36.00	100	0.0181	0.6505	1.9	2.806	3.4564
14000.0	20.16	31.19	24.00	9.93	1.53	36.00	100	0.0187	0.6726	1.9	2.909	3.5814
14250.0	20.52	31.75	24.00	10.11	1.59	36.00	100	0.0193	0.6950	1.9	3.014	3.7087
14500.0	20.88	32.31	24.00	10.28	1.64	36.00	100	0.0199	0.7178	1.9	3.120	3.8381
14750.0	21.24	32.87	24.00	10.46	1.70	36.00	100	0.0206	0.7408	1.9	3.229	3.9697
15000.0	21.60	33.42	24.00	10.64	1.76	36.00	100	0.0212	0.7643	1.9	3.339	4.1035
15250.0	21.96	33.98	24.00	10.82	1.82	36.00	100	0.0219	0.7880	1.9	3.451	4.2395
15500.0	22.32	34.54	24.00	10.99	1.88	36.00	100	0.0226	0.8121	1.9	3.566	4.3777
15750.0	22.68	35.09	24.00	11.17	1.94	36.00	100	0.0232	0.8365	1.9	3.681	4.5180
16000.0	23.04	35.65	24.00	11.35	2.00	36.00	100	0.0239	0.8613	1.9	3.799	4.6606

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	10260	120	0.0000	0.0000	4.5	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	10260	120	0.0000	0.0816	4.5	0.002	0.0838
500.0	0.72	1.11	23.85	0.36	0.00	10260	120	0.0000	0.2945	4.5	0.009	0.3035
750.0	1.08	1.67	23.85	0.54	0.00	10260	120	0.0001	0.6240	4.5	0.020	0.6443
1000.0	1.44	2.23	23.85	0.72	0.01	10260	120	0.0001	1.0631	4.5	0.036	1.0992
1250.0	1.80	2.79	23.85	0.90	0.01	10260	120	0.0002	1.6072	4.5	0.056	1.6635
1500.0	2.16	3.34	23.85	1.08	0.02	10260	120	0.0002	2.2527	4.5	0.081	2.3338
1750.0	2.52	3.90	23.85	1.26	0.02	10260	120	0.0003	2.9971	4.5	0.110	3.1074
2000.0	2.88	4.46	23.85	1.44	0.03	10260	120	0.0004	3.8379	4.5	0.144	3.9821
2250.0	3.24	5.01	23.85	1.62	0.04	10260	120	0.0005	4.7734	4.5	0.182	4.9559
2500.0	3.60	5.57	23.85	1.80	0.05	10260	120	0.0006	5.8019	4.5	0.225	6.0272
2750.0	3.96	6.13	23.85	1.98	0.06	10260	120	0.0007	6.9220	4.5	0.273	7.1946
3000.0	4.32	6.68	23.85	2.15	0.07	10260	120	0.0008	8.1324	4.5	0.324	8.4568
3250.0	4.68	7.24	23.85	2.33	0.08	10260	120	0.0009	9.4319	4.5	0.381	9.8126
3500.0	5.04	7.80	23.85	2.51	0.10	10260	120	0.0011	10.8194	4.5	0.442	11.2609
3750.0	5.40	8.36	23.85	2.69	0.11	10260	120	0.0012	12.2940	4.5	0.507	12.8009
4000.0	5.76	8.91	23.85	2.87	0.13	10260	120	0.0014	13.8549	4.5	0.577	14.4316
4250.0	6.12	9.47	23.85	3.05	0.14	10260	120	0.0015	15.5012	4.5	0.651	16.1522
4500.0	6.48	10.03	23.85	3.23	0.16	10260	120	0.0017	17.2321	4.5	0.730	17.9620
4750.0	6.84	10.58	23.85	3.41	0.18	10260	120	0.0019	19.0470	4.5	0.813	19.8602
5000.0	7.20	11.14	23.85	3.59	0.20	10260	120	0.0020	20.9451	4.5	0.901	21.8461
5250.0	7.56	11.70	23.85	3.77	0.22	10260	120	0.0022	22.9258	4.5	0.993	23.9192
5500.0	7.92	12.25	23.85	3.95	0.24	10260	120	0.0024	24.9885	4.5	1.090	26.0788
5750.0	8.28	12.81	23.85	4.13	0.26	10260	120	0.0026	27.1328	4.5	1.192	28.3244
6000.0	8.64	13.37	23.85	4.31	0.29	10260	120	0.0029	29.3579	4.5	1.298	30.6554
6250.0	9.00	13.93	23.85	4.49	0.31	10260	120	0.0031	31.6635	4.5	1.408	33.0714
6500.0	9.36	14.48	23.85	4.67	0.34	10260	120	0.0033	34.0490	4.5	1.523	35.5718
6750.0	9.72	15.04	23.85	4.85	0.36	10260	120	0.0036	36.5140	4.5	1.642	38.1562
7000.0	10.08	15.60	23.85	5.03	0.39	10260	120	0.0038	39.0581	4.5	1.766	40.8241
7250.0	10.44	16.15	23.85	5.21	0.42	10260	120	0.0041	41.6807	4.5	1.894	43.5752
7500.0	10.80	16.71	23.85	5.39	0.45	10260	120	0.0043	44.3816	4.5	2.027	46.4089
7750.0	11.16	17.27	23.85	5.57	0.48	10260	120	0.0046	47.1602	4.5	2.165	49.3250

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To E Modified High Point

8000.0	11.52	17.83	23.85	5.75	0.51	10260	120	0.0049	50.0163	4.5	2.307	52.3230
8250.0	11.88	18.38	23.85	5.93	0.55	10260	120	0.0052	52.9495	4.5	2.453	55.4026
8500.0	12.24	18.94	23.85	6.10	0.58	10260	120	0.0055	55.9594	4.5	2.604	58.5634
8750.0	12.60	19.50	23.85	6.28	0.61	10260	120	0.0058	59.0457	4.5	2.759	61.8051
9000.0	12.96	20.05	23.85	6.46	0.65	10260	120	0.0061	62.2080	4.5	2.919	65.1274
9250.0	13.32	20.61	23.85	6.64	0.69	10260	120	0.0064	65.4461	4.5	3.084	68.5299
9500.0	13.68	21.17	23.85	6.82	0.72	10260	120	0.0067	68.7596	4.5	3.253	72.0124
9750.0	14.04	21.72	23.85	7.00	0.76	10260	120	0.0070	72.1482	4.5	3.426	75.5745
10000.0	14.40	22.28	23.85	7.18	0.80	10260	120	0.0074	75.6117	4.5	3.604	79.2159
10250.0	14.76	22.84	23.85	7.36	0.84	10260	120	0.0077	79.1498	4.5	3.787	82.9365
10500.0	15.12	23.40	23.85	7.54	0.88	10260	120	0.0081	82.7621	4.5	3.974	86.7358
10750.0	15.48	23.95	23.85	7.72	0.93	10260	120	0.0084	86.4485	4.5	4.165	90.6137
11000.0	15.84	24.51	23.85	7.90	0.97	10260	120	0.0088	90.2087	4.5	4.361	94.5698
11250.0	16.20	25.07	23.85	8.08	1.01	10260	120	0.0092	94.0424	4.5	4.562	98.6040
11500.0	16.56	25.62	23.85	8.26	1.06	10260	120	0.0095	97.9493	4.5	4.767	102.7159
11750.0	16.92	26.18	23.85	8.44	1.11	10260	120	0.0099	101.9293	4.5	4.976	106.9054
12000.0	17.28	26.74	23.85	8.62	1.15	10260	120	0.0103	105.9822	4.5	5.190	111.1722
12250.0	17.64	27.30	23.85	8.80	1.20	10260	120	0.0107	110.1075	4.5	5.409	115.5161
12500.0	18.00	27.85	23.85	8.98	1.25	10260	120	0.0111	114.3053	4.5	5.632	119.9369
12750.0	18.36	28.41	23.85	9.16	1.30	10260	120	0.0116	118.5752	4.5	5.859	124.4343
13000.0	18.72	28.97	23.85	9.34	1.35	10260	120	0.0120	122.9171	4.5	6.091	129.0082
13250.0	19.08	29.52	23.85	9.52	1.41	10260	120	0.0124	127.3306	4.5	6.328	133.6583
13500.0	19.44	30.08	23.85	9.70	1.46	10260	120	0.0128	131.8157	4.5	6.569	138.3844
13750.0	19.80	30.64	23.85	9.88	1.51	10260	120	0.0133	136.3721	4.5	6.814	143.1864
14000.0	20.16	31.19	23.85	10.05	1.57	10260	120	0.0137	140.9997	4.5	7.064	148.0640
14250.0	20.52	31.75	23.85	10.23	1.63	10260	120	0.0142	145.6982	4.5	7.319	153.0170
14500.0	20.88	32.31	23.85	10.41	1.68	10260	120	0.0147	150.4675	4.5	7.578	158.0454
14750.0	21.24	32.87	23.85	10.59	1.74	10260	120	0.0151	155.3073	4.5	7.841	163.1488
15000.0	21.60	33.42	23.85	10.77	1.80	10260	120	0.0156	160.2175	4.5	8.110	168.3271
15250.0	21.96	33.98	23.85	10.95	1.86	10260	120	0.0161	165.1980	4.5	8.382	173.5801
15500.0	22.32	34.54	23.85	11.13	1.92	10260	120	0.0166	170.2485	4.5	8.659	178.9077
15750.0	22.68	35.09	23.85	11.31	1.99	10260	120	0.0171	175.3689	4.5	8.941	184.3097
16000.0	23.04	35.65	23.85	11.49	2.05	10260	120	0.0176	180.5591	4.5	9.227	189.7859

FM System Curve – 23.85" (28" HDPE)

Diameter = 23.85 in

Area = 3.102445 ft^2

RH=D/4= 0.496875

C= 120

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	23.85	0.00	0.00	620	120	0.0000	0.0000	2.7	0.000	0.0000
250.0	0.36	0.56	23.85	0.18	0.00	620	120	0.0000	0.0049	2.7	0.001	0.0063
500.0	0.72	1.11	23.85	0.36	0.00	620	120	0.0000	0.0178	2.7	0.005	0.0232
750.0	1.08	1.67	23.85	0.54	0.00	620	120	0.0001	0.0377	2.7	0.012	0.0499
1000.0	1.44	2.23	23.85	0.72	0.01	620	120	0.0001	0.0642	2.7	0.022	0.0859
1250.0	1.80	2.79	23.85	0.90	0.01	620	120	0.0002	0.0971	2.7	0.034	0.1309
1500.0	2.16	3.34	23.85	1.08	0.02	620	120	0.0002	0.1361	2.7	0.049	0.1848
1750.0	2.52	3.90	23.85	1.26	0.02	620	120	0.0003	0.1811	2.7	0.066	0.2473
2000.0	2.88	4.46	23.85	1.44	0.03	620	120	0.0004	0.2319	2.7	0.087	0.3184
2250.0	3.24	5.01	23.85	1.62	0.04	620	120	0.0005	0.2884	2.7	0.109	0.3979
2500.0	3.60	5.57	23.85	1.80	0.05	620	120	0.0006	0.3506	2.7	0.135	0.4858
2750.0	3.96	6.13	23.85	1.98	0.06	620	120	0.0007	0.4183	2.7	0.164	0.5818
3000.0	4.32	6.68	23.85	2.15	0.07	620	120	0.0008	0.4914	2.7	0.195	0.6861
3250.0	4.68	7.24	23.85	2.33	0.08	620	120	0.0009	0.5699	2.7	0.228	0.7984
3500.0	5.04	7.80	23.85	2.51	0.10	620	120	0.0011	0.6538	2.7	0.265	0.9187
3750.0	5.40	8.36	23.85	2.69	0.11	620	120	0.0012	0.7429	2.7	0.304	1.0470
4000.0	5.76	8.91	23.85	2.87	0.13	620	120	0.0014	0.8372	2.7	0.346	1.1832
4250.0	6.12	9.47	23.85	3.05	0.14	620	120	0.0015	0.9367	2.7	0.391	1.3273
4500.0	6.48	10.03	23.85	3.23	0.16	620	120	0.0017	1.0413	2.7	0.438	1.4792
4750.0	6.84	10.58	23.85	3.41	0.18	620	120	0.0019	1.1510	2.7	0.488	1.6389

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To E Modified High Point

5000.0	7.20	11.14	23.85	3.59	0.20	620	120	0.0020	1.2657	2.7	0.541	1.8063
5250.0	7.56	11.70	23.85	3.77	0.22	620	120	0.0022	1.3854	2.7	0.596	1.9814
5500.0	7.92	12.25	23.85	3.95	0.24	620	120	0.0024	1.5100	2.7	0.654	2.1642
5750.0	8.28	12.81	23.85	4.13	0.26	620	120	0.0026	1.6396	2.7	0.715	2.3546
6000.0	8.64	13.37	23.85	4.31	0.29	620	120	0.0029	1.7740	2.7	0.779	2.5526
6250.0	9.00	13.93	23.85	4.49	0.31	620	120	0.0031	1.9134	2.7	0.845	2.7581
6500.0	9.36	14.48	23.85	4.67	0.34	620	120	0.0033	2.0575	2.7	0.914	2.9712
6750.0	9.72	15.04	23.85	4.85	0.36	620	120	0.0036	2.2065	2.7	0.985	3.1918
7000.0	10.08	15.60	23.85	5.03	0.39	620	120	0.0038	2.3602	2.7	1.060	3.4198
7250.0	10.44	16.15	23.85	5.21	0.42	620	120	0.0041	2.5187	2.7	1.137	3.6554
7500.0	10.80	16.71	23.85	5.39	0.45	620	120	0.0043	2.6819	2.7	1.216	3.8983
7750.0	11.16	17.27	23.85	5.57	0.48	620	120	0.0046	2.8498	2.7	1.299	4.1487
8000.0	11.52	17.83	23.85	5.75	0.51	620	120	0.0049	3.0224	2.7	1.384	4.4064
8250.0	11.88	18.38	23.85	5.93	0.55	620	120	0.0052	3.1996	2.7	1.472	4.6715
8500.0	12.24	18.94	23.85	6.10	0.58	620	120	0.0055	3.3815	2.7	1.562	4.9439
8750.0	12.60	19.50	23.85	6.28	0.61	620	120	0.0058	3.5680	2.7	1.656	5.2237
9000.0	12.96	20.05	23.85	6.46	0.65	620	120	0.0061	3.7591	2.7	1.752	5.5108
9250.0	13.32	20.61	23.85	6.64	0.69	620	120	0.0064	3.9548	2.7	1.850	5.8051
9500.0	13.68	21.17	23.85	6.82	0.72	620	120	0.0067	4.1550	2.7	1.952	6.1067
9750.0	14.04	21.72	23.85	7.00	0.76	620	120	0.0070	4.3598	2.7	2.056	6.4155
10000.0	14.40	22.28	23.85	7.18	0.80	620	120	0.0074	4.5691	2.7	2.163	6.7316
10250.0	14.76	22.84	23.85	7.36	0.84	620	120	0.0077	4.7829	2.7	2.272	7.0549
10500.0	15.12	23.40	23.85	7.54	0.88	620	120	0.0081	5.0011	2.7	2.384	7.3853
10750.0	15.48	23.95	23.85	7.72	0.93	620	120	0.0084	5.2239	2.7	2.499	7.7230
11000.0	15.84	24.51	23.85	7.90	0.97	620	120	0.0088	5.4511	2.7	2.617	8.0678
11250.0	16.20	25.07	23.85	8.08	1.01	620	120	0.0092	5.6828	2.7	2.737	8.4197
11500.0	16.56	25.62	23.85	8.26	1.06	620	120	0.0095	5.9189	2.7	2.860	8.7788
11750.0	16.92	26.18	23.85	8.44	1.11	620	120	0.0099	6.1594	2.7	2.986	9.1450
12000.0	17.28	26.74	23.85	8.62	1.15	620	120	0.0103	6.4043	2.7	3.114	9.5183
12250.0	17.64	27.30	23.85	8.80	1.20	620	120	0.0107	6.6536	2.7	3.245	9.8987
12500.0	18.00	27.85	23.85	8.98	1.25	620	120	0.0111	6.9072	2.7	3.379	10.2862
12750.0	18.36	28.41	23.85	9.16	1.30	620	120	0.0116	7.1652	2.7	3.515	10.6807
13000.0	18.72	28.97	23.85	9.34	1.35	620	120	0.0120	7.4276	2.7	3.655	11.0823
13250.0	19.08	29.52	23.85	9.52	1.41	620	120	0.0124	7.6943	2.7	3.797	11.4909
13500.0	19.44	30.08	23.85	9.70	1.46	620	120	0.0128	7.9653	2.7	3.941	11.9066
13750.0	19.80	30.64	23.85	9.88	1.51	620	120	0.0133	8.2407	2.7	4.089	12.3292
14000.0	20.16	31.19	23.85	10.05	1.57	620	120	0.0137	8.5203	2.7	4.239	12.7589
14250.0	20.52	31.75	23.85	10.23	1.63	620	120	0.0142	8.8042	2.7	4.391	13.1955
14500.0	20.88	32.31	23.85	10.41	1.68	620	120	0.0147	9.0924	2.7	4.547	13.6392
14750.0	21.24	32.87	23.85	10.59	1.74	620	120	0.0151	9.3849	2.7	4.705	14.0898
15000.0	21.60	33.42	23.85	10.77	1.80	620	120	0.0156	9.6816	2.7	4.866	14.5473
15250.0	21.96	33.98	23.85	10.95	1.86	620	120	0.0161	9.9826	2.7	5.029	15.0118
15500.0	22.32	34.54	23.85	11.13	1.92	620	120	0.0166	10.2878	2.7	5.195	15.4833
15750.0	22.68	35.09	23.85	11.31	1.99	620	120	0.0171	10.5972	2.7	5.364	15.9616
16000.0	23.04	35.65	23.85	11.49	2.05	620	120	0.0176	10.9108	2.7	5.536	16.4469

FM System Curve – 25.14" (24" HDPE)

Diameter = 25.14 in
Area = 3.447132 ft^2
RH=D/4= 0.52375
C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.14	0.00	0.00	625	100	0.0000	0.0000	0.6	0.000	0.0000
250.0	0.36	0.56	25.14	0.16	0.00	625	100	0.0000	0.0054	0.6	0.000	0.0056
500.0	0.72	1.11	25.14	0.32	0.00	625	100	0.0000	0.0195	0.6	0.001	0.0204
750.0	1.08	1.67	25.14	0.48	0.00	625	100	0.0001	0.0412	0.6	0.002	0.0434
1000.0	1.44	2.23	25.14	0.65	0.01	625	100	0.0001	0.0702	0.6	0.004	0.0741
1250.0	1.80	2.79	25.14	0.81	0.01	625	100	0.0002	0.1062	0.6	0.006	0.1123
1500.0	2.16	3.34	25.14	0.97	0.01	625	100	0.0002	0.1488	0.6	0.009	0.1576
1750.0	2.52	3.90	25.14	1.13	0.02	625	100	0.0003	0.1980	0.6	0.012	0.2099

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To E Modified High Point

2000.0	2.88	4.46	25.14	1.29	0.03	625	100	0.0004	0.2535	0.6	0.016	0.2691
2250.0	3.24	5.01	25.14	1.45	0.03	625	100	0.0005	0.3153	0.6	0.020	0.3350
2500.0	3.60	5.57	25.14	1.62	0.04	625	100	0.0006	0.3833	0.6	0.024	0.4076
2750.0	3.96	6.13	25.14	1.78	0.05	625	100	0.0007	0.4573	0.6	0.029	0.4867
3000.0	4.32	6.68	25.14	1.94	0.06	625	100	0.0009	0.5372	0.6	0.035	0.5723
3250.0	4.68	7.24	25.14	2.10	0.07	625	100	0.0010	0.6231	0.6	0.041	0.6642
3500.0	5.04	7.80	25.14	2.26	0.08	625	100	0.0011	0.7147	0.6	0.048	0.7624
3750.0	5.40	8.36	25.14	2.42	0.09	625	100	0.0013	0.8122	0.6	0.055	0.8669
4000.0	5.76	8.91	25.14	2.59	0.10	625	100	0.0015	0.9153	0.6	0.062	0.9776
4250.0	6.12	9.47	25.14	2.75	0.12	625	100	0.0016	1.0240	0.6	0.070	1.0943
4500.0	6.48	10.03	25.14	2.91	0.13	625	100	0.0018	1.1384	0.6	0.079	1.2172
4750.0	6.84	10.58	25.14	3.07	0.15	625	100	0.0020	1.2583	0.6	0.088	1.3461
5000.0	7.20	11.14	25.14	3.23	0.16	625	100	0.0022	1.3837	0.6	0.097	1.4810
5250.0	7.56	11.70	25.14	3.39	0.18	625	100	0.0024	1.5145	0.6	0.107	1.6218
5500.0	7.92	12.25	25.14	3.56	0.20	625	100	0.0026	1.6508	0.6	0.118	1.7685
5750.0	8.28	12.81	25.14	3.72	0.21	625	100	0.0029	1.7924	0.6	0.129	1.9211
6000.0	8.64	13.37	25.14	3.88	0.23	625	100	0.0031	1.9394	0.6	0.140	2.0796
6250.0	9.00	13.93	25.14	4.04	0.25	625	100	0.0033	2.0917	0.6	0.152	2.2438
6500.0	9.36	14.48	25.14	4.20	0.27	625	100	0.0036	2.2493	0.6	0.164	2.4138
6750.0	9.72	15.04	25.14	4.36	0.30	625	100	0.0039	2.4122	0.6	0.177	2.5895
7000.0	10.08	15.60	25.14	4.52	0.32	625	100	0.0041	2.5802	0.6	0.191	2.7710
7250.0	10.44	16.15	25.14	4.69	0.34	625	100	0.0044	2.7535	0.6	0.205	2.9581
7500.0	10.80	16.71	25.14	4.85	0.36	625	100	0.0047	2.9319	0.6	0.219	3.1509
7750.0	11.16	17.27	25.14	5.01	0.39	625	100	0.0050	3.1155	0.6	0.234	3.3493
8000.0	11.52	17.83	25.14	5.17	0.42	625	100	0.0053	3.3042	0.6	0.249	3.5533
8250.0	11.88	18.38	25.14	5.33	0.44	625	100	0.0056	3.4979	0.6	0.265	3.7629
8500.0	12.24	18.94	25.14	5.49	0.47	625	100	0.0059	3.6968	0.6	0.281	3.9780
8750.0	12.60	19.50	25.14	5.66	0.50	625	100	0.0062	3.9006	0.6	0.298	4.1987
9000.0	12.96	20.05	25.14	5.82	0.53	625	100	0.0066	4.1096	0.6	0.315	4.4249
9250.0	13.32	20.61	25.14	5.98	0.56	625	100	0.0069	4.3235	0.6	0.333	4.6565
9500.0	13.68	21.17	25.14	6.14	0.59	625	100	0.0073	4.5424	0.6	0.351	4.8937
9750.0	14.04	21.72	25.14	6.30	0.62	625	100	0.0076	4.7662	0.6	0.370	5.1363
10000.0	14.40	22.28	25.14	6.46	0.65	625	100	0.0080	4.9950	0.6	0.389	5.3843
10250.0	14.76	22.84	25.14	6.63	0.68	625	100	0.0084	5.2288	0.6	0.409	5.6377
10500.0	15.12	23.40	25.14	6.79	0.72	625	100	0.0087	5.4674	0.6	0.429	5.8966
10750.0	15.48	23.95	25.14	6.95	0.75	625	100	0.0091	5.7109	0.6	0.450	6.1608
11000.0	15.84	24.51	25.14	7.11	0.79	625	100	0.0095	5.9593	0.6	0.471	6.4303
11250.0	16.20	25.07	25.14	7.27	0.82	625	100	0.0099	6.2126	0.6	0.493	6.7052
11500.0	16.56	25.62	25.14	7.43	0.86	625	100	0.0104	6.4707	0.6	0.515	6.9855
11750.0	16.92	26.18	25.14	7.59	0.90	625	100	0.0108	6.7336	0.6	0.537	7.2710
12000.0	17.28	26.74	25.14	7.76	0.93	625	100	0.0112	7.0013	0.6	0.561	7.5619
12250.0	17.64	27.30	25.14	7.92	0.97	625	100	0.0116	7.2739	0.6	0.584	7.8580
12500.0	18.00	27.85	25.14	8.08	1.01	625	100	0.0121	7.5512	0.6	0.608	8.1594
12750.0	18.36	28.41	25.14	8.24	1.05	625	100	0.0125	7.8333	0.6	0.633	8.4661
13000.0	18.72	28.97	25.14	8.40	1.10	625	100	0.0130	8.1201	0.6	0.658	8.7779
13250.0	19.08	29.52	25.14	8.56	1.14	625	100	0.0135	8.4117	0.6	0.683	9.0951
13500.0	19.44	30.08	25.14	8.73	1.18	625	100	0.0139	8.7079	0.6	0.709	9.4174
13750.0	19.80	30.64	25.14	8.89	1.23	625	100	0.0144	9.0089	0.6	0.736	9.7449
14000.0	20.16	31.19	25.14	9.05	1.27	625	100	0.0149	9.3147	0.6	0.763	10.0776
14250.0	20.52	31.75	25.14	9.21	1.32	625	100	0.0154	9.6250	0.6	0.790	10.4155
14500.0	20.88	32.31	25.14	9.37	1.36	625	100	0.0159	9.9401	0.6	0.818	10.7585
14750.0	21.24	32.87	25.14	9.53	1.41	625	100	0.0164	10.2598	0.6	0.847	11.1067
15000.0	21.60	33.42	25.14	9.70	1.46	625	100	0.0169	10.5842	0.6	0.876	11.4601
15250.0	21.96	33.98	25.14	9.86	1.51	625	100	0.0175	10.9132	0.6	0.905	11.8185
15500.0	22.32	34.54	25.14	10.02	1.56	625	100	0.0180	11.2469	0.6	0.935	12.1821
15750.0	22.68	35.09	25.14	10.18	1.61	625	100	0.0185	11.5851	0.6	0.966	12.5508
16000.0	23.04	35.65	25.14	10.34	1.66	625	100	0.0191	11.9280	0.6	0.997	12.9245

FM System Curve – 25.3" (30" HDPE)

Diameter =	25.3	in
Area =	3.491149	ft^2
RH=D/4=	0.527083	
C=	120	

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To E Modified High Point

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	25.30	0.00	0.00	2455	120	0.0000	0.0000	2.75	0.000	0.0000
250.0	0.36	0.56	25.30	0.16	0.00	2455	120	0.0000	0.0146	2.75	0.001	0.0157
500.0	0.72	1.11	25.30	0.32	0.00	2455	120	0.0000	0.0529	2.75	0.004	0.0572
750.0	1.08	1.67	25.30	0.48	0.00	2455	120	0.0000	0.1120	2.75	0.010	0.1218
1000.0	1.44	2.23	25.30	0.64	0.01	2455	120	0.0001	0.1908	2.75	0.017	0.2082
1250.0	1.80	2.79	25.30	0.80	0.01	2455	120	0.0001	0.2885	2.75	0.027	0.3157
1500.0	2.16	3.34	25.30	0.96	0.01	2455	120	0.0002	0.4044	2.75	0.039	0.4435
1750.0	2.52	3.90	25.30	1.12	0.02	2455	120	0.0002	0.5380	2.75	0.053	0.5912
2000.0	2.88	4.46	25.30	1.28	0.03	2455	120	0.0003	0.6889	2.75	0.070	0.7585
2250.0	3.24	5.01	25.30	1.44	0.03	2455	120	0.0003	0.8568	2.75	0.088	0.9449
2500.0	3.60	5.57	25.30	1.60	0.04	2455	120	0.0004	1.0414	2.75	0.109	1.1501
2750.0	3.96	6.13	25.30	1.76	0.05	2455	120	0.0005	1.2425	2.75	0.132	1.3740
3000.0	4.32	6.68	25.30	1.91	0.06	2455	120	0.0006	1.4597	2.75	0.157	1.6163
3250.0	4.68	7.24	25.30	2.07	0.07	2455	120	0.0007	1.6930	2.75	0.184	1.8767
3500.0	5.04	7.80	25.30	2.23	0.08	2455	120	0.0008	1.9420	2.75	0.213	2.1551
3750.0	5.40	8.36	25.30	2.39	0.09	2455	120	0.0009	2.2067	2.75	0.245	2.4513
4000.0	5.76	8.91	25.30	2.55	0.10	2455	120	0.0010	2.4869	2.75	0.278	2.7652
4250.0	6.12	9.47	25.30	2.71	0.11	2455	120	0.0011	2.7824	2.75	0.314	3.0966
4500.0	6.48	10.03	25.30	2.87	0.13	2455	120	0.0013	3.0931	2.75	0.352	3.4453
4750.0	6.84	10.58	25.30	3.03	0.14	2455	120	0.0014	3.4189	2.75	0.392	3.8113
5000.0	7.20	11.14	25.30	3.19	0.16	2455	120	0.0015	3.7596	2.75	0.435	4.1944
5250.0	7.56	11.70	25.30	3.35	0.17	2455	120	0.0017	4.1151	2.75	0.479	4.5945
5500.0	7.92	12.25	25.30	3.51	0.19	2455	120	0.0018	4.4854	2.75	0.526	5.0115
5750.0	8.28	12.81	25.30	3.67	0.21	2455	120	0.0020	4.8702	2.75	0.575	5.4453
6000.0	8.64	13.37	25.30	3.83	0.23	2455	120	0.0021	5.2696	2.75	0.626	5.8958
6250.0	9.00	13.93	25.30	3.99	0.25	2455	120	0.0023	5.6835	2.75	0.679	6.3629
6500.0	9.36	14.48	25.30	4.15	0.27	2455	120	0.0025	6.1117	2.75	0.735	6.8466
6750.0	9.72	15.04	25.30	4.31	0.29	2455	120	0.0027	6.5541	2.75	0.793	7.3467
7000.0	10.08	15.60	25.30	4.47	0.31	2455	120	0.0029	7.0108	2.75	0.852	7.8631
7250.0	10.44	16.15	25.30	4.63	0.33	2455	120	0.0030	7.4815	2.75	0.914	8.3958
7500.0	10.80	16.71	25.30	4.79	0.36	2455	120	0.0032	7.9663	2.75	0.978	8.9448
7750.0	11.16	17.27	25.30	4.95	0.38	2455	120	0.0034	8.4651	2.75	1.045	9.5098
8000.0	11.52	17.83	25.30	5.11	0.40	2455	120	0.0037	8.9778	2.75	1.113	10.0910
8250.0	11.88	18.38	25.30	5.27	0.43	2455	120	0.0039	9.5043	2.75	1.184	10.6881
8500.0	12.24	18.94	25.30	5.42	0.46	2455	120	0.0041	10.0445	2.75	1.257	11.3012
8750.0	12.60	19.50	25.30	5.58	0.48	2455	120	0.0043	10.5985	2.75	1.332	11.9302
9000.0	12.96	20.05	25.30	5.74	0.51	2455	120	0.0045	11.1661	2.75	1.409	12.5751
9250.0	13.32	20.61	25.30	5.90	0.54	2455	120	0.0048	11.7473	2.75	1.488	13.2356
9500.0	13.68	21.17	25.30	6.06	0.57	2455	120	0.0050	12.3421	2.75	1.570	13.9119
9750.0	14.04	21.72	25.30	6.22	0.60	2455	120	0.0053	12.9504	2.75	1.654	14.6039
10000.0	14.40	22.28	25.30	6.38	0.63	2455	120	0.0055	13.5720	2.75	1.739	15.3115
10250.0	14.76	22.84	25.30	6.54	0.66	2455	120	0.0058	14.2071	2.75	1.827	16.0346
10500.0	15.12	23.40	25.30	6.70	0.70	2455	120	0.0061	14.8555	2.75	1.918	16.7732
10750.0	15.48	23.95	25.30	6.86	0.73	2455	120	0.0063	15.5172	2.75	2.010	17.5273
11000.0	15.84	24.51	25.30	7.02	0.77	2455	120	0.0066	16.1921	2.75	2.105	18.2968
11250.0	16.20	25.07	25.30	7.18	0.80	2455	120	0.0069	16.8803	2.75	2.201	19.0817
11500.0	16.56	25.62	25.30	7.34	0.84	2455	120	0.0072	17.5816	2.75	2.300	19.8819
11750.0	16.92	26.18	25.30	7.50	0.87	2455	120	0.0075	18.2960	2.75	2.401	20.6975
12000.0	17.28	26.74	25.30	7.66	0.91	2455	120	0.0077	19.0234	2.75	2.505	21.5282
12250.0	17.64	27.30	25.30	7.82	0.95	2455	120	0.0081	19.7639	2.75	2.610	22.3741
12500.0	18.00	27.85	25.30	7.98	0.99	2455	120	0.0084	20.5174	2.75	2.718	23.2353
12750.0	18.36	28.41	25.30	8.14	1.03	2455	120	0.0087	21.2838	2.75	2.828	24.1115
13000.0	18.72	28.97	25.30	8.30	1.07	2455	120	0.0090	22.0632	2.75	2.940	25.0028
13250.0	19.08	29.52	25.30	8.46	1.11	2455	120	0.0093	22.8554	2.75	3.054	25.9092
13500.0	19.44	30.08	25.30	8.62	1.15	2455	120	0.0096	23.6605	2.75	3.170	26.8306
13750.0	19.80	30.64	25.30	8.78	1.20	2455	120	0.0100	24.4783	2.75	3.289	27.7669
14000.0	20.16	31.19	25.30	8.94	1.24	2455	120	0.0103	25.3090	2.75	3.409	28.7182
14250.0	20.52	31.75	25.30	9.09	1.28	2455	120	0.0107	26.1523	2.75	3.532	29.6844
14500.0	20.88	32.31	25.30	9.25	1.33	2455	120	0.0110	27.0084	2.75	3.657	30.6655
14750.0	21.24	32.87	25.30	9.41	1.38	2455	120	0.0114	27.8771	2.75	3.784	31.6615
15000.0	21.60	33.42	25.30	9.57	1.42	2455	120	0.0117	28.7585	2.75	3.914	32.6722

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To E Modified High Point

15250.0	21.96	33.98	25.30	9.73	1.47	2455	120	0.0121	29.6525	2.75	4.045	33.6977
15500.0	22.32	34.54	25.30	9.89	1.52	2455	120	0.0124	30.5590	2.75	4.179	34.7380
15750.0	22.68	35.09	25.30	10.05	1.57	2455	120	0.0128	31.4781	2.75	4.315	35.7930
16000.0	23.04	35.65	25.30	10.21	1.62	2455	120	0.0132	32.4097	2.75	4.453	36.8626

FM System Curve – 24"

Diameter = 24 in

Area = 3.141593 ft^2

RH=D/4= 0.5

C= 100

Q	Q	Q	Pipe Dia.	V	V^2/2g	L	C	S	Friction Losses S x L	K	Minor Losses K x (v^2/2g)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	24.00	0.00	0.00	14931	100	0.0000	0.0000	11.94	0.000	0.0000
250.0	0.36	0.56	24.00	0.18	0.00	14931	100	0.0000	0.1614	11.94	0.006	0.1672
500.0	0.72	1.11	24.00	0.35	0.00	14931	100	0.0000	0.5826	11.94	0.023	0.6060
750.0	1.08	1.67	24.00	0.53	0.00	14931	100	0.0001	1.2346	11.94	0.052	1.2871
1000.0	1.44	2.23	24.00	0.71	0.01	14931	100	0.0001	2.1034	11.94	0.093	2.1966
1250.0	1.80	2.79	24.00	0.89	0.01	14931	100	0.0002	3.1797	11.94	0.146	3.3254
1500.0	2.16	3.34	24.00	1.06	0.02	14931	100	0.0003	4.4569	11.94	0.210	4.6667
1750.0	2.52	3.90	24.00	1.24	0.02	14931	100	0.0004	5.9295	11.94	0.286	6.2151
2000.0	2.88	4.46	24.00	1.42	0.03	14931	100	0.0005	7.5931	11.94	0.373	7.9662
2250.0	3.24	5.01	24.00	1.60	0.04	14931	100	0.0006	9.4440	11.94	0.472	9.9161
2500.0	3.60	5.57	24.00	1.77	0.05	14931	100	0.0008	11.4788	11.94	0.583	12.0617
2750.0	3.96	6.13	24.00	1.95	0.06	14931	100	0.0009	13.6948	11.94	0.705	14.4001
3000.0	4.32	6.68	24.00	2.13	0.07	14931	100	0.0011	16.0894	11.94	0.839	16.9288
3250.0	4.68	7.24	24.00	2.31	0.08	14931	100	0.0012	18.6604	11.94	0.985	19.6455
3500.0	5.04	7.80	24.00	2.48	0.10	14931	100	0.0014	21.4055	11.94	1.142	22.5480
3750.0	5.40	8.36	24.00	2.66	0.11	14931	100	0.0016	24.3230	11.94	1.312	25.6346
4000.0	5.76	8.91	24.00	2.84	0.12	14931	100	0.0018	27.4111	11.94	1.492	28.9034
4250.0	6.12	9.47	24.00	3.01	0.14	14931	100	0.0021	30.6682	11.94	1.685	32.3528
4500.0	6.48	10.03	24.00	3.19	0.16	14931	100	0.0023	34.0927	11.94	1.889	35.9813
4750.0	6.84	10.58	24.00	3.37	0.18	14931	100	0.0025	37.6833	11.94	2.104	39.7875
5000.0	7.20	11.14	24.00	3.55	0.20	14931	100	0.0028	41.4385	11.94	2.332	43.7701
5250.0	7.56	11.70	24.00	3.72	0.22	14931	100	0.0030	45.3573	11.94	2.571	47.9279
5500.0	7.92	12.25	24.00	3.90	0.24	14931	100	0.0033	49.4383	11.94	2.821	52.2595
5750.0	8.28	12.81	24.00	4.08	0.26	14931	100	0.0036	53.6805	11.94	3.084	56.7641
6000.0	8.64	13.37	24.00	4.26	0.28	14931	100	0.0039	58.0829	11.94	3.357	61.4404
6250.0	9.00	13.93	24.00	4.43	0.31	14931	100	0.0042	62.6443	11.94	3.643	66.2874
6500.0	9.36	14.48	24.00	4.61	0.33	14931	100	0.0045	67.3639	11.94	3.940	71.3043
6750.0	9.72	15.04	24.00	4.79	0.36	14931	100	0.0048	72.2408	11.94	4.249	76.4901
7000.0	10.08	15.60	24.00	4.96	0.38	14931	100	0.0052	77.2740	11.94	4.570	81.8439
7250.0	10.44	16.15	24.00	5.14	0.41	14931	100	0.0055	82.4628	11.94	4.902	87.3649
7500.0	10.80	16.71	24.00	5.32	0.44	14931	100	0.0059	87.8062	11.94	5.246	93.0523
7750.0	11.16	17.27	24.00	5.50	0.47	14931	100	0.0062	93.3036	11.94	5.602	98.9053
8000.0	11.52	17.83	24.00	5.67	0.50	14931	100	0.0066	98.9543	11.94	5.969	104.9231
8250.0	11.88	18.38	24.00	5.85	0.53	14931	100	0.0070	104.7574	11.94	6.348	111.1051
8500.0	12.24	18.94	24.00	6.03	0.56	14931	100	0.0074	110.7123	11.94	6.738	117.4506
8750.0	12.60	19.50	24.00	6.21	0.60	14931	100	0.0078	116.8183	11.94	7.141	123.9588
9000.0	12.96	20.05	24.00	6.38	0.63	14931	100	0.0082	123.0748	11.94	7.554	130.6291
9250.0	13.32	20.61	24.00	6.56	0.67	14931	100	0.0087	129.4811	11.94	7.980	137.4610
9500.0	13.68	21.17	24.00	6.74	0.70	14931	100	0.0091	136.0367	11.94	8.417	144.4537
9750.0	14.04	21.72	24.00	6.92	0.74	14931	100	0.0096	142.7409	11.94	8.866	151.6068
10000.0	14.40	22.28	24.00	7.09	0.78	14931	100	0.0100	149.5932	11.94	9.326	158.9196
10250.0	14.76	22.84	24.00	7.27	0.82	14931	100	0.0105	156.5930	11.94	9.799	166.3916
10500.0	15.12	23.40	24.00	7.45	0.86	14931	100	0.0110	163.7399	11.94	10.282	174.0222
10750.0	15.48	23.95	24.00	7.62	0.90	14931	100	0.0115	171.0332	11.94	10.778	181.8110
11000.0	15.84	24.51	24.00	7.80	0.95	14931	100	0.0120	178.4724	11.94	11.285	189.7573
11250.0	16.20	25.07	24.00	7.98	0.99	14931	100	0.0125	186.0571	11.94	11.804	197.8608
11500.0	16.56	25.62	24.00	8.16	1.03	14931	100	0.0130	193.7868	11.94	12.334	206.1210
11750.0	16.92	26.18	24.00	8.33	1.08	14931	100	0.0135	201.6610	11.94	12.876	214.5373
12000.0	17.28	26.74	24.00	8.51	1.12	14931	100	0.0140	209.6793	11.94	13.430	223.1093

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To E Modified High Point

12250.0	17.64	27.30	24.00	8.69	1.17	14931	100	0.0146	217.8411	11.94	13.995	231.8365
12500.0	18.00	27.85	24.00	8.87	1.22	14931	100	0.0151	226.1462	11.94	14.572	240.7186
12750.0	18.36	28.41	24.00	9.04	1.27	14931	100	0.0157	234.5939	11.94	15.161	249.7551
13000.0	18.72	28.97	24.00	9.22	1.32	14931	100	0.0163	243.1840	11.94	15.762	258.9456
13250.0	19.08	29.52	24.00	9.40	1.37	14931	100	0.0169	251.9160	11.94	16.374	268.2896
13500.0	19.44	30.08	24.00	9.57	1.42	14931	100	0.0175	260.7894	11.94	16.997	277.7868
13750.0	19.80	30.64	24.00	9.75	1.48	14931	100	0.0181	269.8041	11.94	17.633	287.4367
14000.0	20.16	31.19	24.00	9.93	1.53	14931	100	0.0187	278.9594	11.94	18.280	297.2391
14250.0	20.52	31.75	24.00	10.11	1.59	14931	100	0.0193	288.2551	11.94	18.938	307.1935
14500.0	20.88	32.31	24.00	10.28	1.64	14931	100	0.0199	297.6908	11.94	19.609	317.2995
14750.0	21.24	32.87	24.00	10.46	1.70	14931	100	0.0206	307.2661	11.94	20.291	327.5568
15000.0	21.60	33.42	24.00	10.64	1.76	14931	100	0.0212	316.9807	11.94	20.984	337.9651
15250.0	21.96	33.98	24.00	10.82	1.82	14931	100	0.0219	326.8343	11.94	21.690	348.5240
15500.0	22.32	34.54	24.00	10.99	1.88	14931	100	0.0226	336.8264	11.94	22.407	359.2331
15750.0	22.68	35.09	24.00	11.17	1.94	14931	100	0.0232	346.9569	11.94	23.135	370.0921
16000.0	23.04	35.65	24.00	11.35	2.00	14931	100	0.0239	357.2252	11.94	23.876	381.1007

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – To E Modified High Point

Q (gpm)	Q (mgd)	Losses
0.0	0.00	0.00
250.0	0.36	0.28
500.0	0.72	1.02
750.0	1.08	2.17
1000.0	1.44	3.71
1250.0	1.80	5.61
1500.0	2.16	7.88
1750.0	2.52	10.50
2000.0	2.88	13.46
2250.0	3.24	16.76
2500.0	3.60	20.39
2750.0	3.96	24.34
3000.0	4.32	28.62
3250.0	4.68	33.22
3500.0	5.04	38.14
3750.0	5.40	43.36
4000.0	5.76	48.90
4250.0	6.12	54.74
4500.0	6.48	60.89
4750.0	6.84	67.34
5000.0	7.20	74.09
5250.0	7.56	81.14
5500.0	7.92	88.48
5750.0	8.28	96.11
6000.0	8.64	104.04
6250.0	9.00	112.26
6500.0	9.36	120.77
6750.0	9.72	129.56
7000.0	10.08	138.64
7250.0	10.44	148.01
7500.0	10.80	157.65
7750.0	11.16	167.58
8000.0	11.52	177.79
8250.0	11.88	188.28
8500.0	12.24	199.05
8750.0	12.60	210.09
9000.0	12.96	221.41
9250.0	13.32	233.01
9500.0	13.68	244.87
9750.0	14.04	257.02
10000.0	14.40	269.43
10250.0	14.76	282.11
10500.0	15.12	295.07
10750.0	15.48	308.29
11000.0	15.84	321.78
11250.0	16.20	335.54
11500.0	16.56	349.57
11750.0	16.92	363.86
12000.0	17.28	378.42
12250.0	17.64	393.24
12500.0	18.00	408.33
12750.0	18.36	423.68
13000.0	18.72	439.29
13250.0	19.08	455.16
13500.0	19.44	471.30
13750.0	19.80	487.69
14000.0	20.16	504.35
14250.0	20.52	521.26
14500.0	20.88	538.43
14750.0	21.24	555.86
15000.0	21.60	573.55
15250.0	21.96	591.49
15500.0	22.32	609.69
15750.0	22.68	628.15
16000.0	23.04	646.86

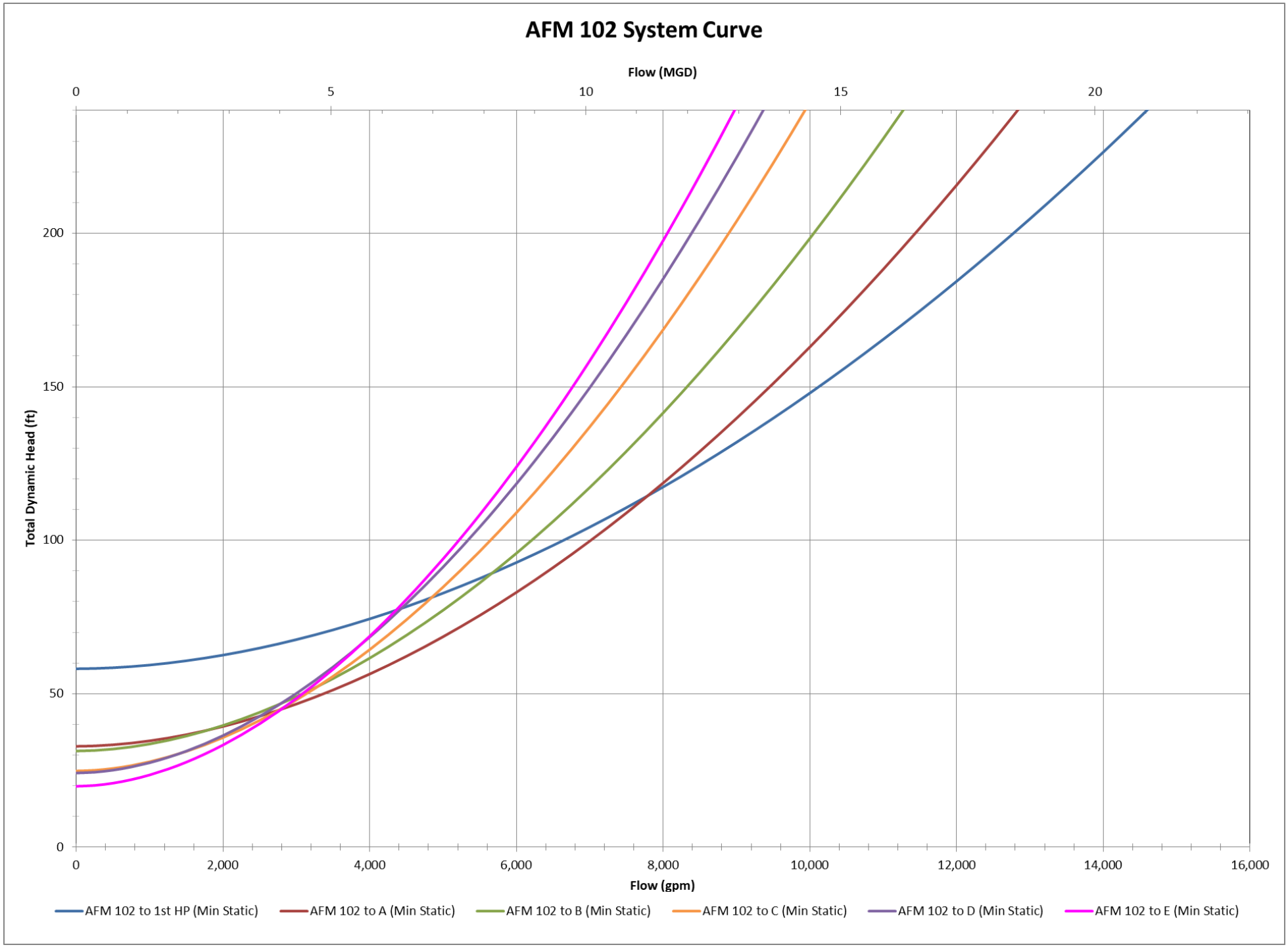
Q (gpm)	Q (mgd)	Min Static	Max Static
0.0	0.00	19.85	24.35
250.0	0.36	20.13	24.63
500.0	0.72	20.87	25.37
750.0	1.08	22.02	26.52
1000.0	1.44	23.56	28.06
1250.0	1.80	25.46	29.96
1500.0	2.16	27.73	32.23
1750.0	2.52	30.35	34.85
2000.0	2.88	33.31	37.81
2250.0	3.24	36.61	41.11
2500.0	3.60	40.24	44.74
2750.0	3.96	44.19	48.69
3000.0	4.32	48.47	52.97
3250.0	4.68	53.07	57.57
3500.0	5.04	57.99	62.49
3750.0	5.40	63.21	67.71
4000.0	5.76	68.75	73.25
4250.0	6.12	74.59	79.09
4500.0	6.48	80.74	85.24
4750.0	6.84	87.19	91.69
5000.0	7.20	93.94	98.44
5250.0	7.56	100.99	105.49
5500.0	7.92	108.33	112.83
5750.0	8.28	115.96	120.46
6000.0	8.64	123.89	128.39
6250.0	9.00	132.11	136.61
6500.0	9.36	140.62	145.12
6750.0	9.72	149.41	153.91
7000.0	10.08	158.49	162.99
7250.0	10.44	167.86	172.36
7500.0	10.80	177.50	182.00
7750.0	11.16	187.43	191.93
8000.0	11.52	197.64	202.14
8250.0	11.88	208.13	212.63
8500.0	12.24	218.90	223.40
8750.0	12.60	229.94	234.44
9000.0	12.96	241.26	245.76
9250.0	13.32	252.86	257.36
9500.0	13.68	264.72	269.22
9750.0	14.04	276.87	281.37
10000.0	14.40	289.28	293.78
10250.0	14.76	301.96	306.46
10500.0	15.12	314.92	319.42
10750.0	15.48	328.14	332.64
11000.0	15.84	341.63	346.13
11250.0	16.20	355.39	359.89
11500.0	16.56	369.42	373.92
11750.0	16.92	383.71	388.21
12000.0	17.28	398.27	402.77
12250.0	17.64	413.09	417.59
12500.0	18.00	428.18	432.68
12750.0	18.36	443.53	448.03
13000.0	18.72	459.14	463.64
13250.0	19.08	475.01	479.51
13500.0	19.44	491.15	495.65
13750.0	19.80	507.54	512.04
14000.0	20.16	524.20	528.70
14250.0	20.52	541.11	545.61
14500.0	20.88	558.28	562.78
14750.0	21.24	575.71	580.21
15000.0	21.60	593.40	597.90
15250.0	21.96	611.34	615.84
15500.0	22.32	629.54	634.04
15750.0	22.68	648.00	652.50
16000.0	23.04	666.71	671.21

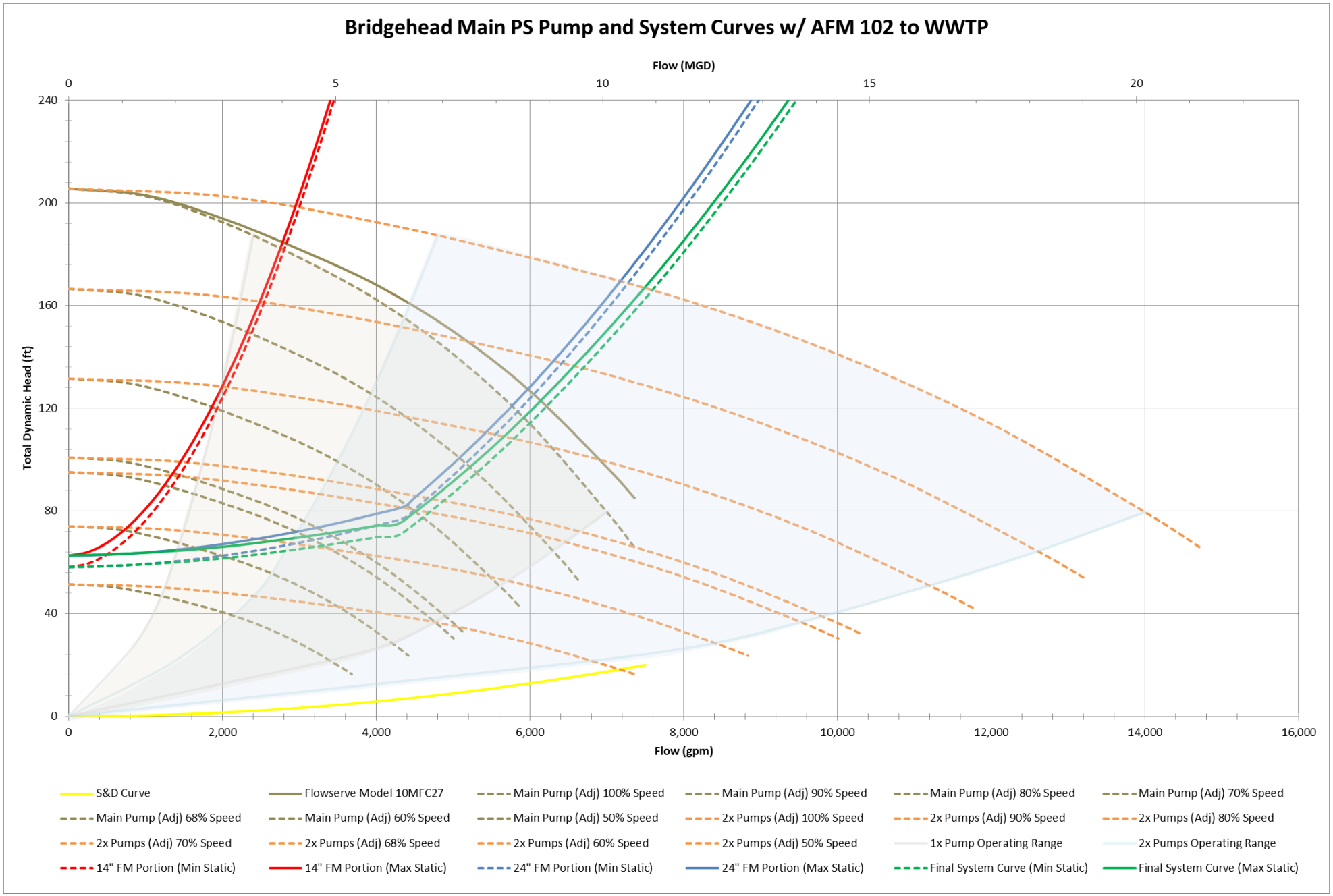
MIN Static Head = 19.85
MAX Static Head = 24.35

Bridgehead Pump Station with AFM102

AFM 102 (24-inch Parallel Forcemain Portion Only) – Final Curve

Q (gpm)	Q (mgd)	Min Static	Max Static
0	0	58.13	62.63
250	0.36	58.22	62.72
500	0.72	58.47	62.97
750	1.08	58.85	63.35
1000	1.44	59.36	63.86
1250	1.8	59.99	64.49
1500	2.16	60.74	65.24
1750	2.52	61.61	66.11
2000	2.88	62.60	67.10
2250	3.24	63.69	68.19
2500	3.6	64.90	69.40
2750	3.96	66.21	70.71
3000	4.32	67.64	72.14
3250	4.68	69.17	73.67
3500	5.04	70.80	75.30
3750	5.4	72.54	77.04
4000	5.76	74.39	78.89
4353	6.26832	77.16	81.66
4500	6.48	80.74	85.24
4750	6.84	87.19	91.69
5000	7.2	93.94	98.44
5250	7.56	100.99	105.49
5500	7.92	108.33	112.83
5750	8.28	115.96	120.46
6000	8.64	123.89	128.39
6250	9	132.11	136.61
6500	9.36	140.62	145.12
6750	9.72	149.41	153.91
7000	10.08	158.49	162.99
7250	10.44	167.86	172.36
7500	10.8	177.50	182.00
7750	11.16	187.43	191.93
8000	11.52	197.64	202.14
8250	11.88	208.13	212.63
8500	12.24	218.90	223.40
8750	12.6	229.94	234.44
9000	12.96	241.26	245.76
9250	13.32	252.86	257.36
9500	13.68	264.72	269.22
9750	14.04	276.87	281.37
10000	14.4	289.28	293.78
10250	14.76	301.96	306.46
10500	15.12	314.92	319.42
10750	15.48	328.14	332.64
11000	15.84	341.63	346.13
11250	16.2	355.39	359.89
11500	16.56	369.42	373.92
11750	16.92	383.71	388.21
12000	17.28	398.27	402.77
12250	17.64	413.09	417.59
12500	18	428.18	432.68
12750	18.36	443.53	448.03
13000	18.72	459.14	463.64
13250	19.08	475.01	479.51
13500	19.44	491.15	495.65
13750	19.8	507.54	512.04
14000	20.16	524.20	528.70
14250	20.52	541.11	545.61
14500	20.88	558.28	562.78
14750	21.24	575.71	580.21
15000	21.6	593.40	597.90
15250	21.96	611.34	615.84
15500	22.32	629.54	634.04
15750	22.68	648.00	652.50
16000	23.04	666.71	671.21


AFM 102 System Curve
Flow (MGD)
0
5
10
15
20
Total Dynamic Head (ft)
0
50
100
150
200
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
Flow (gpm)
AFM 102 to 1st HP (Min Static)
AFM 102 to A (Min Static)
AFM 102 to B (Min Static)
AFM 102 to C (Min Static)
AFM 102 to D (Min Static)
AFM 102 to E (Min Static)


Bridgehead Main PS Pump and System Curves w/ AFM 102 to WWTP
Flow (MGD)
0
5
10
15
20
Total Dynamic Head (ft)
240
200
160
120
80
40
0
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
Flow (gpm)
S&D Curve
Flowserve Model 10MFC27
Main Pump (Adj) 100% Speed
Main Pump (Adj) 90% Speed
Main Pump (Adj) 80% Speed
Main Pump (Adj) 70% Speed
Main Pump (Adj) 68% Speed
Main Pump (Adj) 60% Speed
Main Pump (Adj) 50% Speed
2x Pumps (Adj) 100% Speed
2x Pumps (Adj) 90% Speed
2x Pumps (Adj) 80% Speed
2x Pumps (Adj) 70% Speed
2x Pumps (Adj) 68% Speed
2x Pumps (Adj) 60% Speed
2x Pumps (Adj) 50% Speed
1x Pump Operating Range
2x Pumps Operating Range
14" FM Portion (Min Static)
14" FM Portion (Max Static)
24" FM Portion (Min Static)
24" FM Portion (Max Static)
Final System Curve (Min Static)
Final System Curve (Max Static)

V.W. HOUSEN
& ASSOCIATES

Appendix F. Antioch Diversion Pump Station – Pump and Hydraulic Information

V.W. HOUSEN
& ASSOCIATES

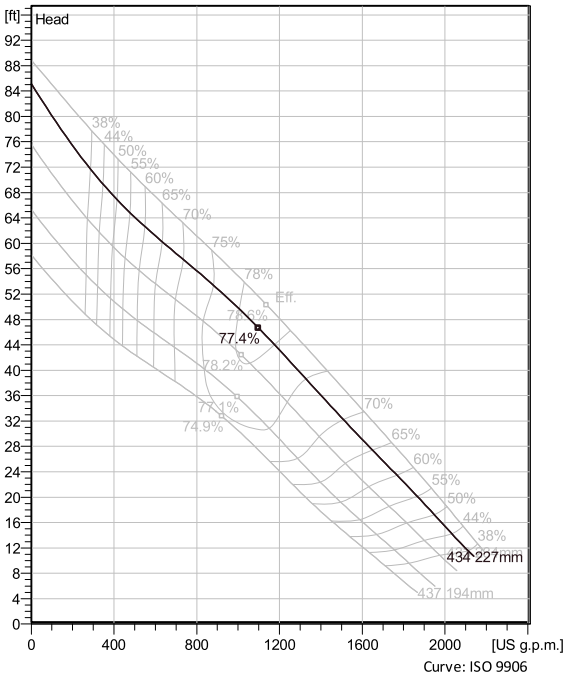
Antioch Diversion Pump Station – New Flygt Pump Information

NP 3153 MT 3~ 434

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

Technical specification

Curves according to: Water, pure ,39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



Curve: ISO 9906

Configuration

Motor number
N3153.091 21-18-4AA-W 20hp

Installation type
P - Semi permanent, Wet

Impeller diameter
227 mm

Discharge diameter
1/4 inch

Pump information

Impeller diameter
227 mm

Discharge diameter
1/4 inch

Inlet diameter
150 mm

Maximum operating speed
1755 rpm

Number of blades
2

Max. fluid temperature
40 °C

Materials

Impeller
Grey cast iron

Project	**Created by**	David Troyer	
Block	**Created on**	7/8/2021	**Last update** 7/8/2021

NP 3153 MT 3~ 434

Technical specification

Motor - General

Motor number N3153.091 21-18-4AA-W 20hp	**Phases** 3~	**Rated speed** 1755 rpm	**Rated power** 20 hp
ATEX approved FM	**Number of poles** 4	**Rated current** 26 A	**Stator variant** 5
Frequency 60 Hz	**Rated voltage** 460 V	**Insulation class** H	**Type of Duty** S1
Version code 091			

Motor - Technical

Power factor - 1/1 Load 0.83	**Motor efficiency - 1/1 Load** 87.5 %	**Total moment of inertia** 2.02 lb ft²	**Starts per hour max.** 30
Power factor - 3/4 Load 0.77	**Motor efficiency - 3/4 Load** 89.0 %	**Starting current, direct starting** 148 A	
Power factor - 1/2 Load 0.66	**Motor efficiency - 1/2 Load** 89.0 %	**Starting current, star-delta** 49.3 A	

Project		**Created by**	David Troyer	
Block		**Created on**	7/8/2021	**Last update** 7/8/2021

PERFORMANCE CURVE

DATE	PROJECT:	ISSUE	PROD
2021-07-20		13	NP 3153.095 FM MT

NO. OF BLADES.....	2	TOT.MOM.OF INERTIA.....	0.086	KGM ^{2}	POLES 4	FREQ. 60	HZ
		RATED SPEED.....	1760	RPM	VOLTAGE.....	460	V
					MOTOR SHAFT POWER.....	20hp / 14.9kW	
					STARTING TORQUE.....	130	NM
					MAX TORQUE.....	220	NM
					RATED CURRENT.....	26	A
					STARTING CURRENT.....	157	A

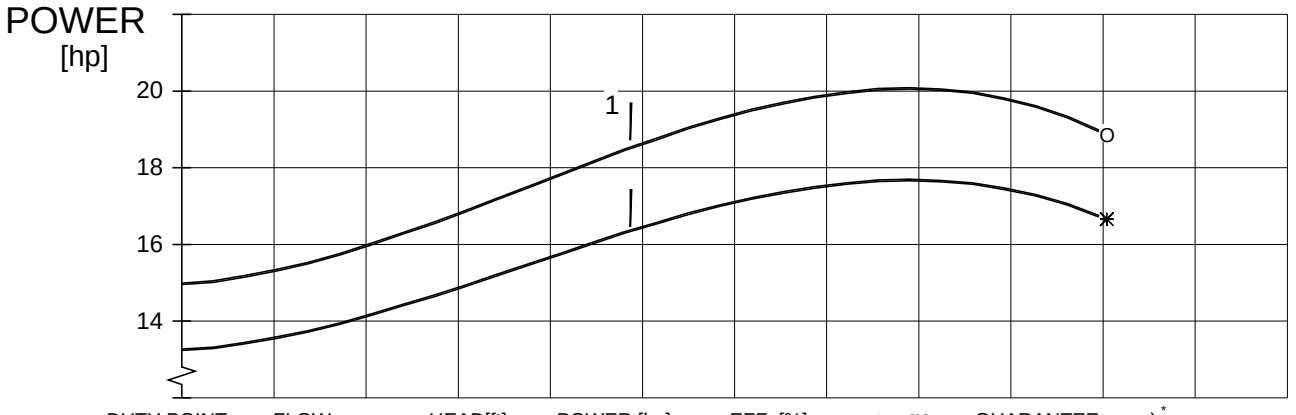
	1/1-LOAD	3/4-LOAD	1/2-LOAD
MOTOR COS PHI	0.83	0.78	0.67
MOTOR EFFICIENCY	87.5%	88.5%	87.5%
GEAR EFFICIENCY			

CURVE NO 63- 434-00 -60 30

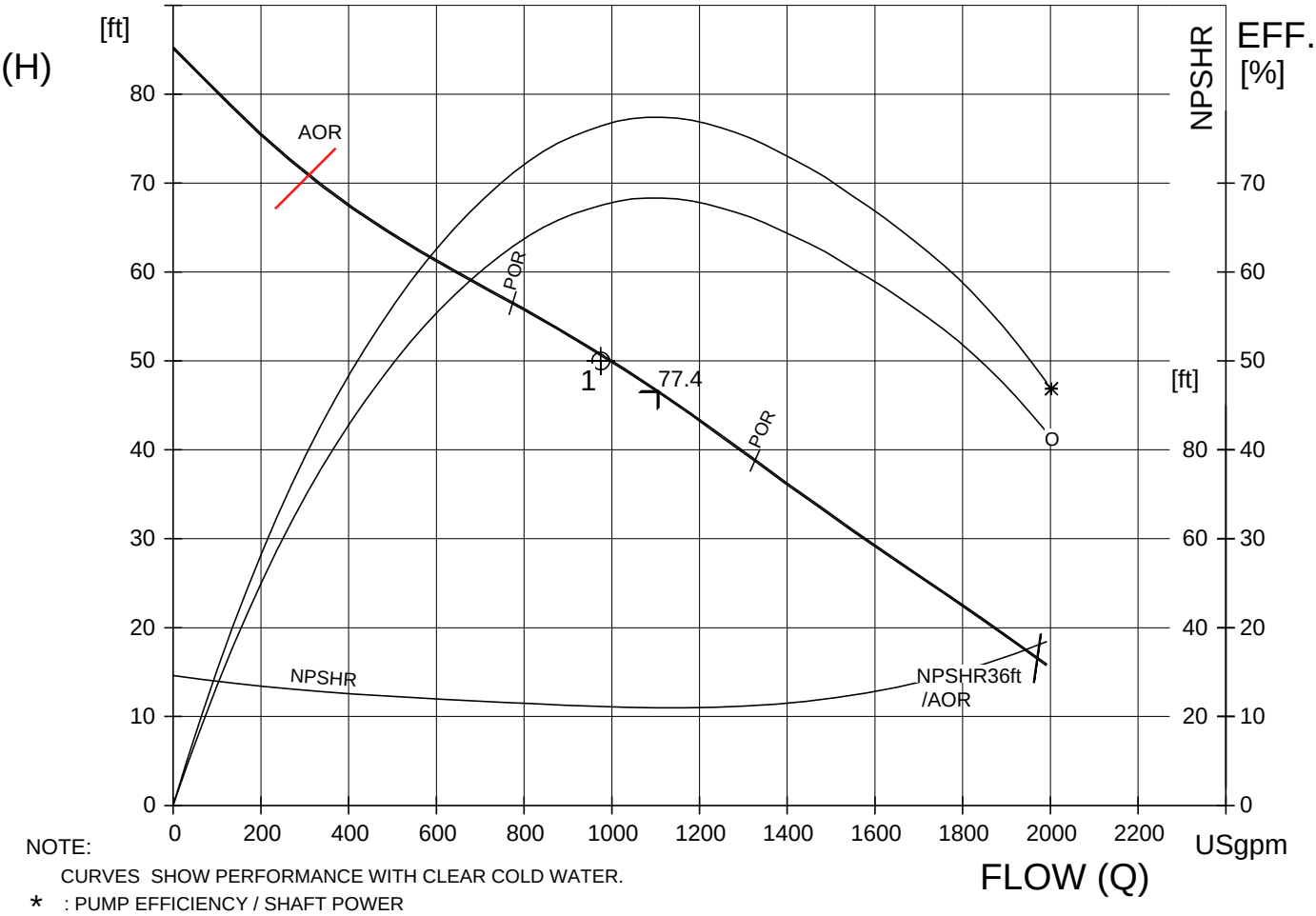
IMPELLER DIAMETER 227 mm

MOTOR TYPE 21-18-4AA /01 (12)

GEAR TYPE RATIO



DUTY POINTs :	FLOW[USgpm]	HEAD[ft]	POWER [hp]	EFF. [%]	NPSHR[ft]	GUARANTEE	) * -> No guarantee
	975	50.0	(<19.3) (<17.0) *	(67.6) (76.5) *	22.9	HI grade 2B Q&H	(ANSI/HI 11.6:2012)



NOTE:

CURVES SHOW PERFORMANCE WITH CLEAR COLD WATER.

* : PUMP EFFICIENCY / SHAFT POWER

O : OVERALL EFFICIENCY / INPUT POWER

NPSHR = NPSH3 + min. operational margin

unix AUTHOR: fus116 PECU rev:21.14 /CUPC

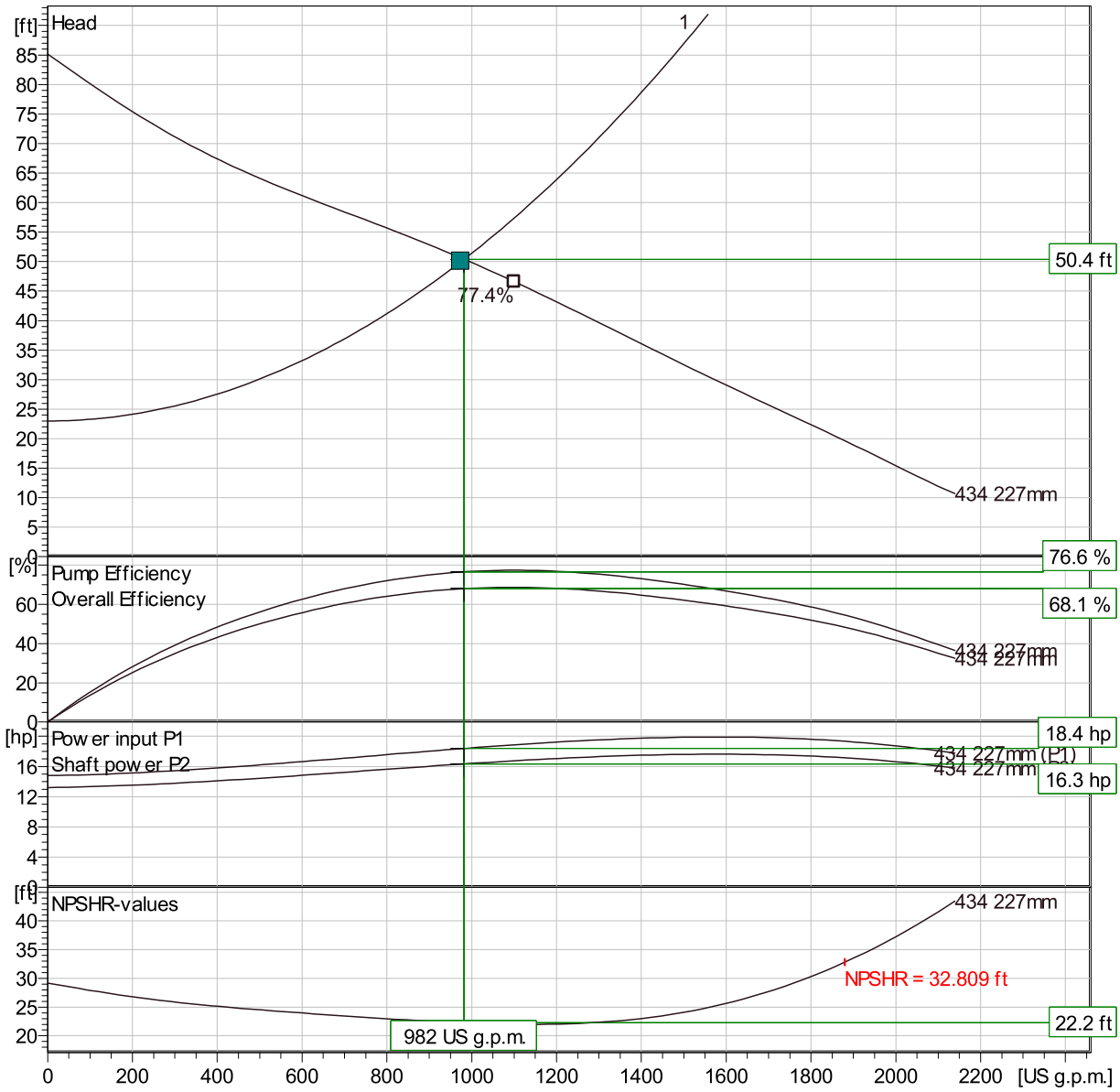
USA

PERFORMANCE CURVE

NP 3153 MT 3~ 434

Duty Analysis

Curves according to: Water, pure ,39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



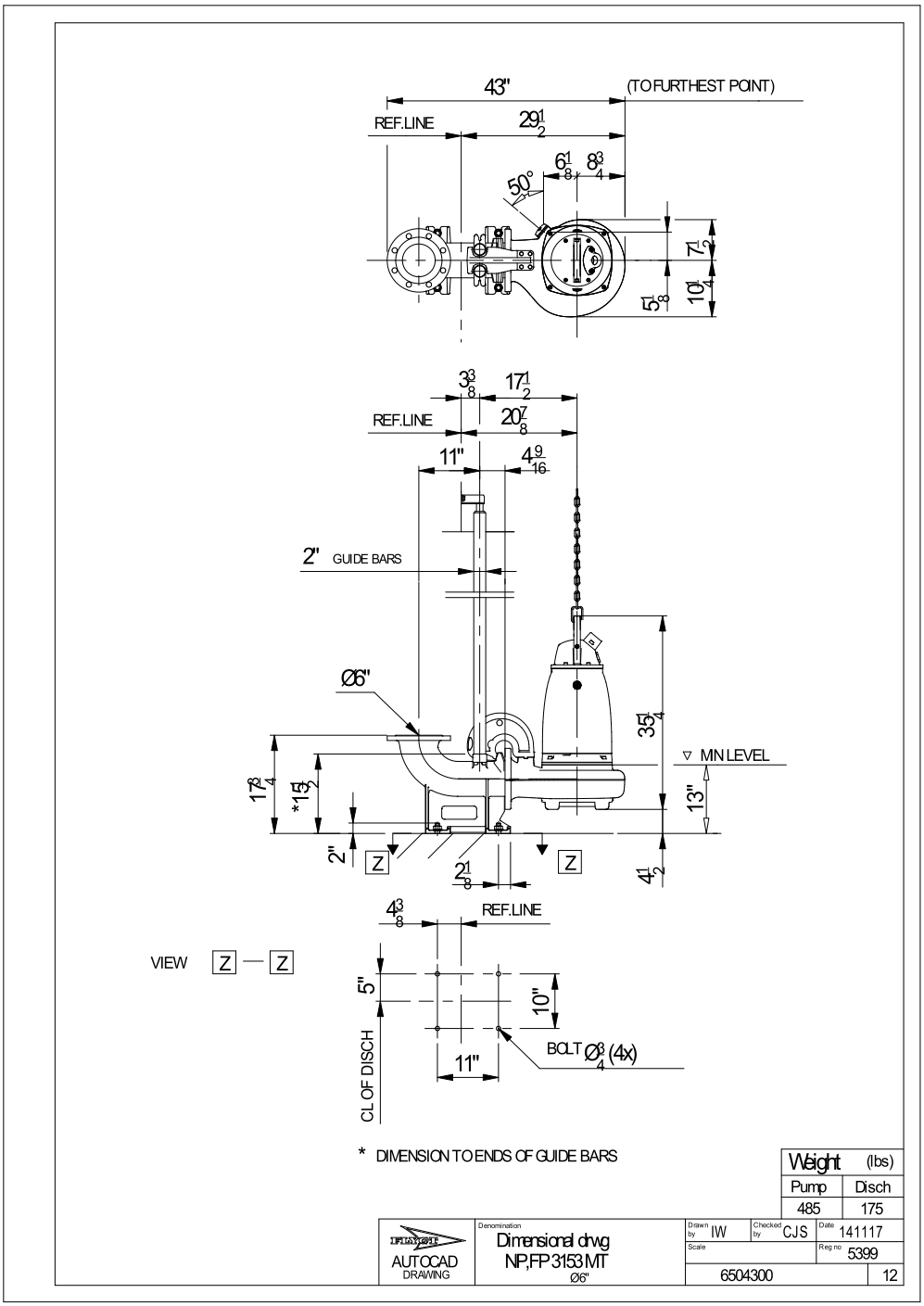
Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
1	982 US g.p.m.	50.4 ft	16.3 hp	982 US g.p.m.	50.4 ft	16.3 hp	76.6 %	233 kWh/US M	22.2 ft

Project		**Created by**	David Troyer		
Block		**Created on**	7/8/2021	**Last update**	7/8/2021

NP 3153 MT 3~ 434

Dimensional drawing



Project		**Created by**	David Troyer
Block		**Created on**	7/8/2021 **Last update** 7/8/2021

V.W. HOUSEN
& ASSOCIATES

Antioch Diversion Pump Station – Hydraulic Calculations

Antioch Diversion Pump Station

Pump and Suction and Discharge Loss Curves – Antioch Diversion Pumps

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Suction & Discharge - 8”

Diameter = 8 in

Area for = 0.349066 ft^2

RH=D/4= 0.166667

C= 120

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x $(v^2/2g)$	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.00	0.00	0.00	8.00	0.00	0.00	38.57	120	0.0000	0.0000	4.55	0.000	0.0000
100.00	0.14	0.22	8.00	0.64	0.01	38.57	120	0.0003	0.0115	4.55	0.029	0.0403
200.00	0.29	0.45	8.00	1.28	0.03	38.57	120	0.0011	0.0415	4.55	0.115	0.1566
300.00	0.43	0.67	8.00	1.91	0.06	38.57	120	0.0023	0.0879	4.55	0.259	0.3470
400.00	0.58	0.89	8.00	2.55	0.10	38.57	120	0.0039	0.1498	4.55	0.461	0.6104
500.00	0.72	1.11	8.00	3.19	0.16	38.57	120	0.0059	0.2264	4.55	0.720	0.9461
600.00	0.86	1.34	8.00	3.83	0.23	38.57	120	0.0082	0.3173	4.55	1.036	1.3537
700.00	1.01	1.56	8.00	4.47	0.31	38.57	120	0.0109	0.4222	4.55	1.411	1.8328
800.00	1.15	1.78	8.00	5.11	0.40	38.57	120	0.0140	0.5406	4.55	1.842	2.3830
900.00	1.30	2.01	8.00	5.74	0.51	38.57	120	0.0174	0.6724	4.55	2.332	3.0042
1000.00	1.44	2.23	8.00	6.38	0.63	38.57	120	0.0212	0.8173	4.55	2.879	3.6960
1200.00	1.73	2.67	8.00	7.66	0.91	38.57	120	0.0297	1.1456	4.55	4.145	5.2910
1400.00	2.02	3.12	8.00	8.94	1.24	38.57	120	0.0395	1.5241	4.55	5.642	7.1664
1600.00	2.30	3.57	8.00	10.21	1.62	38.57	120	0.0506	1.9517	4.55	7.370	9.3213
1800.00	2.59	4.01	8.00	11.49	2.05	38.57	120	0.0629	2.4274	4.55	9.327	11.7545
2000.00	2.88	4.46	8.00	12.77	2.53	38.57	120	0.0765	2.9504	4.55	11.515	14.4654
2150.00	3.10	4.79	8.00	13.72	2.92	38.57	120	0.0875	3.3732	4.55	13.307	16.6803
2200.00	3.17	4.90	8.00	14.04	3.06	38.57	120	0.0913	3.5200	4.55	13.933	17.4532
2400.00	3.46	5.35	8.00	15.32	3.64	38.57	120	0.1072	4.1355	4.55	16.582	20.7171
2500.00	3.60	5.57	8.00	15.96	3.95	38.57	120	0.1156	4.4602	4.55	17.992	22.4525

Antioch Diversion Pump Station

Pump and Suction and Discharge Loss Curves – Antioch Diversion Pumps

Pump Suction and Discharge Losses

Q (gpm)	Q (mgd)	Total Losses S&D (ft)
0.00	0.00	0.0000
100.00	0.14	0.0403
200.00	0.29	0.1566
300.00	0.43	0.3470
400.00	0.58	0.6104
500.00	0.72	0.9461
600.00	0.86	1.3537
700.00	1.01	1.8328
800.00	1.15	2.3830
900.00	1.30	3.0042
1000.00	1.44	3.6960
1200.00	1.73	5.2910
1400.00	2.02	7.1664
1600.00	2.30	9.3213
1800.00	2.59	11.7545
2000.00	2.88	14.4654
2150.00	3.10	16.6803
2200.00	3.17	17.4532
2400.00	3.46	20.7171
2500.00	3.60	22.4525

Antioch Diversion Pumps – Flygt NP3153MT 434 impeller (227mm trim) 20Hp

Mfr Pump Curve				Adjusted Pump Curves 1 Pump			2 Pumps			3 Pumps		
Q	Q	Mfr Curve Head	S&D Losses S&D	Q	Q	ADJ Curve Head	Q	Q	ADJ Curve Head	Q	Q	ADJ Curve Head
(gpm)	(mgd)	(ft)	(ft)	(gpm)	(mgd)	(ft)	(gpm)	(mgd)	(ft)	(gpm)	(mgd)	(ft)
0.00	0.00	85.00	0.0000	0	0.00	85.00	0	0.00	85.00	0	0.00	85.00
100.00	0.14	80.00	0.0403	100	0.14	79.96	200	0.29	79.96	300	0.43	79.96
200.00	0.29	75.20	0.1566	200	0.29	75.04	400	0.58	75.04	600	0.86	75.04
300.00	0.43	71.50	0.3470	300	0.43	71.15	600	0.86	71.15	900	1.30	71.15
400.00	0.58	67.50	0.6104	400	0.58	66.89	800	1.15	66.89	1200	1.73	66.89
500.00	0.72	64.00	0.9461	500	0.72	63.05	1000	1.44	63.05	1500	2.16	63.05
600.00	0.86	61.00	1.3537	600	0.86	59.65	1200	1.73	59.65	1800	2.59	59.65
700.00	1.01	58.00	1.8328	700	1.01	56.17	1400	2.02	56.17	2100	3.02	56.17
800.00	1.15	56.00	2.3830	800	1.15	53.62	1600	2.30	53.62	2400	3.46	53.62
900.00	1.30	53.00	3.0042	900	1.30	50.00	1800	2.59	50.00	2700	3.89	50.00
1000.00	1.44	50.00	3.6960	1000	1.44	46.30	2000	2.88	46.30	3000	4.32	46.30
1200.00	1.73	43.80	5.2910	1200	1.73	38.51	2400	3.46	38.51	3600	5.18	38.51
1400.00	2.02	36.58	7.1664	1400	2.02	29.41	2800	4.03	29.41	4200	6.05	29.41
1600.00	2.30	29.50	9.3213	1600	2.30	20.18	3200	4.61	20.18	4800	6.91	20.18
1800.00	2.59	23.00	11.7545	1800	2.59	11.25	3600	5.18	11.25	5400	7.78	11.25
2000.00	2.88	15.30	14.4654	2000	2.88	0.83	4000	5.76	0.83	6000	8.64	0.83
2150.00	3.10	11.00	16.6803	2150	3.10	-5.68	4300	6.19	-5.68	6450	9.29	-5.68
2200.00	3.17	0.00	17.4532	2200	3.17	-17.45	4400	6.34	-17.45	6600	9.50	-17.45
2400.00	3.46	0.00	20.7171	2400	3.46	-20.72	4800	6.91	-20.72	7200	10.37	-20.72
2500.00	3.60	0.00	22.4525	2500	3.60	-22.45	5000	7.20	-22.45	7500	10.80	-22.45

Antioch Diversion Pump Station

System Curve – 14" Forcemain to ESB

FM System – 14"

Diameter = 16 in
Area = 1.396263 ft^2
RH=D/4= 0.333333
C= 100

Q	Q	Q	Pipe Dia.	V	$V^2/2g$	L	C	S	Friction Losses S x L	K	Minor Losses K x ($v^2/2g$)	Total Losses
(gpm)	(mgd)	(cfs)	(in)	(fps)	(ft)	(ft)			(ft)		(ft)	(ft)
0.0	0.00	0.00	14.00	0.00	0.00	182.00	100	0.0000	0.0000	3.75	0.000	0.0000
200.0	0.29	0.45	14.00	0.42	0.00	182.00	100	0.0001	0.0180	3.75	0.010	0.0281
400.0	0.58	0.89	14.00	0.83	0.01	182.00	100	0.0004	0.0649	3.75	0.040	0.1053
600.0	0.86	1.34	14.00	1.25	0.02	182.00	100	0.0008	0.1375	3.75	0.091	0.2285
800.0	1.15	1.78	14.00	1.67	0.04	182.00	100	0.0013	0.2342	3.75	0.162	0.3961
1000.0	1.44	2.23	14.00	2.08	0.07	182.00	100	0.0019	0.3540	3.75	0.253	0.6070
1200.0	1.73	2.67	14.00	2.50	0.10	182.00	100	0.0027	0.4963	3.75	0.364	0.8605
1400.0	2.02	3.12	14.00	2.92	0.13	182.00	100	0.0036	0.6602	3.75	0.496	1.1560
1600.0	2.30	3.57	14.00	3.33	0.17	182.00	100	0.0046	0.8454	3.75	0.648	1.4931
1800.0	2.59	4.01	14.00	3.75	0.22	182.00	100	0.0058	1.0515	3.75	0.820	1.8712
2000.0	2.88	4.46	14.00	4.17	0.27	182.00	100	0.0070	1.2781	3.75	1.012	2.2900
2200.0	3.17	4.90	14.00	4.59	0.33	182.00	100	0.0084	1.5248	3.75	1.224	2.7492
2400.0	3.46	5.35	14.00	5.00	0.39	182.00	100	0.0098	1.7915	3.75	1.457	3.2486
2600.0	3.74	5.79	14.00	5.42	0.46	182.00	100	0.0114	2.0777	3.75	1.710	3.7878
2800.0	4.03	6.24	14.00	5.84	0.53	182.00	100	0.0131	2.3834	3.75	1.983	4.3667
3000.0	4.32	6.68	14.00	6.25	0.61	182.00	100	0.0149	2.7082	3.75	2.277	4.9850
3200.0	4.61	7.13	14.00	6.67	0.69	182.00	100	0.0168	3.0521	3.75	2.590	5.6425
3400.0	4.90	7.58	14.00	7.09	0.78	182.00	100	0.0188	3.4147	3.75	2.924	6.3391
3600.0	5.18	8.02	14.00	7.50	0.87	182.00	100	0.0209	3.7960	3.75	3.279	7.0746
3800.0	5.47	8.47	14.00	7.92	0.97	182.00	100	0.0231	4.1958	3.75	3.653	7.8487
4000.0	5.76	8.91	14.00	8.34	1.08	182.00	100	0.0254	4.6139	3.75	4.048	8.6615
4200.0	6.05	9.36	14.00	8.75	1.19	182.00	100	0.0277	5.0503	3.75	4.462	9.5127
4400.0	6.34	9.80	14.00	9.17	1.31	182.00	100	0.0302	5.5047	3.75	4.898	10.4022
4600.0	6.62	10.25	14.00	9.59	1.43	182.00	100	0.0328	5.9770	3.75	5.353	11.3299
4800.0	6.91	10.70	14.00	10.00	1.55	182.00	100	0.0355	6.4672	3.75	5.828	12.2957
5000.0	7.20	11.14	14.00	10.42	1.69	182.00	100	0.0383	6.9751	3.75	6.324	13.2994
5200.0	7.49	11.59	14.00	10.84	1.82	182.00	100	0.0412	7.5006	3.75	6.840	14.3410
5400.0	7.78	12.03	14.00	11.26	1.97	182.00	100	0.0442	8.0436	3.75	7.377	15.4203
5600.0	8.06	12.48	14.00	11.67	2.12	182.00	100	0.0473	8.6040	3.75	7.933	16.5372
5800.0	8.35	12.92	14.00	12.09	2.27	182.00	100	0.0504	9.1818	3.75	8.510	17.6917
6000.0	8.64	13.37	14.00	12.51	2.43	182.00	100	0.0537	9.7767	3.75	9.107	18.8837
6200.0	8.93	13.81	14.00	12.92	2.59	182.00	100	0.0571	10.3888	3.75	9.724	20.1131
6400.0	9.22	14.26	14.00	13.34	2.76	182.00	100	0.0605	11.0180	3.75	10.362	21.3797
6600.0	9.50	14.71	14.00	13.76	2.94	182.00	100	0.0641	11.6641	3.75	11.019	22.6836
6800.0	9.79	15.15	14.00	14.17	3.12	182.00	100	0.0677	12.3272	3.75	11.697	24.0246
7000.0	10.08	15.60	14.00	14.59	3.31	182.00	100	0.0715	13.0071	3.75	12.396	25.4027
7200.0	10.37	16.04	14.00	15.01	3.50	182.00	100	0.0753	13.7037	3.75	13.114	26.8178
7400.0	10.66	16.49	14.00	15.42	3.69	182.00	100	0.0792	14.4170	3.75	13.853	28.2697
7600.0	10.94	16.93	14.00	15.84	3.90	182.00	100	0.0832	15.1469	3.75	14.612	29.7586
7800.0	11.23	17.38	14.00	16.26	4.10	182.00	100	0.0873	15.8934	3.75	15.391	31.2842
8000.0	11.52	17.83	14.00	16.67	4.32	182.00	100	0.0915	16.6564	3.75	16.190	32.8466

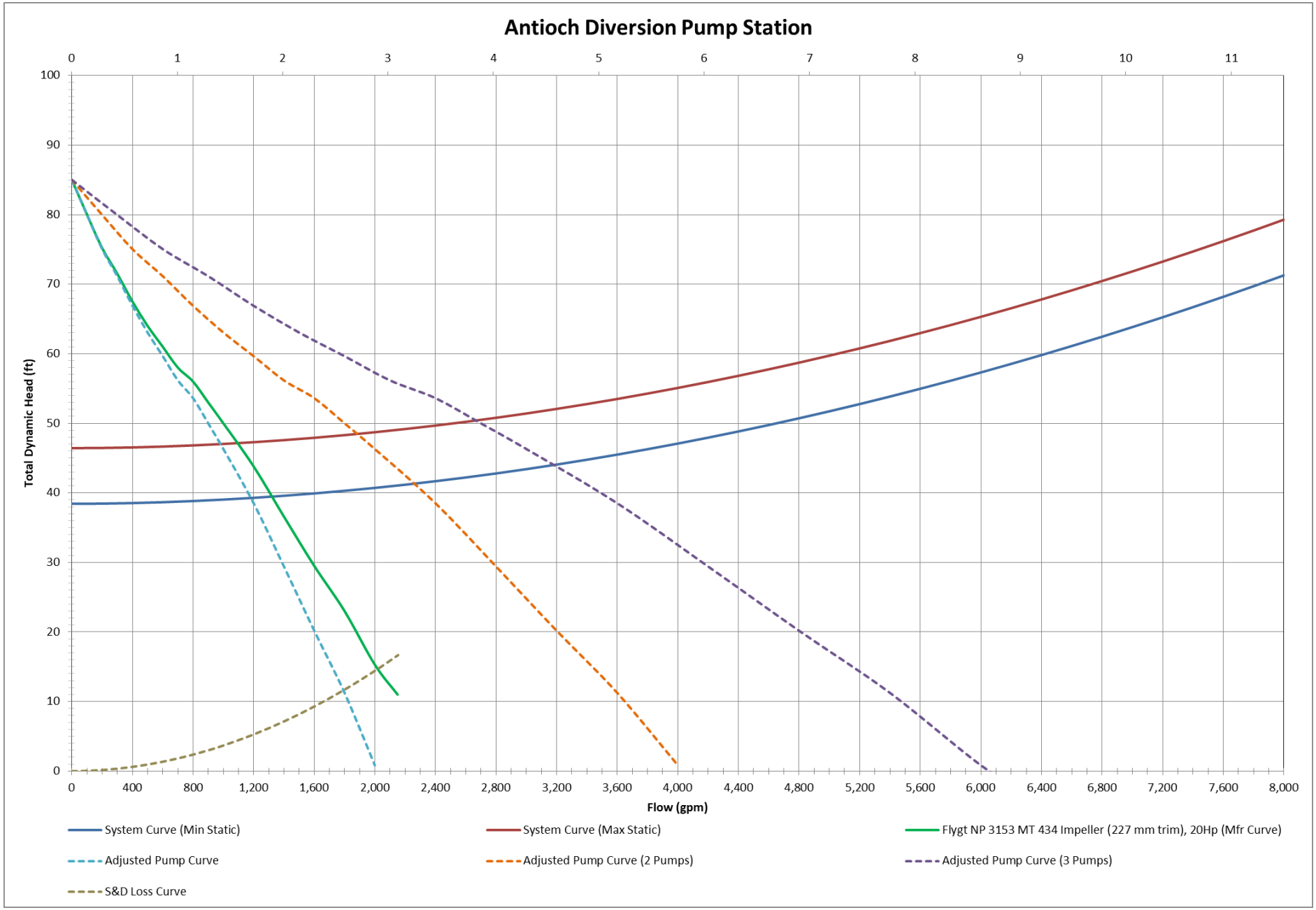
Antioch Diversion Pump Station

System Curve – 14” Forcemain to ESB

Q (gpm)	Q (mgd)	Losses
0	0.00	0.00
200	0.29	0.03
400	0.58	0.11
600	0.86	0.23
800	1.15	0.40
1000	1.44	0.61
1200	1.73	0.86
1400	2.02	1.16
1600	2.30	1.49
1800	2.59	1.87
2000	2.88	2.29
2200	3.17	2.75
2400	3.46	3.25
2600	3.74	3.79
2800	4.03	4.37
3000	4.32	4.98
3200	4.61	5.64
3400	4.90	6.34
3600	5.18	7.07
3800	5.47	7.85
4000	5.76	8.66
4200	6.05	9.51
4400	6.34	10.40
4600	6.62	11.33
4800	6.91	12.30
5000	7.20	13.30
5200	7.49	14.34
5400	7.78	15.42
5600	8.06	16.54
5800	8.35	17.69
6000	8.64	18.88
6200	8.93	20.11
6400	9.22	21.38
6600	9.50	22.68
6800	9.79	24.02
7000	10.08	25.40
7200	10.37	26.82
7400	10.66	28.27
7600	10.94	29.76
7800	11.23	31.28
8000	11.52	32.85

Q (gpm)	Q (mgd)	Min Static	Max Static
0	0.00	38.43	46.43
200	0.29	38.46	46.46
400	0.58	38.54	46.54
600	0.86	38.66	46.66
800	1.15	38.83	46.83
1000	1.44	39.04	47.04
1200	1.73	39.29	47.29
1400	2.02	39.59	47.59
1600	2.30	39.92	47.92
1800	2.59	40.30	48.30
2000	2.88	40.72	48.72
2200	3.17	41.18	49.18
2400	3.46	41.68	49.68
2600	3.74	42.22	50.22
2800	4.03	42.80	50.80
3000	4.32	43.41	51.41
3200	4.61	44.07	52.07
3400	4.90	44.77	52.77
3600	5.18	45.50	53.50
3800	5.47	46.28	54.28
4000	5.76	47.09	55.09
4200	6.05	47.94	55.94
4400	6.34	48.83	56.83
4600	6.62	49.76	57.76
4800	6.91	50.73	58.73
5000	7.20	51.73	59.73
5200	7.49	52.77	60.77
5400	7.78	53.85	61.85
5600	8.06	54.97	62.97
5800	8.35	56.12	64.12
6000	8.64	57.31	65.31
6200	8.93	58.54	66.54
6400	9.22	59.81	67.81
6600	9.50	61.11	69.11
6800	9.79	62.45	70.45
7000	10.08	63.83	71.83
7200	10.37	65.25	73.25
7400	10.66	66.70	74.70
7600	10.94	68.19	76.19
7800	11.23	69.71	77.71
8000	11.52	71.28	79.28

MIN Static Head = 38.43
MAX Static Head = 46.43


Antioch Diversion Pump Station
Total Dynamic Head (ft)
Flow (gpm)
0
1
2
3
4
5
6
7
8
9
10
11
100
90
80
70
60
50
40
30
20
10
0
0
400
800
1,200
1,600
2,000
2,400
2,800
3,200
3,600
4,000
4,400
4,800
5,200
5,600
6,000
6,400
6,800
7,200
7,600
8,000
System Curve (Min Static)
System Curve (Max Static)
Flygt NP 3153 MT 434 Impeller (227 mm trim), 20Hp (Mfr Curve)
Adjusted Pump Curve
Adjusted Pump Curve (2 Pumps)
Adjusted Pump Curve (3 Pumps)
S&D Loss Curve

V.W. HOUSEN
& ASSOCIATES

Appendix G. APS Grinder Analysis – Grinder Information and Construction Cost Estimates

V.W. HOUSEN & ASSOCIATES

APS Grinder Analysis – Grinder (JWC Environmental) Information

JWC Environmental®
A Sulzer Brand

2850 S Red Hill Ave. Suite125
Santa Ana, CA 92705 USA
phone (949) 833-3888
toll-free (800) 331-2277
fax (949) 833-8858
jwce@jwce.com

CMF CHANNEL MONSTER FLEX BUDGET DESIGN INFORMATION

DATE: 8/24/2021

PROJECT: Antioch, CA – Delta Diablo WWTP

TO: Misco Water – Brandon Olson

Thank you for choosing JWC's equipment. Enclosed you will find a specification and drawing based on the design parameters listed below. Please let us know if any of the information below changes.

Number of units:	2
Model:	CMF6030-M2.0E
Flow:	10.3 MGD (1624.6m³/hr)
Channel width:	42 inches (1066.8 mm)
Channel depth:	81 inches (2054.7 mm)
Shipping Weight:	3956 lbs. (1794.4 kg) each unit

5HP XPNV Immersible Grinder Motor with 40' power cable

1HP XPNV Immersible Solids Diverter Motor with 40' power cable

PC2222 Motor Controller in a NEMA 4X FRP Enclosure

Channel Frame, 316SS

Slide Gate, 316SS

Guiderail 13ft., 316SS

Lifting Bail, 316SS

Lifting Chain 20ft., 316SS

BUDGET PRICE **$256,000**

(shipping & handling and one startup service included)

Not to be used for construction

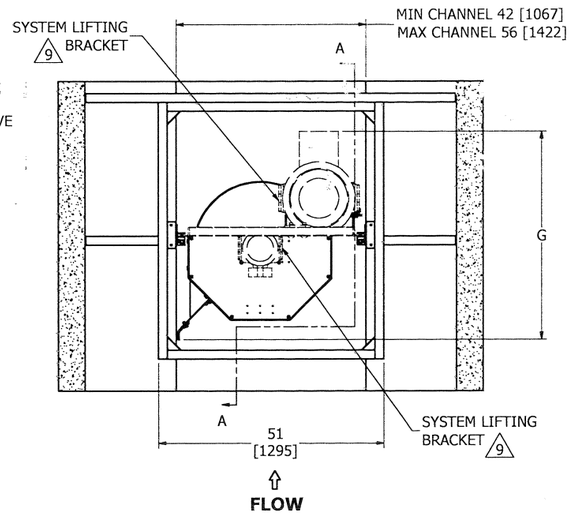
Please contact JWC if you have any questions.

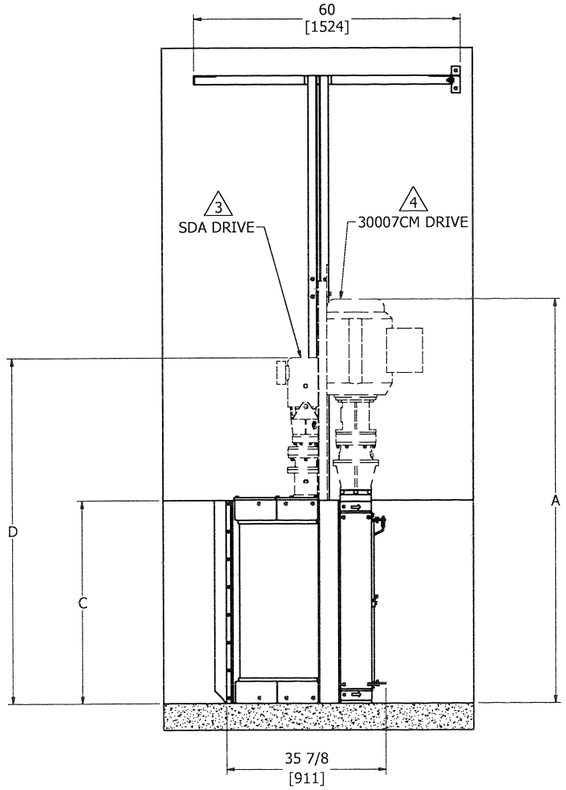
DRAWING NO. **CMF0030-M2.0-CG-GA**

REVISION HISTORY							
ZONE	REV	DESCRIPTION	ECO NO.	DATE	DRWN	CHKD	PE
ALL	A	INITIAL RELEASE	CM-1108	09-24-20	IP	CG	

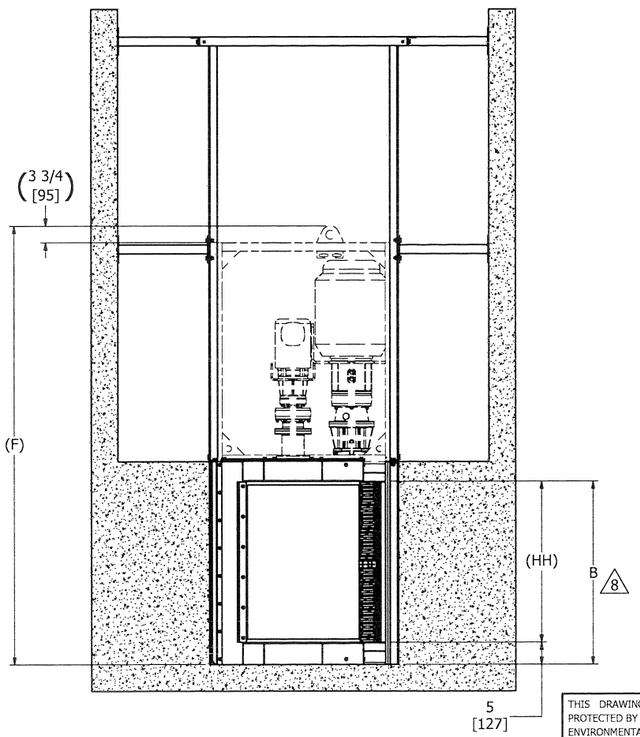
NOTES: (UNLESS OTHERWISE SPECIFIED)

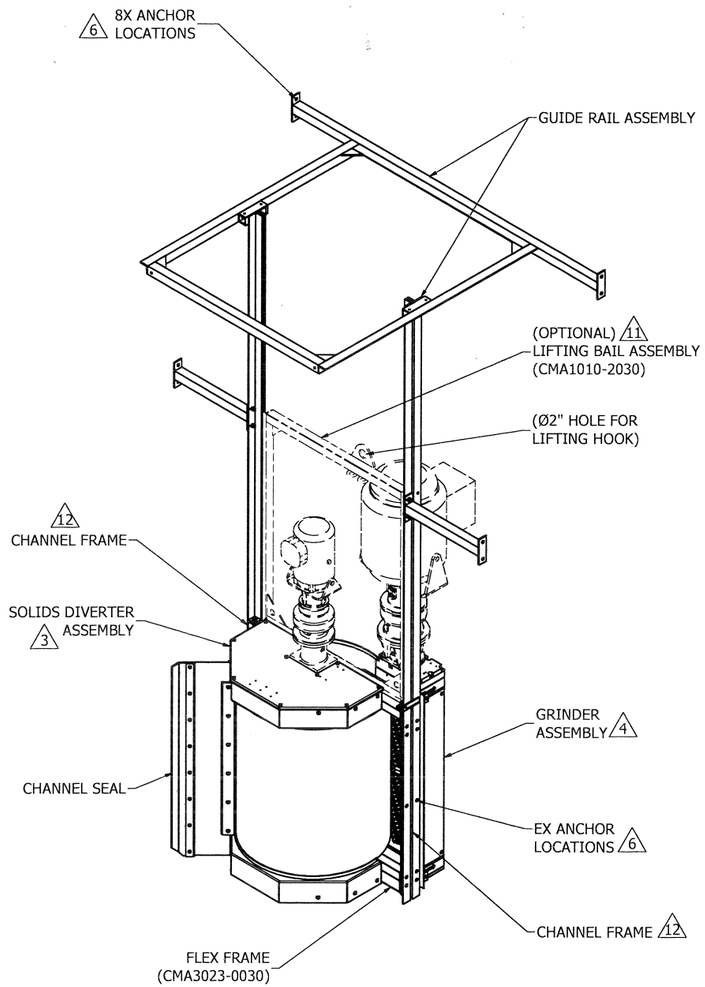
1. INTERPRET DRAWING IN ACCORDANCE WITH ASME Y14.5M-1994 STANDARDS.
2. MODEL NUMBER IS CMFHH30-M2.0DD-XXXX
   HH = NOMINAL INLET HT. (24, 36, 60)
   DD = E FOR ELECTRIC DRIVE
   = H FOR HYDRAULIC DRIVE
   = HE FOR HYD. GRINDER/ ELEC. DRUM DRIVE
   XXXX = 5HP FOR 5HP GRINDER DRIVE
   = 10HP FOR 10 HP GRINDER DRIVE
   = ST FOR STANDARD TORQUE HYD. GRINDER DRIVE
   = HT FOR HIGH TORQUE HYD. GRINDER DRIVE
3. REFER TO DRAWING SDA0030-MD-CD FOR SOLIDS DIVERTER CONFIGURATION.
4. REFER TO DRAWING 30007CM-MD-CD FOR GRINDER CONFIGURATION.
5. DIMENSIONS ARE BASED ON JWCE STANDARD OFFERINGS AND SHOULD BE USED AS A GUIDE ONLY. CONSULT FACTORY FOR CERTIFIED DRAWINGS.
6. QTY. E - FRAME ANCHOR LOCATIONS. QTY. 8 GUIDE RAIL ANCHOR LOCATIONS. (BASED ON 16' [4877] SEGMENT) (Ø1/2" ANCHOR BOLTS SUPPLIED BY OTHERS).
7. CONTRACTOR SHALL GROUT OR SEAL GAPS BETWEEN FRAME AND WALL TO PREVENT ANY LARGE PARTICLES FROM PASSING.
8. MAXIMUM UPSTREAM WATER DEPTH.
9. LIFT SYSTEM USING INNER BRACKETS AND MINIMUM 6 FT. (1.8 M) SLING OR CABLE.
10. GUIDE RAIL SEGMENTS ARE AVAILABLE IN LENGTHS UP TO 16' [4877]. USE MULTIPLE SEGMENTS FOR LONGER REQUIREMENTS. CONSULT FACTORY FOR SPECIFIC APPLICATIONS.
11. LIFTING BAIL ASSEMBLY PROVIDES SINGLE LIFTING POINT. WEIGHT IS 57.5 LB [26.1 KG].
12. REFER TO DRAWING CMA1001-0030-2.0-CD FOR CHANNEL FRAME CONFIGURATIONS.





SECTION A-A





UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [mm]
FRACTIONS ± 1/8 DECIMALS .XX ± .XXX± ANGLES ± °
MATERIAL
FINISH 250 (CAST) 125 (MACHINED) UNLESS OTHERWISE SPECIFIED
DO NOT SCALE DRAWING

	APPROVALS	DATE
CONTRACT NO.		
DRAWN	I.PINEDO	09/24/20
CHECKED	C. Glanzberman	10/14/20
PROJ ENGR	R. SNELL	10/20/20
REVISED		

JWC ENVIRONMENTAL
2850 S. RED HILL AVE, SUITE 125, SANTA ANA, CA 92705

OPEN CHANNEL GUIDE RAIL GENERAL ARRANGEMENT
CHANNEL MONSTER CMF Ø30" SCREEN
MUNICIPAL WASTEWATER

SIZE	DRAWING NO.	REV
D	CMF0030-M2.0-CG-GA	A

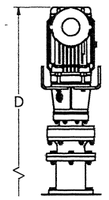
SCALE: NTS | CAD MODEL: CMF0030-M2.0-CG-GA | SHEET 1 OF 2

DRAWING NO. **CMF0030-M2.0-CG-GA**

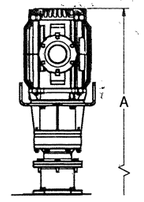
ELECTRIC DRIVE MODELS

MODEL DIMENSIONS AND WEIGHTS - 5 HP ELECTRIC GRINDER DRIVE

MODEL NUMBER	A	B	C	D	E	F (MIN)	G	WEIGHT
CMF2430-M2.0E-5HP	67 1/2 [1715]	29 11/16 [746]	33 7/8 [860]	66 3/16 [1681]	12	75 3/8 [1915]	43 1/16 [1094]	1407 LB [638 KG]
CMF3630-M2.0E-5HP	79 3/8 [2019]	41 1/4 [1048]	45 3/4 [1162]	78 1/16 [1983]	12	87 1/4 [2216]	43 1/16 [1094]	1608 LB [729 KG]
CMF6030-M2.0E-5HP	103 3/8 [2626]	65 1/4 [1657]	69 3/4 [1772]	102 1/16 [2592]	16	111 1/4 [2826]	43 1/16 [1094]	1966 LB [892 KG]



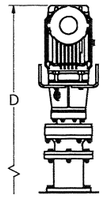
1 HP SDA DRIVE



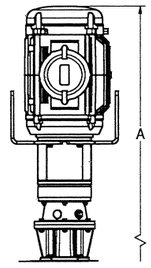
5 HP GRINDER DRIVE

MODEL DIMENSIONS AND WEIGHTS - 10 HP ELECTRIC GRINDER DRIVE

MODEL NUMBER	A	B	C	D	E	F (MIN)	G	WEIGHT
CMF2430-M2.0E-10HP	79 5/16 [2015]	29 3/8 [746]	33 7/8 [860]	66 3/16 [1681]	12	87 1/8 [2213]	47 [1194]	1765 LB [800 KG]
CMF3630-M2.0E-10HP	91 3/16 [2316]	41 1/4 [1048]	45 3/4 [1162]	78 1/16 [1983]	12	99 [2515]	47 [1194]	1966 LB [892 KG]
CMF6030-M2.0E-10HP	115 3/16 [2926]	65 1/4 [1657]	69 3/4 [1772]	102 1/16 [2592]	16	123 [3124]	47 [1194]	2324 LB [1054 KG]



1 HP SDA DRIVE

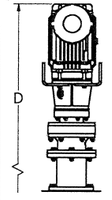


10 HP GRINDER DRIVE

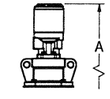
HYBRID HYDRAULIC / ELECTRIC DRIVE MODELS

MODEL DIMENSIONS AND WEIGHTS - STANDARD TORQUE HYDRAULIC / ELECTRIC DRIVE

MODEL NUMBER	A	B	C	D	E	F (MIN)	G	WEIGHT
CMF2430-M2.0HE-ST	48 [1219]	29 3/8 [746]	33 7/8 [860]	66 3/16 [1681]	12	75 3/8 [1915]	38 1/2 [978]	1119 LB [508 KG]
CMF3630-M2.0HE-ST	59 7/8 [1521]	41 1/4 [1048]	45 3/4 [1162]	78 1/16 [1983]	12	87 1/4 [2216]	38 1/2 [978]	1321 LB [599 KG]
CMF6030-M2.0HE-ST	83 7/8 [2130]	65 1/4 [1657]	69 3/4 [1772]	102 1/16 [2592]	16	111 1/4 [2826]	38 1/2 [978]	1678 LB [761 KG]



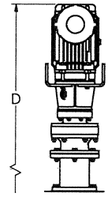
1 HP SDA DRIVE



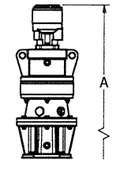
STANDARD TORQUE HYDRAULIC GRINDER DRIVE

MODEL DIMENSIONS AND WEIGHTS - HIGH TORQUE HYDRAULIC / ELECTRIC DRIVE

MODEL NUMBER	A	B	C	D	E	F (MIN)	G	WEIGHT
CMF2430-M2.0HE-HT	62 1/16 [1576]	29 3/8 [746]	33 7/8 [860]	66 3/16 [1681]	12	75 3/8 [1915]	38 1/2 [978]	1264 LB [573 KG]
CMF3630-M2.0HE-HT	74 [1880]	41 1/4 [1048]	45 3/4 [1162]	78 1/16 [1983]	12	87 1/4 [2216]	38 1/2 [978]	1466 LB [665 KG]
CMF6030-M2.0HE-HT	98 [2489]	65 1/4 [1657]	69 3/4 [1772]	102 1/16 [2592]	16	111 1/4 [2826]	38 1/2 [978]	1823 LB [827 KG]



1 HP SDA DRIVE

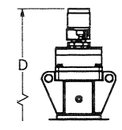


HIGH TORQUE HYDRAULIC GRINDER DRIVE

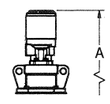
HYDRAULIC DRIVE MODELS

MODEL DIMENSIONS AND WEIGHTS - STD TORQUE HYDRAULIC DRIVE

MODEL NUMBER	A	B	C	D	E	F (MIN)	G	WEIGHT
CMF2430-M2.0H-ST	48 [1219]	29 3/8 [746]	33 7/8 [860]	52 7/16 [1132]	12	75 3/8 [1915]	38 1/2 [978]	1014 LB [460 KG]
CMF3630-M2.0H-ST	59 7/8 [1521]	41 1/4 [1048]	45 3/4 [1162]	64 5/16 [1634]	12	87 1/4 [2216]	38 1/2 [978]	1215 LB [551 KG]
CMF6030-M2.0H-ST	83 7/8 [2130]	65 1/4 [1657]	69 3/4 [1772]	88 5/16 [2243]	16	111 1/4 [2826]	38 1/2 [978]	1573 LB [714 KG]



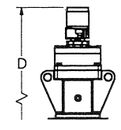
STANDARD TORQUE HYDRAULIC SDA DRIVE



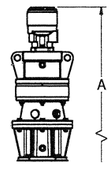
STANDARD TORQUE HYDRAULIC GRINDER DRIVE

MODEL DIMENSIONS AND WEIGHTS -HIGH TORQUE HYDRAULIC DRIVE

MODEL NUMBER	A	B	C	D	E	F (MIN)	G	WEIGHT
CMF2430-M2.0H-HT	62 1/16 [1576]	29 3/8 [746]	33 7/8 [860]	52 7/16 [1132]	12	75 3/8 [1915]	38 1/2 [978]	1159 LB [526 KG]
CMF3630-M2.0H-HT	74 [1880]	41 1/4 [1048]	45 3/4 [1162]	64 5/16 [1634]	12	87 1/4 [2216]	38 1/2 [978]	1360 LB [617 KG]
CMF6030-M2.0H-HT	98 [2489]	65 1/4 [1657]	69 3/4 [1772]	88 5/16 [2243]	16	111 1/4 [2826]	38 1/2 [978]	1718 LB [779 KG]



HIGH TORQUE HYDRAULIC SDA DRIVE



HIGH TORQUE HYDRAULIC GRINDER DRIVE

JWC ENVIRONMENTAL
2850 S. RED HILL AVE, SUITE 125, SANTA ANA, CA 92705

OPEN CHANNEL GUIDE RAIL GENERAL ARRANGEMENT
CHANNEL MONSTER CMF Ø30" SCREEN
MUNICIPAL WASTEWATER

SIZE	DRAWING NO.	REV
D	CMF0030-M2.0-CG-GA	A

SCALE: NTS	CAD MODEL: CMM-TENV-1HP	SHEET 2 OF 2

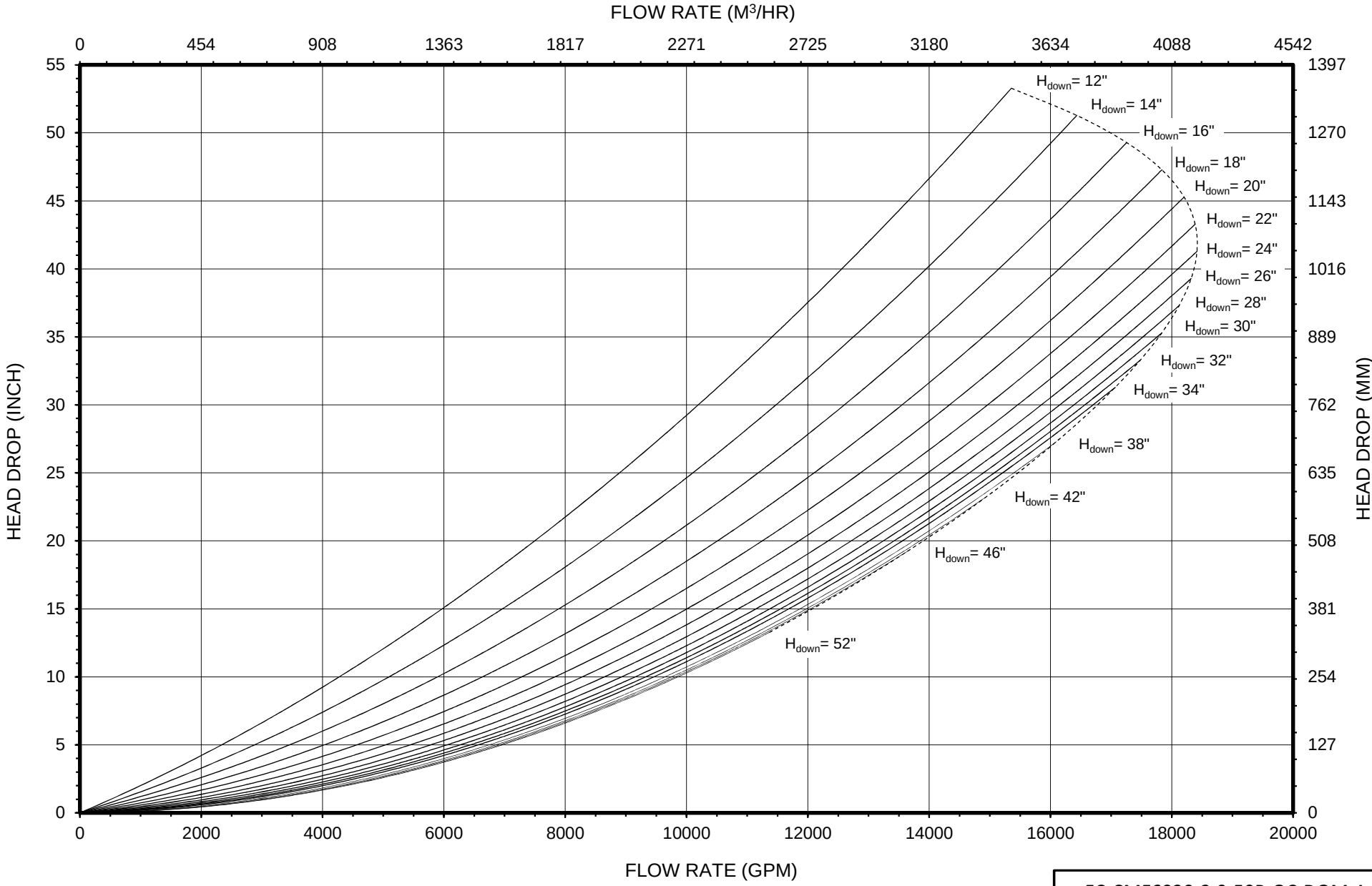
JWC Environmental®
A Sulzer Brand

REV A, ECN000026, 03/02/21, CG

HEAD DROP

MODEL CMF6030-2.0
Ø1/2" PERFORATIONS

9-06-18

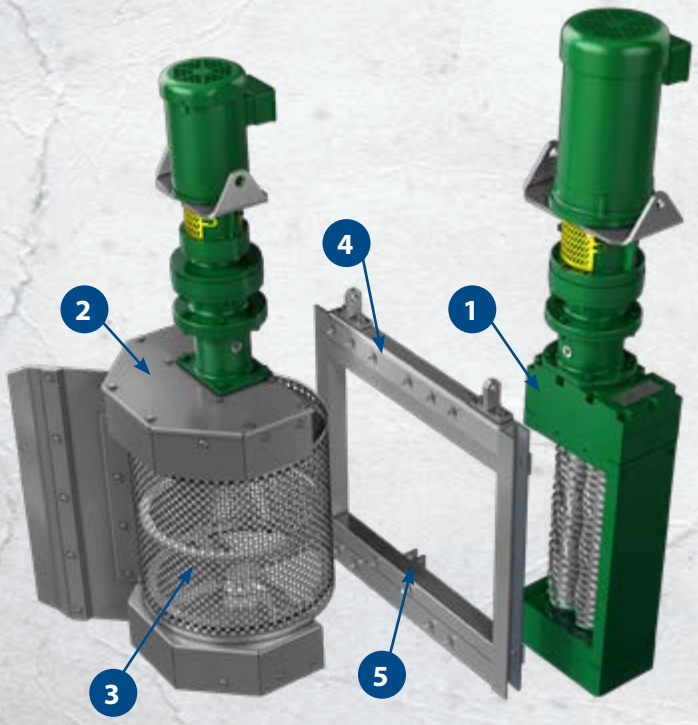


FC-CMF6030-2.0-50P-OC-DOM-A

CHANNEL MONSTER® FLEX

Overview

The patent pending Channel Monster FLEX consists of a FLEX grinder and a solids diverter with perforated screen connected by a FLEX frame. This modular design allows for the flexibility of servicing the FLEX grinder and solids diverter separately while maintaining the best-in-class technology for wastewater solids reduction. An exacta-lock adjuster mechanism allows for fine-distance adjustment between the grinder and screen to minimize solids bypass. The Channel Monster FLEX continues the Channel Monster legacy of high flow capacity while capturing and shredding rags, rocks, wood, and other solids into small pieces to pass harmlessly through pumps, pipes, and processing equipment.



Benefits

Equipment protection

- Protect pumps and other critical equipment from costly clogs and damage from tough solids

Efficient treatment operations

- Grinding separates organic from inorganic materials in the waste stream keeping organics in the treatment process, and removed screenings are cleaner

Lower operating cost

- Grinding solids into smaller pieces keeps pipes and pumps clear, resulting in shorter pump run cycles and lower electrical costs
- Reduced unit maintenance expense with modular FLEX grinder and solids diverter

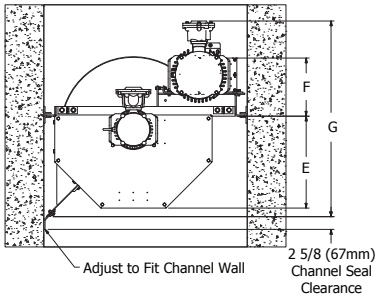
Features

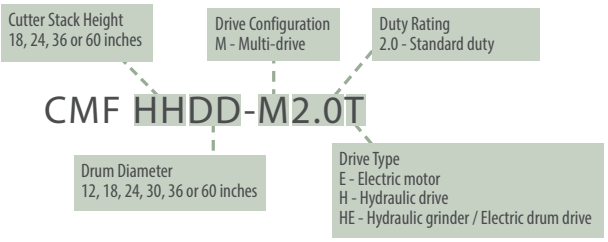
1. **FLEX grinder**
   - Dual-shafted, slow-speed, high-torque to grind a wide variety of solids
   - Modular for easy field replacement
   - Optional 10 hp motor for the highest cutting force for grinder in its size class
2. **Solids diverter with perforated screen**
   - Allows higher flow while capturing solids and directing them into the grinder
3.
   - 304 stainless steel 1/2-inch (12.7 mm) perforated drum
   - Modular assembly for easy field replacement
4. **FLEX frame**
   - Connects FLEX grinder and solids diverter
5.
   - Exacta-lock adjuster precisely locks distance between grinder and drum to optimize solids capture and shredding of solids

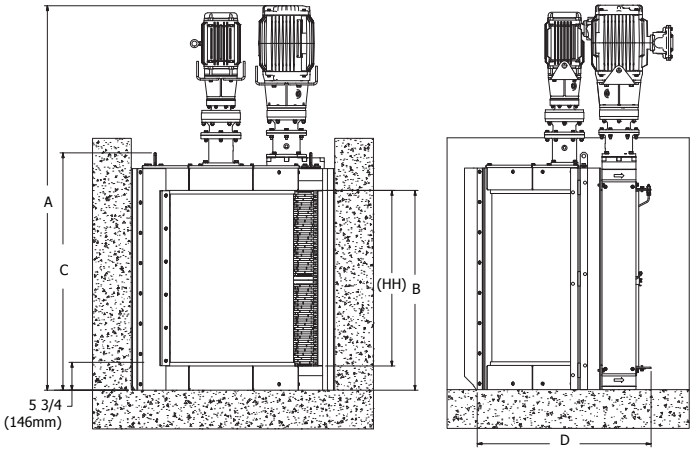
Channel Monster® FLEX

Materials of construction

Solids diverter perforated screen: 304 stainless steel
Solids diverter cover: 304 stainless steel
Solids diverter end housings: Gray iron
FLEX grinder cutter and spacers: Hardened alloy steel standard, other metals optional
FLEX grinder shafts: Hardened alloy steel
FLEX grinder end housings, covers and side rails: Gray iron
Mechanical seal faces: Tungsten carbide
FLEX and channel frames: 304 stainless steel







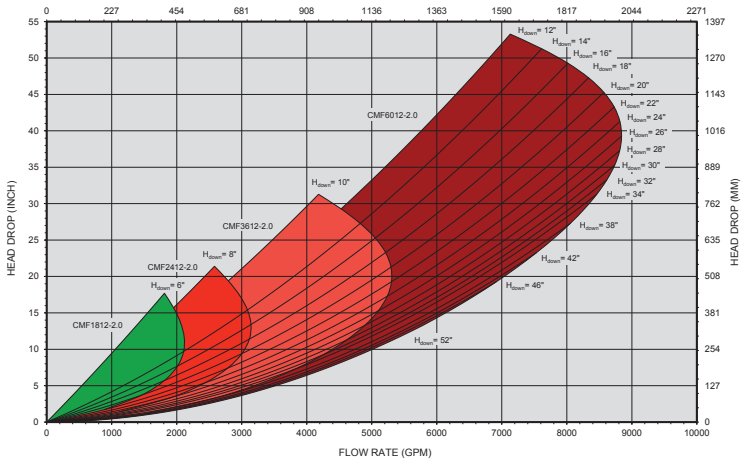
Model	A[1] - inches (mm)	B - inches (mm)	C - inches (mm)	D - inches (mm)	E - inches (mm)	F - inches (mm)	G - inches (mm)	Min/Max Channel Width - inches (mm)	Max Flow – mgd (m3/hr)	Approximate Net Weight - lbs (kg)[1]
CMF1812-M2.0E[2]	90-7/16 (2297)	23-3/4 (603)	31-1/2 (800)	23 (586)	10-1/4 (260)	8-3/4 (222)	27-5/8 (700)	22 / 36 (559) / (914)	3.0 (479)	1085 (492)
CMF2412-M2.0E[2]	96-3/16 (2443)	29-1/2 (749)	37-1/8 (943)	23 (586)	10-1/4 (260)	8-3/4 (222)	27-5/8 (700)	22 / 36 (559) / (914)	4.6 (720)	1146 (520)
CMF3612-M2.0E[2]	108-1/16 (2745)	41-1/4 (1048)	49 (1245)	23 (586)	10-1/4 (260)	8-3/4 (222)	27-5/8 (700)	22 / 36 (559) / (914)	7.6 (1206)	1311 (595)
CMF6012-M2.0E[2]	132-1/16 (3354)	65-1/4 (1657)	73 (1854)	23 (586)	10-1/4 (260)	8-3/4 (222)	27-5/8 (700)	22 / 36 (559) / (914)	12.7 (2008)	1813 (822)
CMF1818-M2.0E	61-13/16 (1570)	23-3/4 (603)	31-1/2 (800)	27-3/4 (706)	13 (330)	9-1/4 (235)	32-3/8 (821)	30 / 44 (762) / (1118)	4.6 (723)	1048 (475)
CMF2418-M2.0E	67-1/2 (1715)	29-1/2 (749)	37-1/8 (943)	27-3/4 (706)	13 (330)	9-1/4 (235)	32-3/8 (821)	30 / 44 (762) / (1118)	6.6 (1036)	1116 (506)
CMF3618-M2.0E	79-3/8 (2016)	41-1/4 (1048)	49 (1245)	27-3/4 (706)	13 (330)	9-1/4 (235)	32-3/8 (821)	30 / 44 (762) / (1118)	10.4 (1647)	1284 (582)
CMF6018-M2.0E	103-3/8 (2626)	65-1/4 (1657)	73 (1854)	27-3/4 (706)	13 (330)	9-1/4 (235)	32-3/8 (821)	30 / 44 (762) / (1118)	16.5 (2596)	1587 (720)
CMF1824-M2.0E	61-13/16 (1570)	23-3/4 (603)	31-1/2 (800)	31-5/8 (805)	16 (406)	10-7/8 (276)	36-1/4 (919)	36 / 50 (914) / (1270)	6.0 (945)	1088 (493)
CMF2424-M2.0E	67-1/2 (1715)	29-1/2 (749)	37-1/8 (943)	31-5/8 (805)	16 (406)	10-7/8 (276)	36-1/4 (919)	36 / 50 (914) / (1270)	8.5 (1334)	1160 (526)
CMF3624-M2.0E	79-3/8 (2016)	41-1/4 (1048)	49 (1245)	31-5/8 (805)	16 (406)	10-7/8 (276)	36-1/4 (919)	36 / 50 (914) / (1270)	13.1 (2059)	1344 (609)
CMF6024-M2.0E	103-3/8 (2626)	65-1/4 (1657)	73 (1854)	31-5/8 (805)	16 (406)	10-7/8 (276)	36-1/4 (919)	36 / 50 (914) / (1270)	20.0 (3160)	1674 (759)
CMF2430-M2.0E	67-1/2 (1715)	29-1/2 (749)	37-1/8 (943)	35-7/8 (912)	19 (482)	12 (305)	40-3/8 (1026)	42 / 56 (1067) / (1422)	10.5 (1658)	1287 (584)
CMF3630-M2.0E	79-3/8 (2016)	41-1/4 (1048)	49 (1245)	35-7/8 (912)	19 (482)	12 (305)	40-3/8 (1026)	42 / 56 (1067) / (1422)	16.9 (2660)	1486 (674)
CMF6030-M2.0E	103-3/8 (2626)	65-1/4 (1657)	73 (1854)	35-7/8 (912)	19 (482)	12 (305)	40-3/8 (1026)	42 / 56 (1067) / (1422)	26.6 (4191)	1838 (834)
CMF3636-M2.0E	79-3/8 (2016)	41-1/4 (1048)	49 (1245)	40 (1015)	22 (559)	13 (330)	44-1/2 (1129)	48 / 62 (1219) / (1575)	23.5 (3709)	1601 (726)
CMF6036-M2.0E	103-3/8 (2626)	65-1/4 (1657)	73 (1854)	40 (1015)	22 (559)	13 (330)	44-1/2 (1129)	48 / 62 (1219) / (1575)	40.4 (6378)	1977 (897)

1. Estimated height and weight based on 1 hp XPNV solids diverter motor and 5 hp XPNV FLEX grinder motor.
2. Dimension "A" height is for solids diverter motor height with extended shaft. If extended shaft is required for FLEX grinder drive, solids diverter extended shaft must always exceed by a minimum of 30 inches (752mm).

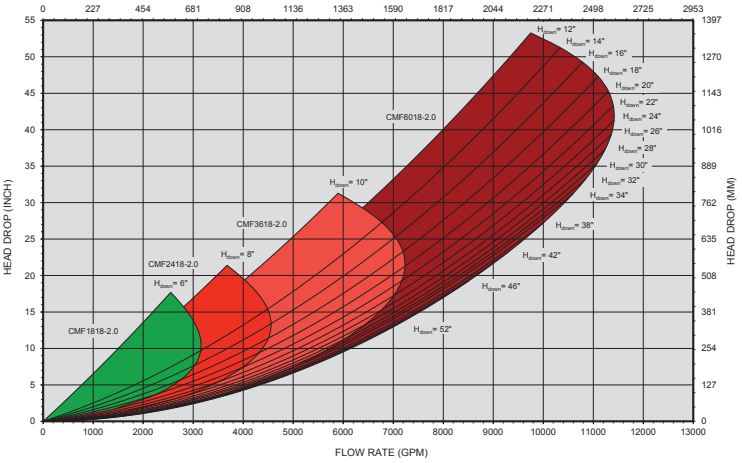
* patent pending

Channel Monster® FLEX

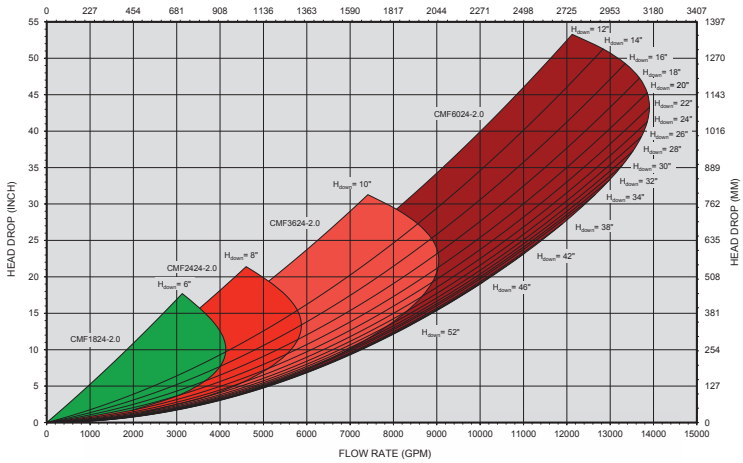
HEAD DROP
MODEL CMFHH12-2.0 Ø1/2" PERFORATIONS
FLOW RATE (M³/HR)



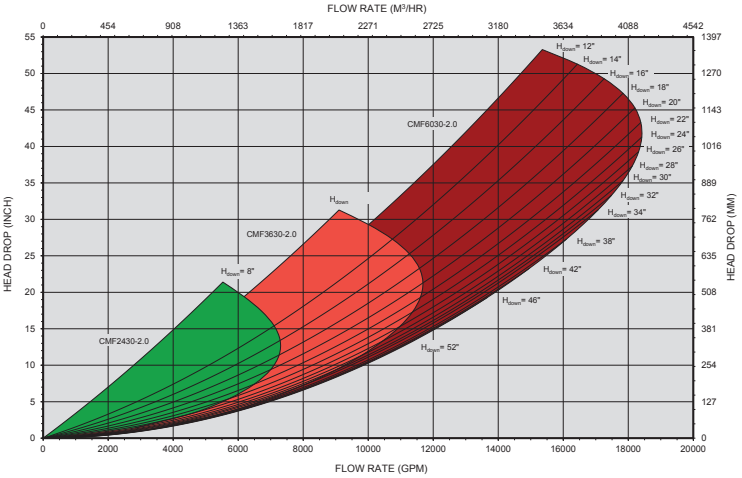
HEAD DROP
MODEL CMFHH18-2.0 Ø1/2" PERFORATIONS
FLOW RATE (M³/HR)



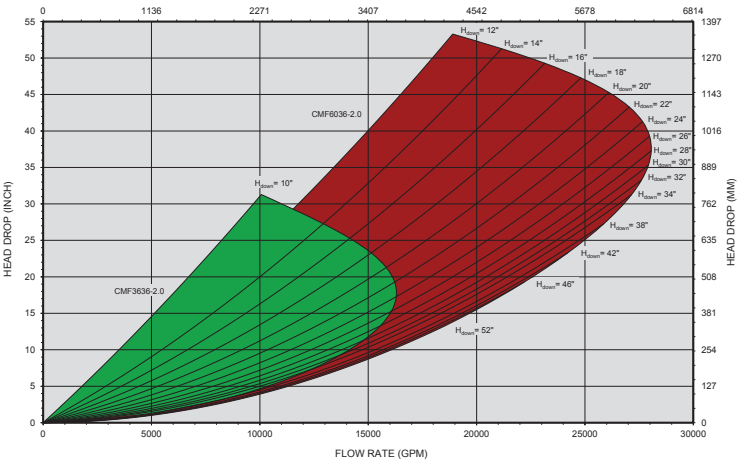
HEAD DROP
MODEL CMFHH24-2.0 Ø1/2" PERFORATIONS
FLOW RATE (M³/HR)



HEAD DROP
MODEL CMFHH30-2.0 Ø1/2" PERFORATIONS
FLOW RATE (M³/HR)



HEAD DROP
MODEL CMFHH36-2.0 Ø1/2" PERFORATIONS
FLOW RATE (M³/HR)



7-tooth:
Heavy Solids

11-tooth:
Typical Solids Loading

17-tooth:*
Rags & Stringy Materials

FLEX grinder cutters

- 7- and 11-tooth cutters in alloy steel or stainless steel
- 17-tooth serrated Wipes Ready® cutters* in alloy steel

Custom wall and channel frames

- Custom-built to meet site requirements: may include guide rails, grinder support base, overflow bar racks and more
- Guide rails for easy installation and maintenance of unit
- Stainless steel construction

Extended Motor Shaft

Extended motor shaft

- Places motor above highest water level
- Available in 1-foot (305 mm) increments
- Maximum: 15 feet (4570 mm)

Model PC2200 Standard Enclosure

Smart controller

- Load-sensing control system automatically reverses to clear jams
- Standard: NEMA 4X FRP enclosure with 3-position switch and status indicators
- Optional: NEMA 4X stainless steel or NEMA 7 enclosures
- Customized control configurations for any installation
- UL registered

Electric Motor

Exclusive: JWC-Designed Immersible Motor (NEMA 6P)

Hydraulic Drives for 10 hp Power Pack

Hydraulic Drives with 15 hp Power Pack

Electric motors

FLEX grinder 5 hp standard, 10 hp optional
solids diverter 1 hp

- TEFC: Totally enclosed fan-cooled
- XPFC: Explosion-proof fan-cooled
- XPNV: Exclusive immersible

Hydraulic drive motor assembly

- 10 hp hydraulic power pack: 3 hp equivalent on FLEX grinder, 1 hp equivalent on solids diverter
- 15 hp hydraulic power pack: 5 hp equivalent on FLEX grinder, 1 hp equivalent on solids diverter

JWC Environmental® SERVICE SOLUTIONS

JWC Service Solutions

Monster Renew: Replace the worn Channel Monster FLEX grinder or solids diverter with a factory-new module. Renew module minimizes downtime and comes with a 1-year factory warranty.

* patent pending

JWC Environmental®
A Sulzer Brand

Headquarters
2850 S. Red Hill Ave., Suite 125
Santa Ana, CA 92705 USA
toll free: **800.331.2277**
phone: **949.833.3888**
fax: **949.833.8858**
email: **jwce@jwce.com**

Muffin Monster® MONSTER INDUSTRIAL IPEC®

www.jwce.com

(CMF-4pg-NA-JWCE-0221)

DRAWING NO. **PC2222-000-1**

REVISION HISTORY								
ZONE	REV	DESCRIPTION	ECN NO	DATE	CHK	PE	MFG	QC
ALL	A	INITIAL RELEASE		10/22/18				

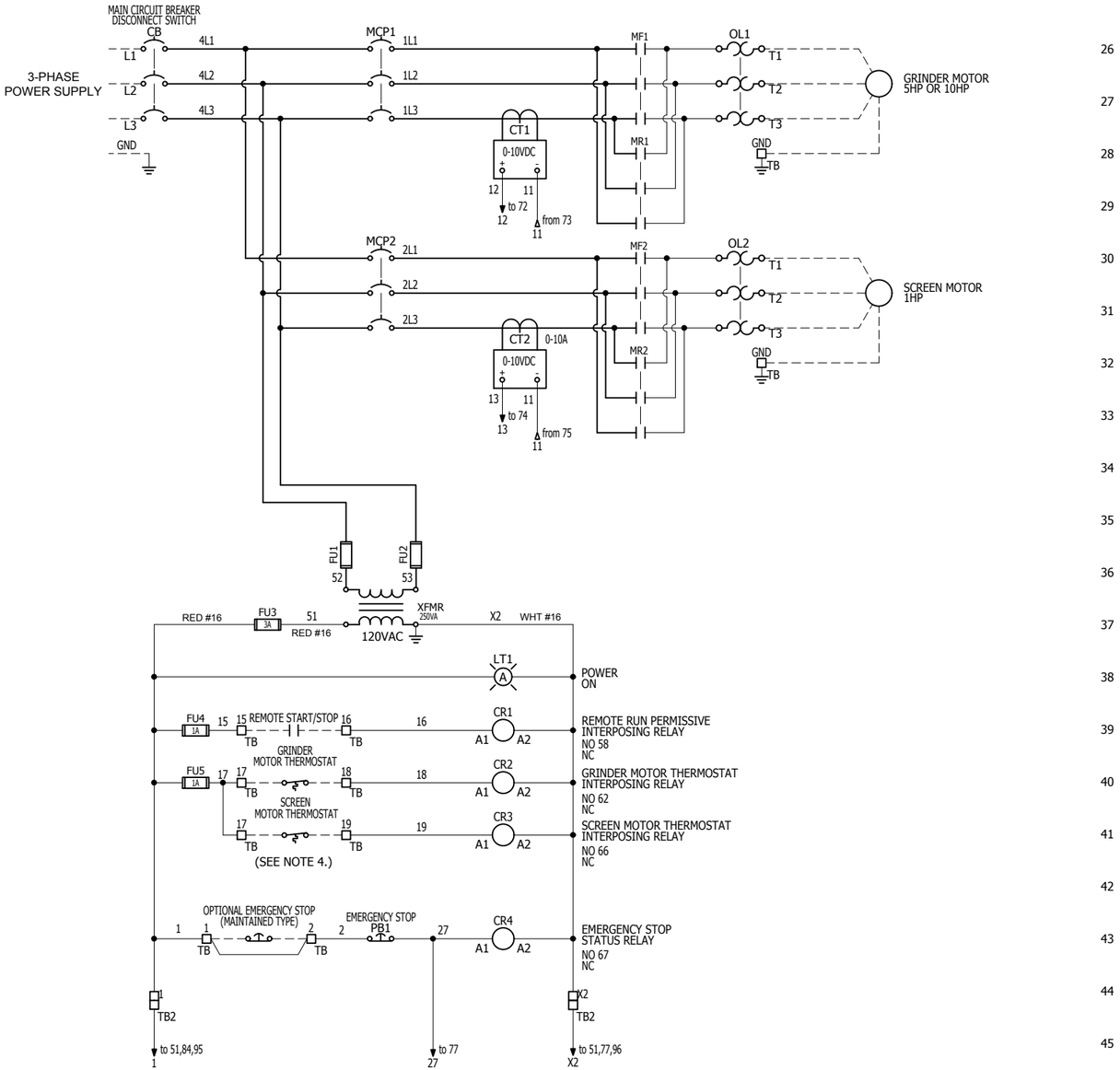


TABLE 1

BRANCH CIRCUIT PROTECTION BASED ON VOLTAGE AND HORSE-POWER					
VOLTAGE	TAG	DEVICE CURRENT RATING / WIRE SIZE			
		1HP	5HP	10HP	TYPE
208V	CB	-	45A / #10	80A / #6	AB 140G, G FRAME
	MCP1	-	16A / #10	45A / #8	AB 140M-D / F
	MCP2	4A / #12	-	-	AB 140M-D
	FU1-FU2	2A / #14			CLASS CC TIME-DELAY
230V	CB	-	40A / #10	70A / #6	AB 140G, G FRAME
	MCP1	-	16A / #12	32A / #8	AB 140M-D
	MCP2	4A / #12	-	-	AB 140M-D
	FU1-FU2	2A / #14			CLASS CC TIME-DELAY
460V	CB	-	20A / #12	35A / #12	AB 140G, G FRAME
	MCP1	-	6.3A / #12	16A / #12	AB 140M-D
	MCP2	1.6A / #12	-	-	AB 140M-C
	FU1-FU2	1A / #14			CLASS CC TIME-DELAY
575V	CB	-	15A / #12	25A / #12	AB 140G, G FRAME
	MCP1	-	6.3A / #12	10A / #12	AB 140M-D
	MCP2	1.6A / #12	-	-	AB 140M-C
	FU1-FU2	1A / #14			CLASS CC TIME-DELAY

Sequence of Operation:

Grinder selector switch, ON
- energize grinder motor forward contactor, Grinder Run indicator lamp & Grinder Run relay

Grinder selector switch, OFF
- de-energize grinder motor contactors, Grinder Run indicator lamp & Grinder Run relay

Grinder selector switch, REMOTE
- energize grinder motor forward contactor when Remote Run Permissive interposing relay input to PLC is ON; energize Grinder Run indicator lamp & Grinder Run relay

Screen selector switch, ON
- energize Screen motor forward contactor, Screen Run indicator lamp & Screen Run relay

Screen selector switch, OFF
- de-energize motor contactors, Screen Run indicator lamp, Screen Run relay

Screen selector switch, AUTO
- energize Screen motor forward contactor when the Grinder is running; energize Screen Run indicator lamp & Screen Run relay

Grinder Jam Clearing Sequence
- when the current sensor detects a jam, the motor forward contactor will be momentarily de-energized
- the motor reverse contactor will be energized for a pre-determined period of time and de-energized
- the motor forward contactor will be re-energized
- this sequence is repeated, as required, to clear the jam for a total of no more than 3 reversals in a 30-second period
- if the jam is not cleared in accordance with this sequence, an alarm condition is set
- in order to avoid nuisance trips, the inrush current is ignored for 2.5 seconds when the motor is energized

Screen Jam Clearing Sequence
- when the current sensor detects a jam, the motor forward contactor will be momentarily de-energized
- the motor reverse contactor will be energized for a pre-determined period of time and de-energized
- the motor forward contactor will be re-energized
- this sequence is repeated, as required, to clear the jam for a total of no more than 2 reversals in a 30-second period
- if the jam is not cleared in accordance with this sequence, an alarm condition is set
- in order to avoid nuisance trips, the inrush current is ignored for 2.5 seconds when the motor is energized

NOTES: UNLESS OTHERWISE SPECIFIED.
1. PROGRAM NUMBER: PC2222-000
2. THE TRIP SETTING FOR THE GRINDER MOTOR CURRENT SENSOR CT1 SHALL BE 80% OF THE MOTOR LOCKED ROTOR CURRENT (LRC); THE TRIP SETTING FOR THE SCREEN MOTOR CURRENT SENSOR CT2 SHALL BE TWO (2) TIMES THE MOTOR FULL LOAD AMPERAGE (FLA)
3. SHORT CIRCUIT CURRENT RATING (SCCR) FOR THE CONTROLLER IS 50kA @ 240V, 25kA @ 480V, 10kA @ 600Y/347V
4. A WIRE JUMPER IS REQUIRED, IF THE MOTOR IS NOT EQUIPPED WITH THE THERMOSTAT.

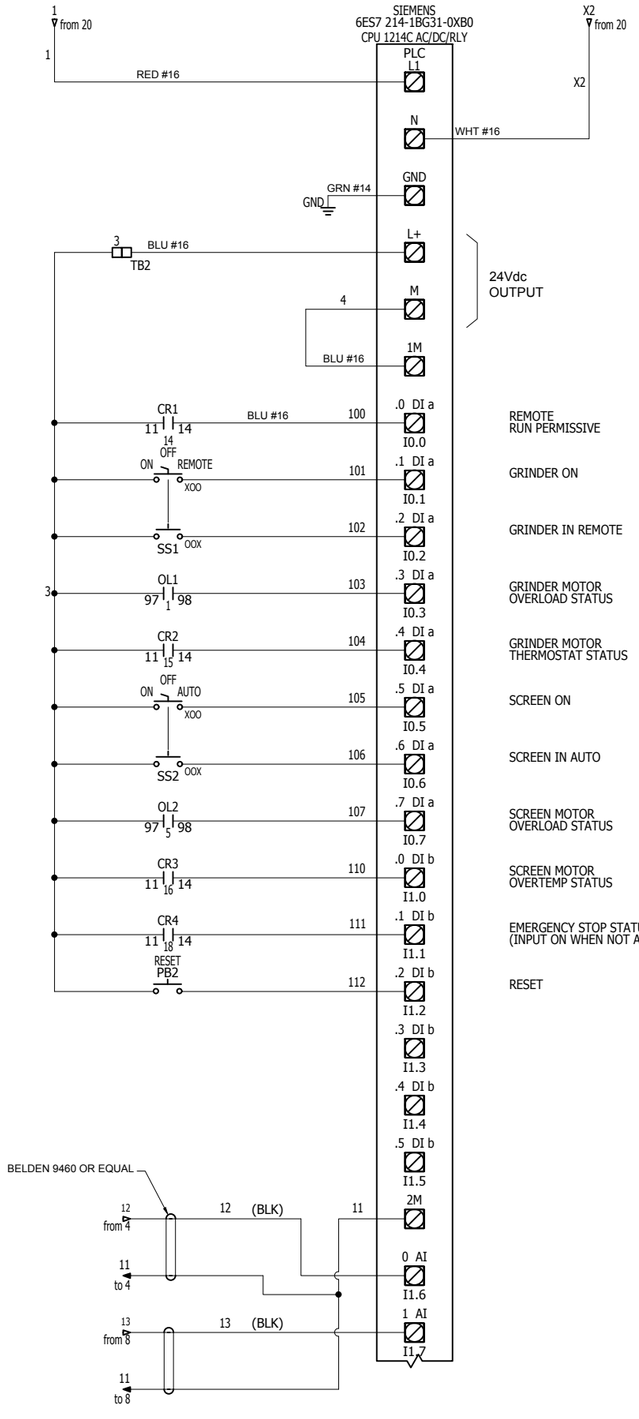
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
FRACTIONS ± 1/32 DECIMALS .XX ± .06 .XXX± .005 ANGLES ± 1/2°
MATERIAL
FINISH 250 √(CAST) 125 √(MACHINED) UNLESS OTHERWISE SPECIFIED
DO NOT SCALE DRAWING

APPROVALS	DATE
DRAWN TRAN, T.	10/22/18
CHECKED	
MANUF.	
Q.C.	

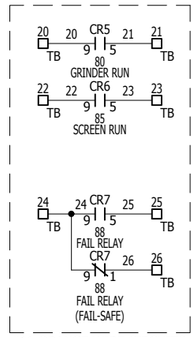
JWC ENVIRONMENTAL
2850 S. Red Hill Ave. Suite 125, Santa Ana, CA 92705

PC2222 MOTOR CONTROLLER
NEMA 4X FIBERGLASS - TWO MOTORS MOTOR CONTROLLER - SERIES PC2222

SIZE D | DRAWING NO. PC2222-000-1 | REV A
SCALE: NONE | 1 OF 3

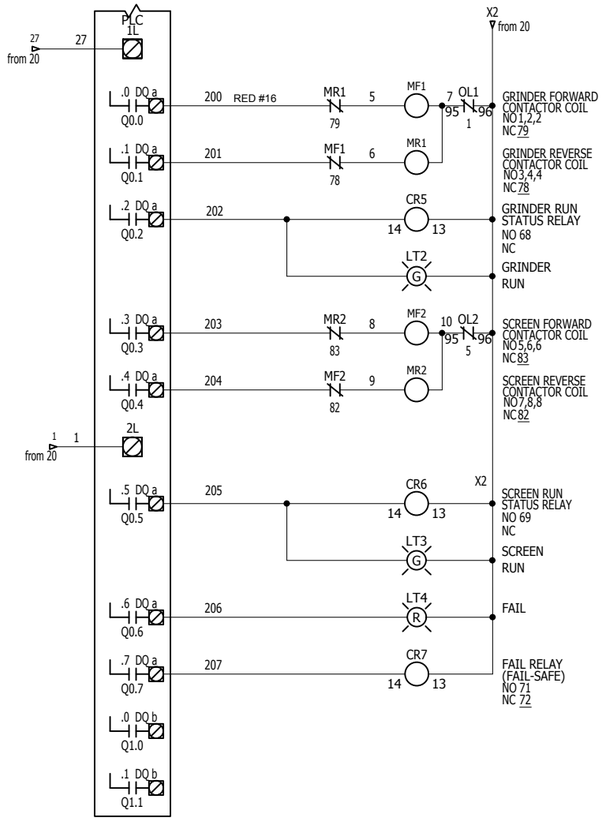


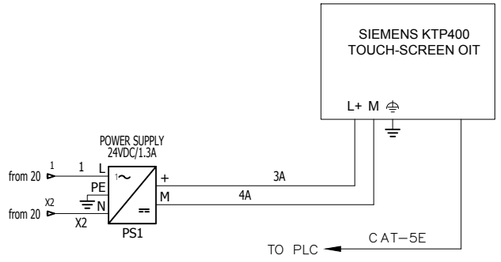
REMOTE RUN PERMISSIVE	
GRINDER ON	
GRINDER IN REMOTE	
GRINDER MOTOR OVERLOAD STATUS	
GRINDER MOTOR THERMOSTAT STATUS	
SCREEN ON	
SCREEN IN AUTO	
SCREEN MOTOR OVERLOAD STATUS	
SCREEN MOTOR OVERTEMP STATUS	
EMERGENCY STOP STATUS (INPUT ON WHEN NOT ACTIVATED)	
RESET	



#16 ORANGE WIRE CIRCUITS.

*** CAUTION ***
OPEN MAIN DISCONNECT SWITCH WILL NOT DE-ENERGIZE ORANGE COLOR WIRE CIRCUITS.





OIT Alarm Messages:

- Grinder Jammed
- Grinder Motor Overload
- Grinder Motor Overtemp
- Grinder Fail to Run
- Screen Jammed
- Screen Overload
- Screen Overtemp
- Screen Fail to Run
- Emergency Stop Activated

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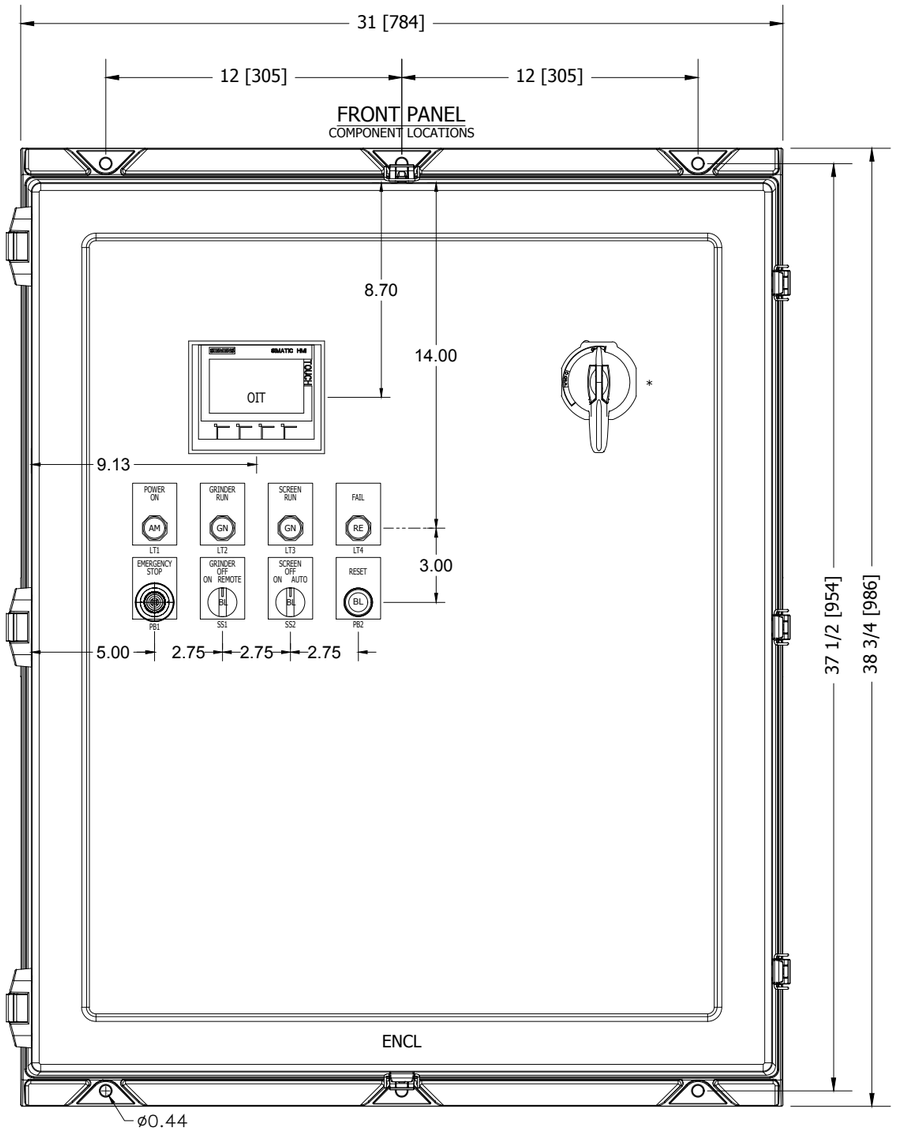
2850 S. Red Hill Ave. Suite 125, Santa Ana, CA 92705

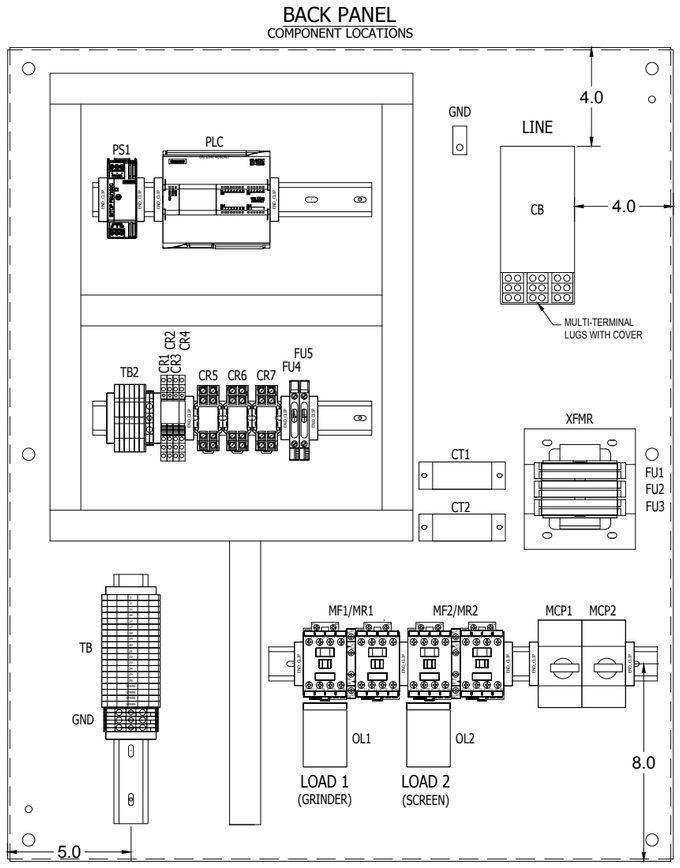
PC2222 MOTOR CONTROLLER
NEMA 4X FIBERGLASS - TWO MOTORS
MOTOR CONTROLLER - SERIES PC2222

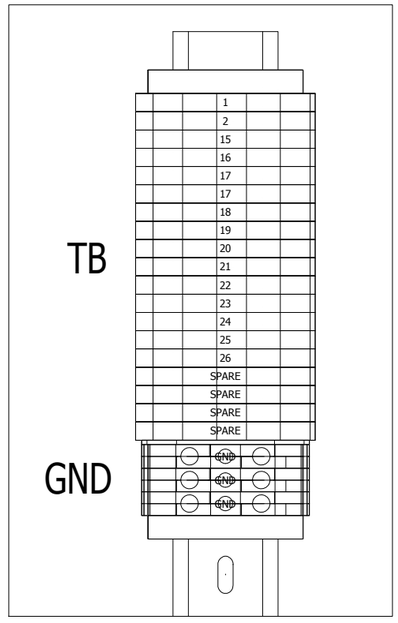
SIZE	DRAWING NO.	REV
D	PC2222-000-1	A

SCALE: NONE — 2 OF 3

DRAWING NO. **PC2222-000-1**







TERMINAL BLOCK LAYOUT

ENCLOSURE:
NEMA TYPE 4X FIBERGLASS-REINFORCED
36" x 30" x 8"

* CB OPERATING HANDLE SHOWN IN THE ON POSITION

JWC ENVIRONMENTAL
2850 S. Red Hill Ave. Suite 125, Santa Ana, CA 92705

PC2222 MOTOR CONTROLLER

NEMA 4X FIBERGLASS - TWO MOTORS
MOTOR CONTROLLER - SERIES PC2222

SIZE	DRAWING NO.	REV
D	PC2222-000-1	A
SCALE: NONE		3 OF 3

V.W. HOUSEN
& ASSOCIATES

APS Grinder Analysis – Construction Cost Estimates (Options 1, 2a and 2b)

Antioch Pump Station - Grinder Structure (1 - Build common structure with Diversion PS at same time) Antioch and Bridgehead Pump Stations and Conveyance System Improvments Project - Phase II Long Term Alternatives Analysis Preliminary Level Construction Cost Estimate	
Description	**Total**
Summary - Specification Divisions	
Division 1 - General Requirements	$33,030
Division 2 - Site work	$69,036
Division 3 - Concrete	$81,160
Division 4 - Masonry (Not Used)	$0
Division 5- Metals	$71,049
Division 6 - Wood and Plastics	$0
Division 7 - Thermal and Moisture Protection	$4,204
Division 8 - Doors and Windows (Not Used)	$0
Division 9 - Finishes	$18,500
Division 10 - Specialties (Not Used)	$0
Division 11 - Equipment	$302,000
Division 12 - Furnishings (Not Used)	$0
Division 13 - Special Construction (Not Used)	$0
Division 14 - Conveying Systems (Not Used)	$0
Division 15 - Mechanical	$0
Division 16 - Electrical	$57,500
Division 17 - Instrumentation	$57,150
Subtotal	$693,629
Bond, Insurance, Overhead, and Profit (18%)	$124,853
Contingencies (30%)	$208,089
Total Cost (Rounded)	$1,027,000

[1]Cost Estimate in 2017 Dollars

Antioch Pump Station - Grinder Structure (1 - Build common structure with Diversion PS at same time)
Antioch and Bridgehead Pump Stations and Conveyance System Improvments Project - Phase II Long Term Alternatives Analysis
Preliminary Level Construction Cost Estimate

Description	Quantity		Material Cost		Labor Cost		Total Cost	
	Number	Unit	Unit Cost	Total[2]	Unit Cost	Total	Unit Cost	Total
Division 1 - General Requirements								
Mobilization/Demobilization (5%)	1	LS					33030	$33,030
Construction Sequencing and Constraints (Included with Diversion PS)	1	LS					0	$0
Total Division 1							33030	**$33,030**
Division 2 - Site Work								
02050 Demolition (Included with Initial Project)								
Demolition	1	LS					0	$0
02100 Site Preparation (Included with Initial Project)								
Site Preperation	1	LS					0	$0
02140 Dewatering								
Grinder Structure	1	LS					28000	$28,000
02200 Earthwork								
Earthwork								
Grinder Structure								
Excavation	445	CY	0	$0	35	$15,575	35	$15,575
Import	85	CY	15	$1,275	0	$0	15	$1,275
Backfill & Compaction	85	CY	0	$0	20	$1,700	20	$1,700
Removal of Excess	445	CY	0	$0	10	$4,450	10	$4,450
Extra for Diversion PS								
Excavation	34	CY	0	$0	35	$1,190	35	$1,190
Import	9	CY	15	$135	0	$0	15	$135
Backfill & Compaction	9	CY	0	$0	20	$180	20	$180
Removal of Excess	34	CY	0	$0	10	$340	10	$340
Geotextile Fabric								
Grinder Structure	77	SY	2	$154	6	$462	8	$616
02390 Shoring								
Shoring								
Grinder Structure	1	LS					12000	$12,000
02513 AC Pavement and Base								
AC Pavement	715	SF	2	$1,430	3	$2,145	5	$3,575
Total Division 2								**$69,036**
Division 3 - Concrete								
03100 Concrete Formwork								
(Included in section 03300)								
03200 Reinforcing Steel								
(Included in section 03300)								
03300 Cast-in-Place Concrete								
Grinder Structure								
Slab on grade	19	CY	700	$13,300	1	$19.0	701	$13,319
Walls	43	CY	900	$38,700	38	$1,634.0	938	$40,334
Suspended Slab	8	CY	1270	$10,160	50	$400.0	1320	$10,560
Extra for Diversion PS								
Slab on grade	2	CY	700	$1,400	1	$2.0	701	$1,402
Walls	12.5	CY	900	$11,250	38	$475.0	938	$11,725
Suspended Slab	1	CY	1270	$1,270	50	$50.0	1320	$1,320
03600 Grout								
Miscellaneous Grout	1	LS					2500	$2,500
Total Division 3								**$81,160**
Division 4 - Masonry (Not Used)								

Antioch Pump Station - Grinder Structure (1 - Build common structure with Diversion PS at same time)
Antioch and Bridgehead Pump Stations and Conveyance System Improvments Project - Phase II Long Term Alternatives Analysis
Preliminary Level Construction Cost Estimate

Description	Quantity		Material Cost		Labor Cost		Total Cost	
	Number	Unit	Unit Cost	Total[2]	Unit Cost	Total	Unit Cost	Total
Division 5 - Metals								
05070 Miscellaneous Metalwork								
Miscellaneous Metalwork	1	LS					5000	$5,000
Hatches (Type 316 SST)								
Hatch for Grinder Structure								
(4'X8')(SST)	1	EA	16500	$16,500	5000	$5,000	21500	$21,500
(3'x3')(SST)	1	EA	6500	$6,500	2500	$2,500	9000	$9,000
Grating (Type 316 SST)								
Grinder Structure								
Grating	154	SF	65.5	$10,087	3	$462	69	$10,549
Banding	125	LF	21	$2,625	3	$375	24	$3,000
Supports	1	LS					10000	$10,000
Weir Plate								
Grinder Structure								
Weir Plate (Type 316 SST)	1	LS					1000	$1,000
Fasteners	1	LS					5000	$5,000
Ladder Rungs								
Rungs w/ Ladder up safety post	1	LS					6000	$6,000
Total Division 5								**$71,049**
Division 6 - Wood and Plastics (Not Used)								
Division 7 - Thermal and Moisture Protection								
07110 Waterproofing, Dampproofing, and Moistureproofing								
Grinder Structure	1065	SF	0.6	$639	1	$1,065	2	$1,704
07920 Sealants and Caulking	1	LS					2500	$2,500
Total Division 7								**$4,204**
Division 8 - Doors and Windows (Not Used)								
Division 9 - Finishes								
09800 Protective Coatings								
Protective Coatings (Misc)	1	LS					1000	$1,000
Protective Coatings (Concrete Strucutre Lining)	1	LS					17500	$17,500
Total Division 9								**$18,500**
Division 10 - Specialties (Not Used)								
Division 11 - Equipment								
11390 Channel Grinders (includes explosion proof immersible motors, power cable, guide rails, stop gates, lifting chain and contoller enclosure)								
Grinder Structure	2	EA	141000	$282,000	10000	$20,000	151000	$302,000
Total Division 11								**$302,000**
Division 12 - Furnishings (Not Used)								
Division 13 - Special Construction (Not Used)								
Division 14 - Conveyance Systems (Not Used)								
Division 15 - Mechanical								
15050 Piping, General								
Sleeve-type Couplings (48" Ø) included with Diversion PS	0	EA	5000	$0	1500	$0	6500	$0
15069 Reinforced Concrete Pipe (Included with Diversion PS)								
48" Ø RCP (w/ T-Lock)	1	LS					0	$0
Total Division 15								**$0**

Antioch Pump Station - Grinder Structure (1 - Build common structure with Diversion PS at same time) Antioch and Bridgehead Pump Stations and Conveyance System Improvments Project - Phase II Long Term Alternatives Analysis Preliminary Level Construction Cost Estimate								
Description	**Quantity**		**Material Cost**		**Labor Cost**		**Total Cost**	
	Number	**Unit**	**Unit Cost**	**Total[2]**	**Unit Cost**	**Total**	**Unit Cost**	**Total**
Division 16 - Electrical								
Electrical (Additional for Grinder Structure)	1	LS					50000	$50,000
Subcontractor Markup (15%)								$7,500
Total Division 16								**$57,500**
Division 17 - Instrumentation								
Electrical (Additional for Grinder Structure)	1	LS					45000	$45,000
Subcontractor Markup (15%)								$6,750
Electrical Sub Markup On I&C (12%)								$5,400
Total Division 17								**$57,150**
Subtotal								$693,629
Bond, Insurance, Overheard, & Profit (18%)								$124,853
Contingencies (30%)								$208,089
Total Cost								$1,026,571
Total (Rounded)								$1,027,000

[1]Cost estimate in 2021 dollars

[2]Material cost includes tax

Antioch Pump Station - Grinder Structure (2a - Build common structure with Diversion PS at later time) Antioch and Bridgehead Pump Stations and Conveyance System Improvments Project - Phase II Long Term Alternatives Analysis	
Description	**Total**
Summary - Specification Divisions	
Division 1 - General Requirements	$95,987
Division 2 - Site work	$203,686
Division 3 - Concrete	$82,160
Division 4 - Masonry (Not Used)	$0
Division 5- Metals	$71,049
Division 6 - Wood and Plastics	$0
Division 7 - Thermal and Moisture Protection	$4,204
Division 8 - Doors and Windows (Not Used)	$0
Division 9 - Finishes	$18,500
Division 10 - Specialties (Not Used)	$0
Division 11 - Equipment	$302,000
Division 12 - Furnishings (Not Used)	$0
Division 13 - Special Construction (Not Used)	$0
Division 14 - Conveying Systems (Not Used)	$0
Division 15 - Mechanical	$13,000
Division 16 - Electrical	$86,250
Division 17 - Instrumentation	$88,900
Subtotal	$965,736
Bond, Insurance, Overhead, and Profit (18%)	$173,833
Contingencies (30%)	$289,721
Total Cost (Rounded)	$1,430,000

[1]Cost Estimate in 2017 Dollars

Antioch Pump Station - Grinder Structure (2a - Build common structure with Diversion PS at later time)
Antioch and Bridgehead Pump Stations and Conveyance System Improvments Project - Phase II Long Term Alternatives Analysis
Preliminary Level Construction Cost Estimate

Description	Quantity		Material Cost		Labor Cost		Total Cost	
	Number	Unit	Unit Cost	Total[2]	Unit Cost	Total	Unit Cost	Total
Division 1 - General Requirements								
Mobilization/Demobilization (5%)	1	LS					45987	$45,987
Construction Sequencing and Constraints (Included with Diversion PS)	1	LS					50000	$50,000
Total Division 1							95987	**$95,987**
Division 2 - Site Work								
02050 Demolition								
Demolition	1	LS					10000	$10,000
02100 Site Preparation								
Site Preperation	1	LS					5000	$5,000
02140 Dewatering								
Grinder Structure	2	months					54000	$108,000
02200 Earthwork								
Earthwork								
Grinder Structure								
Excavation	500	CY	0	$0	35	$17,500	35	$17,500
Import	140	CY	15	$2,100	0	$0	15	$2,100
Backfill & Compaction	140	CY	0	$0	20	$2,800	20	$2,800
Removal of Excess	500	CY	0	$0	10	$5,000	10	$5,000
Extra for Diversion PS								
Excavation	34	CY	0	$0	35	$1,190	35	$1,190
Import	9	CY	15	$135	0	$0	15	$135
Backfill & Compaction	9	CY	0	$0	20	$180	20	$180
Removal of Excess	34	CY	0	$0	10	$340	10	$340
Geotextile Fabric								
Grinder Structure	77	SY	2	$154	6	$462	8	$616
02390 Shoring								
Shoring								
Grinder Structure	1500	SF	23	$34,500	8.5	$12,750	32	$47,250
02513 AC Pavement and Base								
AC Pavement	715	SF	2	$1,430	3	$2,145	5	$3,575
Total Division 2								**$203,686**
Division 3 - Concrete								
03100 Concrete Formwork								
(Included in section 03300)								
03200 Reinforcing Steel								
(Included in section 03300)								
03300 Cast-in-Place Concrete								
Grinder Structure								
Slab on grade	19	CY	700	$13,300	1	$19.0	701	$13,319
Walls	43	CY	900	$38,700	38	$1,634.0	938	$40,334
Suspended Slab	8	CY	1270	$10,160	50	$400.0	1320	$10,560
Grinder Structure Starter Walls (w/ Diversion Structure)	1	LS					1000	$1,000
Extra for Diversion PS								
Slab on grade	2	CY	700	$1,400	1	$2.0	701	$1,402
Walls	12.5	CY	900	$11,250	38	$475.0	938	$11,725
Suspended Slab	1	CY	1270	$1,270	50	$50.0	1320	$1,320
03600 Grout								
Miscellaneous Grout	1	LS					2500	$2,500
Total Division 3								**$82,160**
Division 4 - Masonry (Not Used)								

Antioch Pump Station - Grinder Structure (2a - Build common structure with Diversion PS at later time)
Antioch and Bridgehead Pump Stations and Conveyance System Improvments Project - Phase II Long Term Alternatives Analysis
Preliminary Level Construction Cost Estimate

Description	Quantity		Material Cost		Labor Cost		Total Cost	
	Number	Unit	Unit Cost	Total[2]	Unit Cost	Total	Unit Cost	Total
Division 5 - Metals								
05070 Miscellaneous Metalwork								
Miscellaneous Metalwork	1	LS					5000	$5,000
Hatches (Type 316 SST)								
Hatch for Grinder Structure								
(4'X8')(SST)	1	EA	16500	$16,500	5000	$5,000	21500	$21,500
(3'x3')(SST)	1	EA	6500	$6,500	2500	$2,500	9000	$9,000
Grating (Type 316 SST)								
Grinder Structure								
Grating	154	SF	65.5	$10,087	3	$462	69	$10,549
Banding	125	LF	21	$2,625	3	$375	24	$3,000
Supports	1	LS					10000	$10,000
Weir Plate								
Grinder Structure								
Weir Plate (Type 316 SST)	1	LS					1000	$1,000
Fasteners	1	LS					5000	$5,000
Ladder Rungs								
Rungs w/ Ladder up safety post	1	LS					6000	$6,000
Total Division 5								**$71,049**
Division 6 - Wood and Plastics (Not Used)								
Division 7 - Thermal and Moisture Protection								
07110 Waterproofing, Dampproofing, and Moistureproofing								
Grinder Structure	1065	SF	0.6	$639	1	$1,065	2	$1,704
07920 Sealants and Caulking	1	LS					2500	$2,500
Total Division 7								**$4,204**
Division 8 - Doors and Windows (Not Used)								
Division 9 - Finishes								
09800 Protective Coatings								
Protective Coatings (Misc)	1	LS					1000	$1,000
Protective Coatings (Concrete Strucutre Lining)	1	LS					17500	$17,500
Total Division 9								**$18,500**
Division 10 - Specialties (Not Used)								
Division 11 - Equipment								
11390 Channel Grinders (includes explosion proof immersible motors, power cable, guide rails, stop gates, lifting chain and contoller enclosure)								
Grinder Structure	2	EA	141000	$282,000	10000	$20,000	151000	$302,000
Total Division 11								**$302,000**
Division 12 - Furnishings (Not Used)								
Division 13 - Special Construction (Not Used)								
Division 14 - Conveyance Systems (Not Used)								
Division 15 - Mechanical								
15050 Piping, General								
Sleeve-type Couplings (48" Ø)	2	EA	5000	$10,000	1500	$3,000	6500	$13,000
15069 Reinforced Concrete Pipe (Included with Diversion PS)								
48" Ø RCP (w/ T-Lock)	1	LS					0	$0
Total Division 15								**$13,000**

Antioch Pump Station - Grinder Structure (2a - Build common structure with Diversion PS at later time) Antioch and Bridgehead Pump Stations and Conveyance System Improvments Project - Phase II Long Term Alternatives Analysis Preliminary Level Construction Cost Estimate								
Description	**Quantity**		**Material Cost**		**Labor Cost**		**Total Cost**	
	Number	**Unit**	**Unit Cost**	**Total[2]**	**Unit Cost**	**Total**	**Unit Cost**	**Total**
Division 16 - Electrical								
Electrical (Additional for Grinder Structure)	1	LS					75000	$75,000
Subcontractor Markup (15%)								$11,250
Total Division 16								**$86,250**
Division 17 - Instrumentation								
Electrical (Additional for Grinder Structure)	1	LS					70000	$70,000
Subcontractor Markup (15%)								$10,500
Electrical Sub Markup On I&C (12%)								$8,400
Total Division 17								**$88,900**
Subtotal								$965,736
Bond, Insurance, Overheard, & Profit (18%)								$173,833
Contingencies (30%)								$289,721
Total Cost								$1,429,290
Total (Rounded)								$1,430,000

[1]Cost estimate in 2021 dollars

[2]Material cost includes tax

Antioch Pump Station - Grinder Structure (2b - Build as separate structure at later time) Antioch and Bridgehead Pump Stations and Conveyance System Improvments Project - Phase II Long Term Alternatives Analysis Preliminary Level Construction Cost Estimate	
Description	**Total**
Summary - Specification Divisions	
Division 1 - General Requirements	$66,012
Division 2 - Site work	$221,991
Division 3 - Concrete	$80,783
Division 4 - Masonry (Not Used)	$0
Division 5- Metals	$71,049
Division 6 - Wood and Plastics	$0
Division 7 - Thermal and Moisture Protection	$4,772
Division 8 - Doors and Windows (Not Used)	$0
Division 9 - Finishes	$18,500
Division 10 - Specialties (Not Used)	$0
Division 11 - Equipment	$302,000
Division 12 - Furnishings (Not Used)	$0
Division 13 - Special Construction (Not Used)	$0
Division 14 - Conveying Systems (Not Used)	$0
Division 15 - Mechanical	$26,000
Division 16 - Electrical	$86,250
Division 17 - Instrumentation	$88,900
Subtotal	$966,257
Bond, Insurance, Overhead, and Profit (18%)	$173,926
Contingencies (30%)	$289,877
Total Cost (Rounded)	$1,431,000

[1]Cost Estimate in 2017 Dollars

Antioch Pump Station - Grinder Structure (2b - Build as separate structure at later time) Antioch and Bridgehead Pump Stations and Conveyance System Improvments Project - Phase II Long Term Alternatives Analysis Preliminary Level Construction Cost Estimate								
Description	Quantity		Material Cost		Labor Cost		Total Cost	
	Number	Unit	Unit Cost	Total[2]	Unit Cost	Total	Unit Cost	Total
Division 1 - General Requirements								
Mobilization/Demobilization (5%)	1	LS					46012	$46,012
Construction Sequencing and Constraints (Included with Diversion PS)	1	LS					20000	$20,000
Total Division 1							66012	**$66,012**
Division 2 - Site Work								
02050 Demolition								
Demolition	1	LS					10000	$10,000
02100 Site Preparation								
Site Preperation	1	LS					5000	$5,000
02140 Dewatering								
Grinder Structure	2	months					54000	$108,000
02200 Earthwork								
Earthwork								
Grinder Structure								
Excavation	555	CY	0	$0	35	$19,425	35	$19,425
Import	195	CY	15	$2,925	0	$0	15	$2,925
Backfill & Compaction	195	CY	0	$0	20	$3,900	20	$3,900
Removal of Excess	555	CY	0	$0	10	$5,550	10	$5,550
Geotextile Fabric								
Grinder Structure	77	SY	2	$154	6	$462	8	$616
02390 Shoring								
Shoring								
Grinder Structure	2000	SF	23	$46,000	8.5	$17,000	32	$63,000
02513 AC Pavement and Base								
AC Pavement	715	SF	2	$1,430	3	$2,145	5	$3,575
Total Division 2								**$221,991**
Division 3 - Concrete								
03100 Concrete Formwork								
(Included in section 03300)								
03200 Reinforcing Steel								
(Included in section 03300)								
03300 Cast-in-Place Concrete								
Grinder Structure								
Slab on grade	19	CY	700	$13,300	1	$19.0	701	$13,319
Walls	58	CY	900	$52,200	38	$2,204.0	938	$54,404
Suspended Slab	8	CY	1270	$10,160	50	$400.0	1320	$10,560
03600 Grout								
Miscellaneous Grout	1	LS					2500	$2,500
Total Division 3								**$80,783**
Division 4 - Masonry (Not Used)								
Division 5 - Metals								
05070 Miscellaneous Metalwork								
Miscellaneous Metalwork	1	LS					5000	$5,000
Hatches (Type 316 SST)								
Hatch for Grinder Structure								
(4'X8')(SST)	1	EA	16500	$16,500	5000	$5,000	21500	$21,500
(3'x3')(SST)	1	EA	6500	$6,500	2500	$2,500	9000	$9,000
Grating (Type 316 SST)								
Grinder Structure								
Grating	154	SF	65.5	$10,087	3	$462	69	$10,549

Antioch Pump Station - Grinder Structure (2b - Build as separate structure at later time) Antioch and Bridgehead Pump Stations and Conveyance System Improvments Project - Phase II Long Term Alternatives Analysis Preliminary Level Construction Cost Estimate								
Description	Quantity		Material Cost		Labor Cost		Total Cost	
	Number	Unit	Unit Cost	Total[2]	Unit Cost	Total	Unit Cost	Total
Banding	125	LF	21	$2,625	3	$375	24	$3,000
Supports	1	LS					10000	$10,000
Weir Plate								
Grinder Structure								
Weir Plate (Type 316 SST)	1	LS					1000	$1,000
Fasteners	1	LS					5000	$5,000
Ladder Rungs								
Rungs w/ Ladder up safety post	1	LS					6000	$6,000
Total Division 5								**$71,049**
Division 6 - Wood and Plastics (Not Used)								
Division 7 - Thermal and Moisture Protection								
07110 Waterproofing, Dampproofing, and Moistureproofing								
Grinder Structure	1420	SF	0.6	$852	1	$1,420	2	$2,272
07920 Sealants and Caulking	1	LS					2500	$2,500
Total Division 7								**$4,772**
Division 8 - Doors and Windows (Not Used)								
Division 9 - Finishes								
09800 Protective Coatings								
Protective Coatings (Misc)	1	LS					1000	$1,000
Protective Coatings (Concrete Strucutre Lining)	1	LS					17500	$17,500
Total Division 9								**$18,500**
Division 10 - Specialties (Not Used)								
Division 11 - Equipment								
11390 Channel Grinders (includes explosion proof immersible motors, power cable, guide rails, stop gates, lifting chain and contoller enclosure)								
Grinder Structure	2	EA	141000	$282,000	10000	$20,000	151000	$302,000
Total Division 11								**$302,000**
Division 12 - Furnishings (Not Used)								
Division 13 - Special Construction (Not Used)								
Division 14 - Conveyance Systems (Not Used)								
Division 15 - Mechanical								
15050 Piping, General								
Sleeve-type Couplings (48" Ø)	4	EA	5000	$20,000	1500	$6,000	6500	$26,000
15069 Reinforced Concrete Pipe (Included with Diversion PS)								
48" Ø RCP (w/ T-Lock)	1	LS					0	$0
Total Division 15								**$26,000**
Division 16 - Electrical								
Electrical (Additional for Grinder Structure)	1	LS					75000	$75,000
Subcontractor Markup (15%)								$11,250
Total Division 16								**$86,250**
Division 17 - Instrumentation								
Electrical (Additional for Grinder Structure)	1	LS					70000	$70,000

Antioch Pump Station - Grinder Structure (2b - Build as separate structure at later time) Antioch and Bridgehead Pump Stations and Conveyance System Improvments Project - Phase II Long Term Alternatives Analysis Preliminary Level Construction Cost Estimate								
Description	Quantity		Material Cost		Labor Cost		Total Cost	
	Number	Unit	Unit Cost	Total[2]	Unit Cost	Total	Unit Cost	Total
Subcontractor Markup (15%)								$10,500
Electrical Sub Markup On I&C (12%)								$8,400
Total Division 17								**$88,900**
Subtotal								$966,257
Bond, Insurance, Overheard, & Profit (18%)								$173,926
Contingencies (30%)								$289,877
Total Cost								$1,430,061
Total (Rounded)								$1,431,000

[1]Cost estimate in 2021 dollars

[2]Material cost includes tax

V.W. HOUSEN & ASSOCIATES

Appendix H. AFM102 High Point Evaluation - Final TM

Antioch and Bridgehead Pump Station and Conveyance Systems

Antioch Forcemain 102 High Point Analysis

November 2021

Prepared by

V.W. HOUSEN
& ASSOCIATES

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Figure 1.2 Antioch Forcemain AFM102 Profile

Figure 2.1 GHD Drawing Showing Active and Inactive Combination Air Release Valves

Figure 3.1 Residual Water in AFM-102 When Not in Use

Figure 3.2 Cured-in-Place Pipe Repair Locations

APPENDICES

Appendix A – AFM-102 Profiles with Findings

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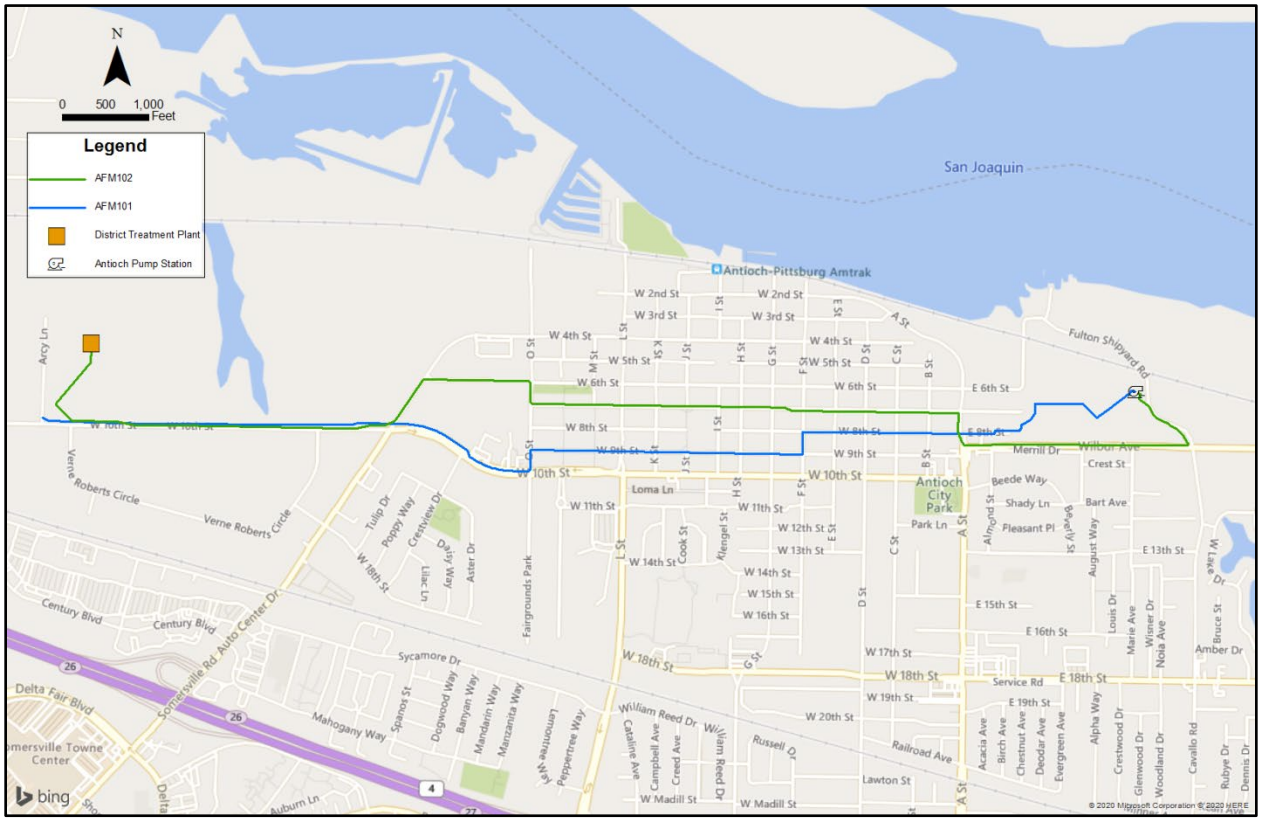
SECTION 1 - ANTIOCH FORCEMAIN 102 HIGH POINT ANALYSIS

1.0 INTRODUCTION

Delta Diablo ("District") provides water resource recovery services for the City of Antioch, the City of Pittsburg, and the unincorporated community of Bay Point, serving a population of nearly 200,000. The District owns and operates five pump stations, including the Antioch Pump Station ("APS"), located on Fulton Shipyard Road north of Wilbur Avenue in Antioch, and the Bridgehead Pump Station ("BHPS"), located upstream and to the east of the APS. BHPS currently conveys flows to the APS, where the flow is then re-pumped to the District's wastewater treatment plant ("WWTP"). The APS has two independent 24-inch diameter forcemains, AFM-101 and AFM-102, that were installed in 1977 and 1998, respectively. Figure 1.1 includes a site plan that shows the locations of the APS and WWTP, and pipeline alignments for AFM-101 and AFM-102. BHPS, located east of the APS, is not shown in Figure 1.1.

Figure 1.1 Site plan showing the Antioch Pump Station, AFM-101 and 102, and the WWTP



The forcemains are comprised of AWWA C-303 bar-wrapped, steel cylinder concrete pressure pipe ("CCPP"). In 2013, the District experienced the first leak from AFM-102, on Pittsburg-Antioch Highway near Verne Roberts Circle. The leak was evaluated and repaired with a cured-in-place pipe ("CIPP") liner. At that time, a second potentially compromised section of AFM-102 on West 7th Street between G and H Streets was also lined as a preventive measure. In 2017,

the District experienced a second failure on Pittsburg-Antioch Highway east of the wastewater treatment plant, which was repaired using CIPP liner. In December 2019, pipe adjacent to the 2013 preventive repair failed, leading to an emergency repair using a new HDPE pipe spool. This pipe spool leaked during testing, and was repaired by installing a concrete patch. The repair locations are discussed further in Section 3 and shown on Figure 3.2.

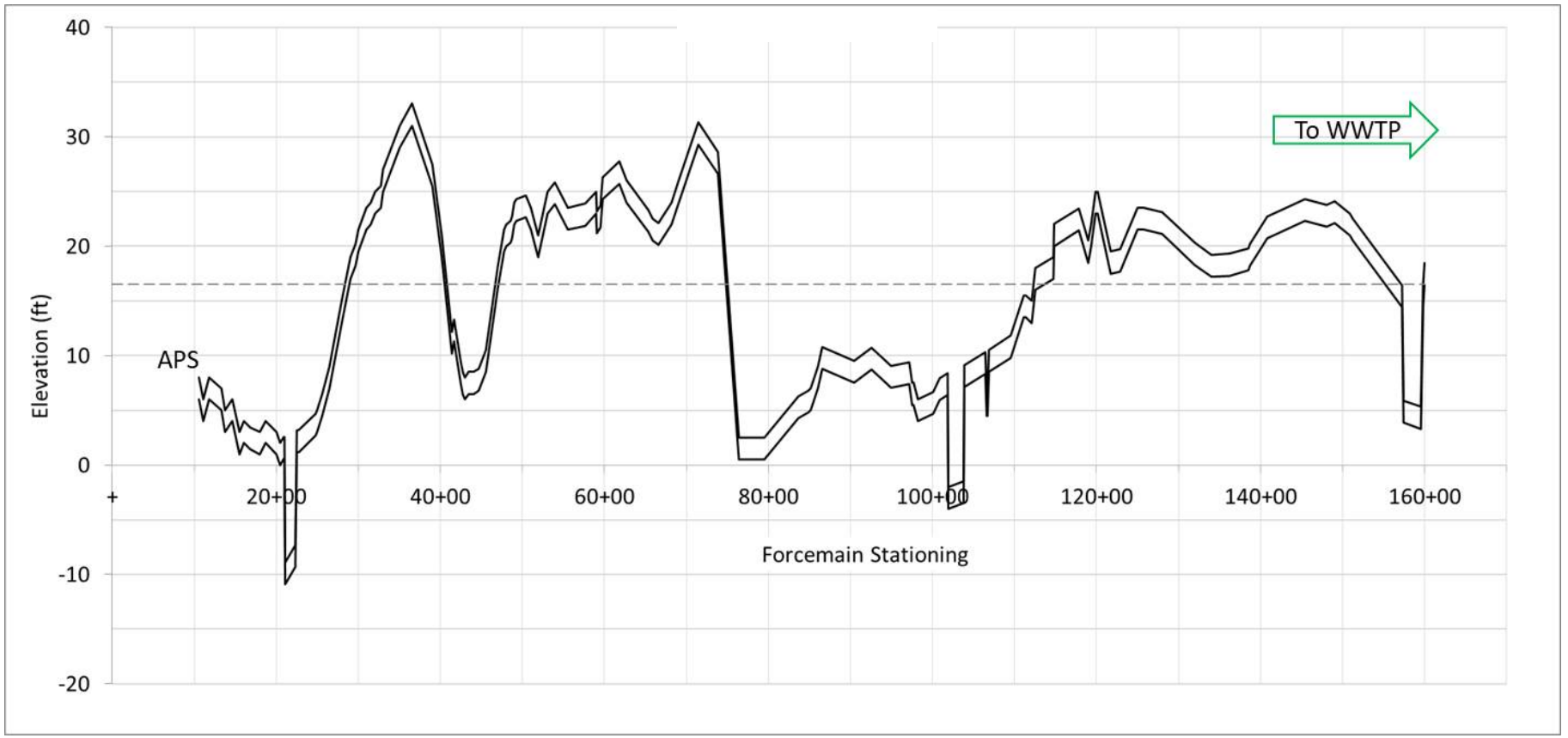
The leaks, which occurred at high points in the forcemain, were the result of corrosion of the CCPP steel cylinder and bar-wrap. It is believed that gaseous sulfide was trapped in these locations, and could not be released due to non-functioning or previously-removed CARVs. The gaseous sulfide corroded the interior mortar lining, steel cylinder, and bar-wrap, leading to each failure. AFM-102 was installed with elevations that generally follow the existing topography between the APS and the WWTP. As a result, the forcemain has numerous high and low points, creating multiples areas of risk related to internal corrosion. Figure 1.2 on the following page shows the profile of AFM-102.

The District has contracted with V. W. Housen & Associates ("VWHA") to complete the Antioch and Bridgehead Pump Station and Conveyance System Project – Phase 2 ("Phase 2 Project"). Among other tasks, this project reviews pumping and forcemain options for the BHPS. As a component of the Phase 2 project, the District requested that VWHA review the potential to reduce the number of high points on AFM-102 to help reduce further risk of corrosion. The District also asked VWHA to determine whether lowering high points could potentially improve operational efficiency of the APS pumps.

This Technical Memorandum ("TM") summarizes the work completed for the AFM-102 High Point Analysis. This TM includes the following three sections:

Section 1	Introduction
Section 2	Background
Section 3	Findings and Recommendations

Figure 1.2 Antioch Forcemain 102 (AFM-102) Profile



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SECTION 2 - BACKGROUND

This section presents general background information on prior failures, assessments, and system operations as pertinent to the AFM-102 High Point Analysis. A significant amount of work has been completed related to these topics, and additional information beyond the summaries presented in this TM is available through the previously completed studies that are discussed in this section.

2.1 Prior Studies and Assessments

The District has completed numerous assessments and repairs on AFM-102 that provided information relevant to the AFM-102 High Point Analysis. Information from the prior assessments was used to help determine the benefit of adjusting forcemain high points, and to also help define alternative project recommendations. Table 2.1 on the following page summarizes the referenced work, which includes:

- Antioch Forcemain Assessment Technical Memorandum, GHD, March 24, 2014
- Delta Diablo Wall Map of AFM-102, undated
- Closed-Circuit Television inspection videos, various dates
- Wall Thickness Reports, CTS, December 30, 2019
- AFM-101 and AFM-102 Forcemain Corrosion Assessment, VWHA, May 27, 2020
- Contract Documents for the Construction of AFM-102, Winzler & Kelly, 1998
- Wastewater Treatment Plant Headworks Modifications, G.S. Dodson, 1999

2.2 System Operations

This section discusses system operations as relevant to the AFM-102 High Point Analysis.

2.2.1 Wet-Dry Cycles and Corrosion

As discussed above, the APS has two 24-inch diameter forcemains that were installed at different times: AFM-101 and AFM-102. The two forcemains are connected to the APS pumps through a common header and operate in parallel under normal conditions. The forcemains have different alignments and profiles. As a result, the forcemains have different hydraulic characteristics. During a short period during the night when the APS sees its lowest flows, the system hydraulics cause flow to move only through AFM-101. During this time, AFM-102 partially drains. The only other time that one of the Antioch forcemains is not used is if the forcemain is taken out of service for maintenance.

AFM-102 was constructed with numerous peaks and troughs as shown above in Figure 1.2. When AFM-102 drains, some of the peaks are filled with air. The air gaps created by the wet-dry cycle combined with the tendency for raw wastewater to release dissolved sulfides as hydrogen

sulfide gas create a corrosion-enhancing environment within the AFM-102 high points. If the trapped air is not able to be released through operable combination air release valves ("CARVs") when the pumps restart, then this corrosive environment continues to be present within the pipe during normal operations.

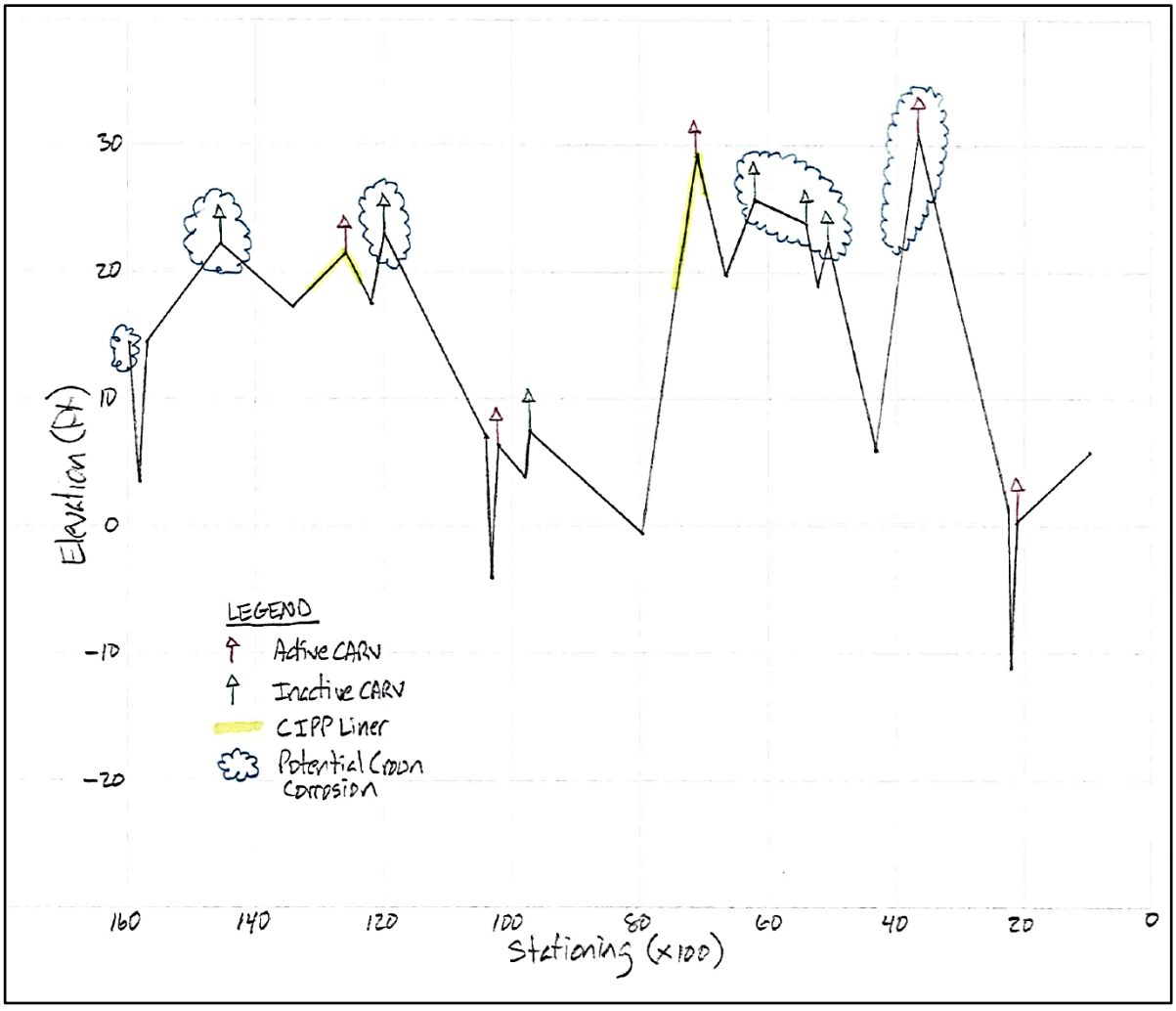
Table 2.1 Summary of Documents Reviewed for the High Point Analysis

Document	Description
Antioch Forcemain Assessment Technical Memorandum, GHD, March 24, 2014	This document evaluated options to address AFM-102 after the 2013 forcemain failure. The memorandum provides a number of recommendations and "Figure 2" showing the location of active and inactive CARVs. GHS Figure 2 is reproduced as Figure 2.1 on the following page.
Delta Diablo Wall Map of AFM-102 showing historical CCTV inspection and repair activities (undated)	Delta Diablo staff maintain a wall map that uses the 1998 Winzler & Kelley drawings (see below) to identify the locations of prior repairs and closed circuit television ("CCTV") inspections. This map is available for viewing at the District and pertinent information is included in Section 3, Recommendations.
Closed-Circuit Television ("CCTV") inspection videos (various dates)	The District provided videos and tables summarizing prior pipeline inspections. The video from AFM-102 Station 119+60 to 124+71 was reviewed for this analysis, as this location correlated with a high point.
Wall Thickness Reports, CTS, December 30, 2019	Following an AFM-102 failure in December 2019, the District contracted with CTS to measure remaining wall thickness at two locations along the pipe. The results indicated the potential for imminent failure of the forcemain in the tested locations. These results initiated the broader testing program that is summarized below.
AFM-101 and AFM-102 Forcemain Corrosion Assessment, VWHA, May 27, 2020	The District measured pipe wall thickness at eight locations on AFM-102, and one location on AFM-101 following the December 2019 failure. During this effort, the team confirmed that two pipe wall thicknesses were used during construction of AFM-102. The pipe from the two December 2019 field test locations used the thinner wall. Therefore, those measurements no longer indicated an emergency situation. This document also discusses the temporary repair that was completed in December 2019 and recommends a permanent repair coupling at that location as well as reinstatement of inactive CARVs.
Contract Documents for Construction of AFM-102, Winzler & Kelly, 1998	Elevation profiles and information on utility conflicts were obtained from the original construction drawings for AFM-102.
Contract Documents for Construction of the WWTP Headworks Modifications, G. S.	The continuation of AFM-102 from the Winzler & Kelley 1998 documents to the WWTP are shown in these drawings. This pipe is labeled in the drawings as "RCCP" and may be Reinforced Concrete Cylinder Pipe in lieu of AWWA C-303 pipe used for the remainder of the alignment.

Dodson & Associates, 1999	

When the APS begins pumping through AFM-102, entrapped air would ideally migrate into the peaks and escape the pipe through CARVs. However, to exacerbate the potential for corrosion, FM-102 does not have operable CARVs at all of the forcemain high points. Figure 2.1 includes a figure taken from the Antioch Forcemain Assessment Technical Memorandum (GHD, 2014) that shows the location of active and inactive CARVs.

Figure 2.1 GHD Drawing Showing Active and Inactive CARVs
(Figure 2 from GHD March 24, 2014 Memo, including GHD Notes)



2.2.2 Potential Changes in System Hydraulics

In addition to the referenced materials listed in Table 2.1, in December 2020, VWHA provided a Technical Memorandum titled, "APS and BHPS and Conveyance System Phase 1 – Existing Conditions Hydraulic Analysis." This memorandum evaluated current hydraulic conditions at the APS and BHPS. One component of the study was an evaluation of the APS pumps under a range of hydraulic conditions. This evaluation concluded that the controlling high point along the AFM-102 changes as flows change. Initially, one aspect of the High Point analysis was to determine whether lowering any high points to reduce the risk of corrosion would also provide operational benefits in certain pumping scenarios.

As a separate component of the Phase 2 Project, VWHA is completing a BHPS alternatives analysis in parallel with the High Point analysis. The BHPS alternatives analysis is evaluating the most efficient flow scenario for managing buildout peak wet weather flows at both the BHPS and APS. Preliminary findings, which will be discussed in further detail at the upcoming APS and BHPS Conveyance System Alternatives Meeting (June 2021), indicate that the most efficient pumping scenario will result in utilization of AFM-102 by the BHPS, and utilization of AFM-101 by the APS. In this situation, a new controlling high point will be created along the BHPS forcemain, upstream of the APS and no controlling high points will occur within the AFM-102 alignment. Therefore, in this future scenario, the existing AFM-102 high points will no longer be a factor in calculating system hydraulics. As a result, the operational assessment component of this study has been tabled.

Further, District staff have confirmed that the BHPS pumps operate continuously, including during the lowest nighttime flows. Therefore, in this future scenario, AFM-102 should not experience any downtime or draining during the normal operating cycle; the only time AFM-102 would drain down would be when the forcemain is taken out of service for repairs.

The future scenario, where AFM-102 remains continuously full, should result in decreased corrosion risk and an improvement in the remaining service life for AFM-102. In order to achieve the maximum remaining useful life for AFM-102, it is important that we confirm that that any locations along the forcemain that are at risk of corrosion due to the current wet-dry cycles are reinforced through lining or replacement, as some degradation in these locations has likely occurred.

SECTION 3 FINDINGS AND RECOMMENDATIONS

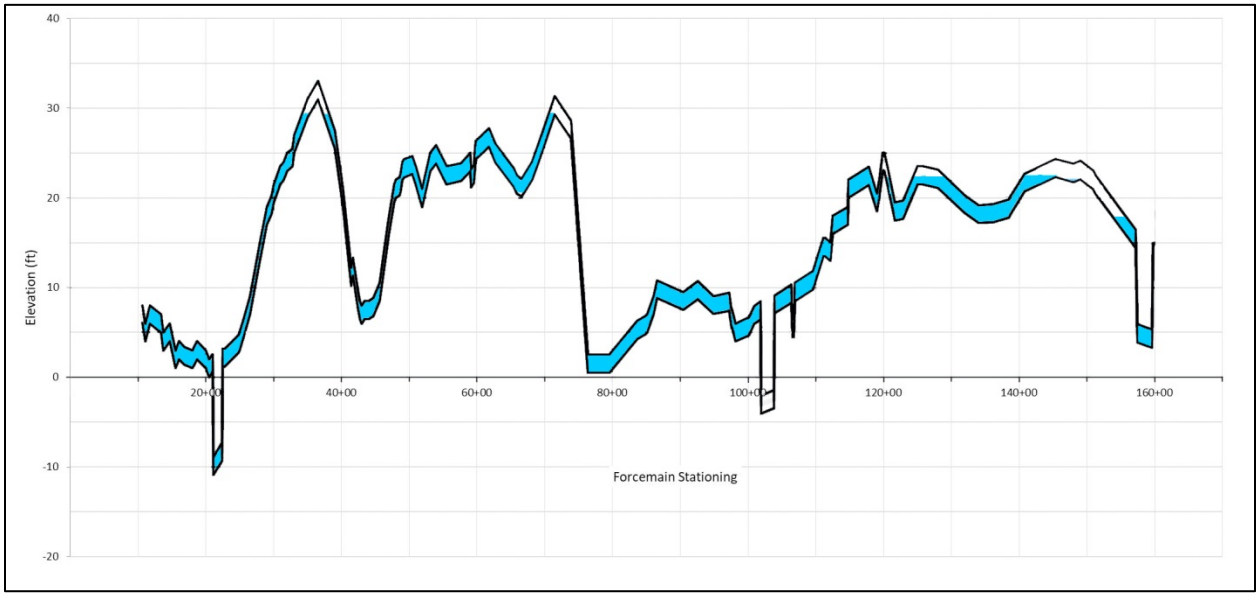
The following process was used to identify and prioritize recommended changes to address and protect high points along AFM-102:

1. Reviewed areas that drain during wet-dry cycles that occur at low nighttime flows;
2. Reviewed available repair documentation to identify whether some or all of the exposed pipe that is at risk for corrosion due to draining has been lined through previous projects. If the pipe has been lined, then the evaluation assumed that lowering the pipe to reduce the risk of corrosion would not be necessary;
3. Reviewed whether each high point that is at risk for corrosion due to draining has an associated working CARV. If an area under consideration for capital improvements as part of the AFM-102 High Point Analysis does not have an active CARV, the project recommendation includes reinstatement of the inactive CARV.
4. If available CCTV inspection data was available for the location under review, the video was reviewed as a component of the analysis.

3.1 Water Level during Wet-Dry Cycles

During low flow periods, AFM-102 drains and the resulting water level in AFM-102 is as shown on Figure 3.1.

Figure 3.1 Residual Water in AFM-102 when Not in Use



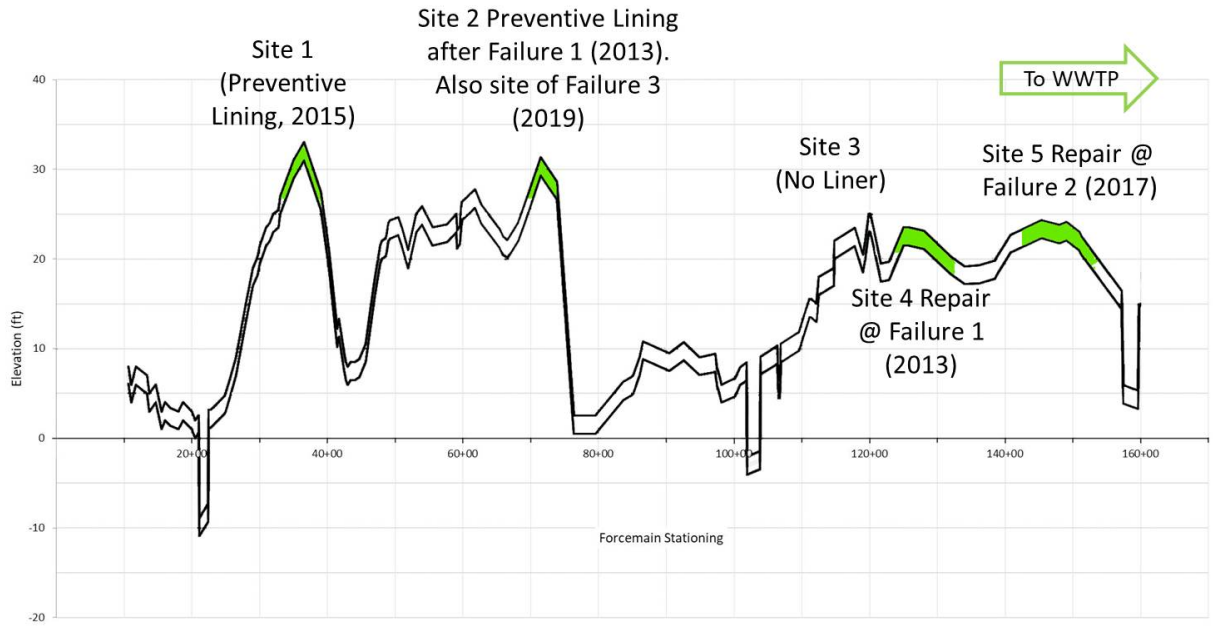
As shown on Figure 3.1, several high points drain completely. These locations are more prone to corrosion because they are exposed to air on a daily cycle, and in particular, air that may contain gaseous sulfides. The District has had three corrosion-related failures along the forcemain; all of these failures were located at exposed high points. The first failure occurred at approximate Station 127+00 in 2013. The second failure occurred at approximate Station 147+00 in 2017, and

the third failure occurred at approximate Station 70+50 in 2019. The failure locations are shown in Figure 3.2.

3.2 Prior Lining Installations and CARV Status

The District repaired Failures 1 and 2, as shown at on Figure 3.2 (Sites 4 and 5), with a CIPP liner. The District also installed preventive CIPP liner in two areas, Sites 1 and 2, that have the potential to fail due to being high points that are exposed to air when AFM-102 drains.

Figure 3.2 Cured-in-Place Pipe Repair Locations



The pipe profile and the extent of exposed and repaired pipe were reviewed more closely in the five high point areas shown on Figure 3.2. Appendix A includes detailed figures showing the extent of exposed pipe and repairs. Following are the findings from this review:

- Site 1. The preventive liner that was installed in 2015 extends from approximate Stations 34+00 to 39+00. The length of pipe that is exposed to air when the pipeline is out of use spans from approximate Station 33+80 to 38+60. Approximately 20 lineal feet of pipe remains unprotected on the eastern end of the installed lining, from Stations 33+80 to 34+00. This site has an active CARV.
- Site 2. The preventive liner that was installed in 2013 was installed from approximate Stations 70+50 to 74+50. The length of pipe that is exposed to air when the pipeline drains spans from approximate Station 70+40 to 74+20. Approximately 10 lineal feet of pipe remained unprotected from Station 70+40 to 70+50. In December 2019, the pipe failed at this location. The District installed an interim repair spool in order to place the pipe back in service. However, a permanent repair has not been completed to date. This site has an active CARV.

- Site 3. This location includes two high points. The first, at approximate Station 117+80, includes approximately 150 lineal feet of pipe that is exposed to air when AFM-102 drains. The second adjacent location at approximate Station 120+00 was inspected in 2014 and similarly, has 150 lineal feet of pipe that is exposed to air when the forcemain drains. The inspection revealed that the internal coating is missing at the crown of pipe throughout the inspected length. However, the remaining exposed concrete appears to be intact. Pipe wall thickness measurements conducted in early 2020 indicate that the pipe wall thickness at both Site 3 locations is intact. The pipe at this location cannot be lowered due to utility conflicts. Site 3 includes an inactive CARV at the high point closer to the WWTP, and no CARV at the high point closer to the APS.
- Site 4. This site was repaired using CIPP lining after the first pipe failure in 2013. The liner extends beyond the extent of pipe that is exposed to air when AFM-102 is drained. Therefore, additional lining or repair is not required. This site has an active CARV.
- Site 5. This site was repaired using CIPP lining after the second pipe failure in 2017. The liner on the plant side (i.e., Station 153+20) leaves approximately 230 feet of pipe unprotected when AFM-102 drains. The liner on the APS side (i.e., Station 143+30 leaves approximately 270 feet of pipe unprotected. This site has an inactive CARV.

3.3 Recommendations and Estimated Costs

Based on the findings discussed above, four of the five sites that are exposed to air when AFM-102 is taken out of service should be considered for additional repairs. These four locations are Site 1, Site 2, Site 3, which includes two high points, and Site 5. If AFM-102 is converted for use as a dedicated forcemain for the BHPS in the future, the forcemain should no longer experience wet and dry cycles on a daily basis. Therefore the risk of continued corrosion will be reduced. However, since these locations have been subject to a high-risk environment for over 20 years, these areas are inherently more vulnerable to failure than the remainder of the forcemain if left unrepaired.

The improvements discussed in this section must be completed before buildout occurs, and before AFM-102 is converted for use as the new BHPS forcemain. In order to take AFM-102 out of service during construction, the APS and adjacent equalization storage basin must have sufficient capacity to be able to pump and store all incoming flows for the duration of construction, including flows from the BHPS.

3.3.1 Recommendations for Repair

- Site 1: Approximately 20 lineal feet of pipe remains unprotected from approximate Stations 33+80 to 34+00. It is recommended that the District address this portion of pipe by lining (60 feet) or pipe replacement. The adjacent section of pipe has a very thin wall and has been lined. The repair method would need to assure that the interface between the previously-lined pipe and new repair is structurally sound and protected from future corrosion. If a new pipe spool is installed, a repair length of at least 80 lineal feet is recommended, as it is likely that a portion of the previous repair will need to be removed in order to facilitate the new repair.

- Site 2: Approximately 10 lineal feet of pipe remained unprotected at approximate Station 70+50 prior to the December 2019 failure at this location. A replacement pipe spool was installed but leaked upon startup. The leak was addressed with a concrete patch and no further leaks have occurred from this repair location since this time. If the replacement spool was greater than 10 feet in length, then it is possible that the unprotected pipe section has been removed. However, if AFM-102 is placed in continuous service as a dedicated forcemain for the BHPS, it is recommended that the District install a permanent repair spool that spans from Stations 70+00 to 70+50. The same precautions at the interface between the existing, lined pipe and repair spool as discussed for Site 1 would apply to Site 2. Therefore, the actual repair may be up to 80 feet in length.
- Site 3. Preventive CIPP lining is recommended at the two Site 3 high points. The first liner would span from approximate Stations 116+20 to 118+50 (230 lineal feet), and the second liner would span from approximate Stations 119+10 to 121+40 (230 lineal feet). Although not necessary, the incremental cost to line the additional 60 feet of existing pipe between these two sections may justify a continuous liner for these two high points. It is also recommended that the District reinstate the CARV at the location of the currently inactive CARV.
- Site 5: Approximately 490 lineal feet of pipe remain unprotected on both sides of the existing CIPP liner when APS-102 drains. It is recommended that the District address these sections by lining or pipe replacement. The adjacent sections of pipe have very thin walls and have been lined. The repair method would need to assure that the interface between the previously-lined pipe and new repair is structurally sound and protected from future corrosion. If a new pipe spool is installed, a repair length of at least 250 lineal feet is recommended on the plant side, and 300 lineal feet on the APS side, as it is likely that a portion of the previous repair will need to be removed on each side of the existing CIPP lined sections in order to facilitate the new repairs.

3.3.2 Estimated Costs

Estimated costs are provided for the recommended improvements described in Section 3.3.1. For comparison, the cost to lower pipe at each site to avoid relining, if feasible, is also provided.

- CIPP Lining, installed: $250/foot, with a minimum cost of $20,000.
- 24-inch pipeline replacement, installed: $900/foot
- Reinstated CARV, installed: $25,000
- Allowance for appurtenances and unknowns: 30 percent
- Engineering (12%), Admin (5%), CM (12%), Permitting (1%): 30 percent
- Contingency for Field Changes: 10 percent

Estimated Costs for Site 1

Costs were developed for four different repair scenarios at Site 1. Option 1 is recommended if feasible, followed by Option 2.

1. Install 60 lineal feet of liner from approximate Stations 33+60 to 34+00. This cost assumes that the interface between existing and new liner can be made seamless.
   - Construction Only: $26,000
   - Total Project Cost: $36,400
2. Install an 80-foot repair spool to connect to the previously-lined pipe at approximate Station 34+00.
   - Construction Only: $93,600
   - Total Project Cost: $131,040
3. Replace and lower approximately 500 lineal feet of 24-inch pipe to eliminate portion of pipe that is exposed during wet-dry cycles. This project would also require a new CARV.
   - Construction Only: $617,500
   - Total Project Cost: $864,500
4. Remove the localized high point through the installation of approximately 2,000 lineal feet of new pipe to a maximum depth of 36 feet and abandoning the same length of existing pipe. It should be noted that most of this length is not vulnerable to corrosion.
   - Construction Cost Only: $2,340,000
   - Total Project Cost: $3,276,000

Estimated Costs for Site 2

Costs were developed for three different repair scenarios at Site 2. Option 1 is recommended.

1. Replace the temporary repair spool with new, 80-foot long permanent repair spool. This cost assumes that the recently-installed spool will not be reused.
   - Construction Only: $93,600
   - Total Project Cost: $131,040
2. Replace and lower approximately 400 lineal feet of 24-inch pipe to eliminate the portion of pipe that is exposed during wet-dry cycles. This project would also require a new CARV.
   - Construction Only: $500,500
   - Total Project Cost: $700,700
3. Remove the localized high point by installing approximately 780 lineal feet of new pipe and abandoning the same length of existing pipe.
   - Construction Cost Only: $912,600
   - Total Project Cost: $1,277,640

Estimated Costs for Sites 3 and 4

The existing pipeline at Site 3 cannot be lowered due to conflicting utilities. Therefore, estimated costs were developed for two options: 1) lining plus reinstatement of the inactive CARV at the high point closest to the WWTP; and 2) lower pipeline to eliminate high points. During the May 26, 2021 meeting to discuss these results, the District expressed a preference for Option 2.

1. Install CIPP liner in two locations, separated by 100 feet of unlined pipe. Total combined length of liner is 460 lineal feet.
   - Construction Only: $182,000
   - Total Project Cost: $254,800
   - The incremental cost to install continuous liner across both locations would be $27,300.
2. Remove the localized high point by installing at least 1,500 lineal feet of new pipe and abandoning the same length of existing pipe. The actual length may be greater to avoid existing utilities.
   - Construction Only: $1,755,000
   - Total Project Cost: $2,457,000

Estimated Costs for Site 5

Costs were developed for two different repair scenarios at Site 5. Option 1 is recommended if feasible. The existing pipeline at Site 5 cannot be lowered due to conflicting utilities.

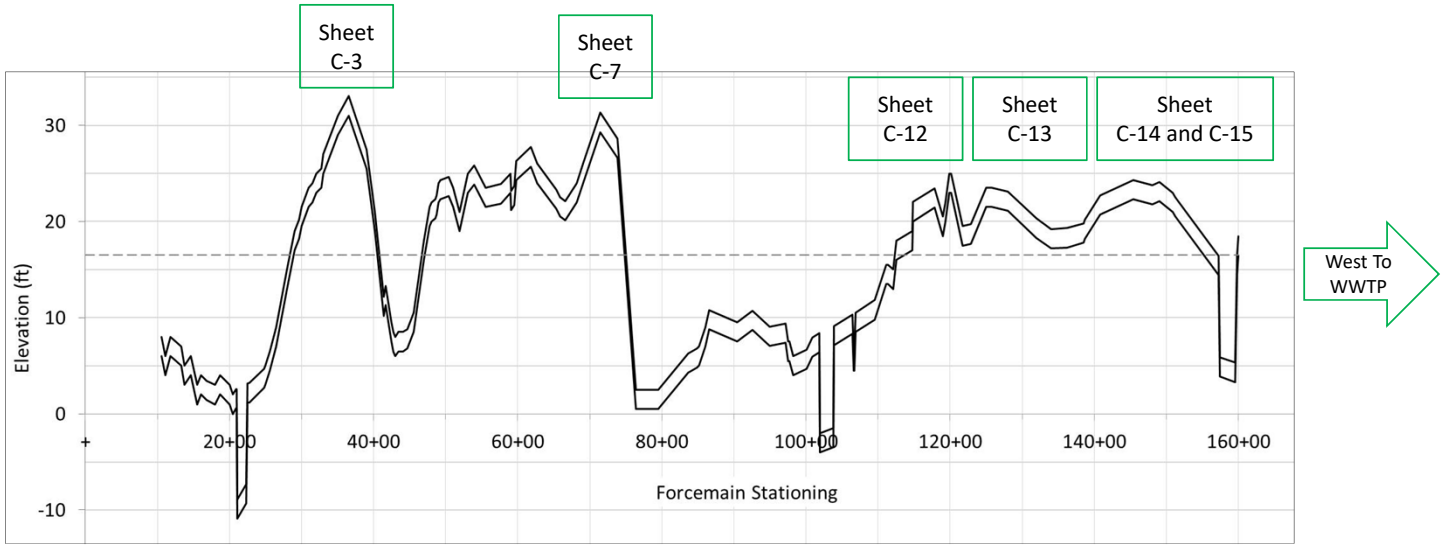
1. Install 310 lineal feet of liner from approximate Stations 140+20 to 143+30. Also install 260 lineal feet of liner from approximate Stations 153+20 to 155+80, and reinstate the CARV. This cost assumes that the interface between existing and new liner can be made seamless.
   - Construction Only: $217,750
   - Total Project Cost: $304,850
3. Install a 250-foot repair spool on the plant side and 300-foot repair spool on the APS side. Connect to existing lined pipe on each end, and reinstate the CARV.
   - Construction Only: $676,000
   - Total Project Cost: $946,400

Antioch Pump Station and Bridgehead Pump Station and Conveyance Systems
Antioch FM-102 High Point Analysis

Appendix A

AFM-102 Profiles with Findings

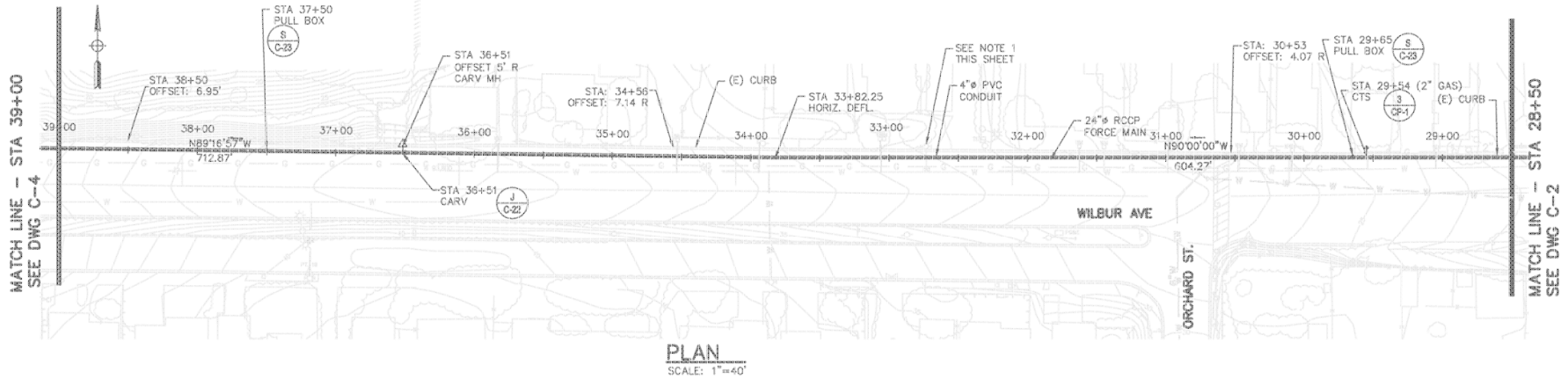
Antioch FM 102 High Point Analysis

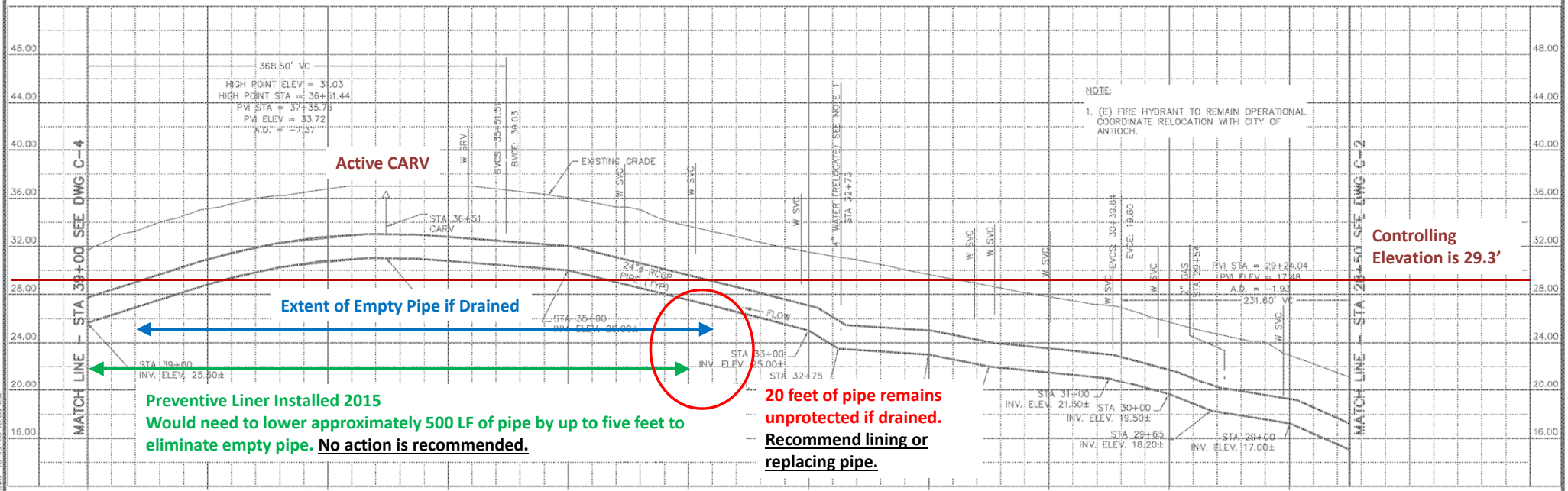


Findings and Recommendations

- Sheet C-3 (Site 1):
  - This section was lined in 2015, except for a 20-foot length @ STA34+00 (east edge) that remains unprotected. Recommend lining or replacing 40 feet of pipe (includes 20-foot buffer).
  - Alternatively, if lining is not feasible, install an 80-foot repair spool.
  - In order to lower the high point to address all of the exposed length (including lined pipe), approximately 500 LF of new pipe would be required. No hydraulic benefit would be achieved. This option is not recommended.
- Sheet C-7 (Site 2):
  - This section was lined in 2013, except for a 10-foot section @ STA70+50 (east edge) that remained unprotected. The exposed portion had a second failure in December 2019 and received a temporary repair. Replace temporary repair with new, 80-foot permanent repair spool.
  - In order to lower the high point to address all of the exposed length, approximately 400 LF of new pipe would be required. No hydraulic benefit would be achieved. This project is not recommended.
- Sheet C-12 (Site 3):
  - Two locations are exposed to air when the pipe drains, neither of which have been lined. Both locations were potholed and the pipe wall thickness appears to be intact.
  - At Station 117+40, approximately 150 LF of pipe crown is exposed to air when the pipe drains. 230 LF of pipe liner (including buffer) is recommended.
  - At Station 120+00, approximately 150 LF of pipe is exposed to air when the pipe drains and the existing air valve is inactive. 230 LF of pipe liner (including buffer) and reinstatement of the CARV are recommended (only one of the two high point had a pre-existing CARV that is recommended for reinstatement).
- Sheet C-13 (Site 4)
  - 400 LF of pipe crown is exposed to air when the pipe drains. In 2013, a liner was installed to address this section. No action is recommended.
- Sheets C-14 and C-15 (Site 5)
  - 1,460 LF of pipe beginning at Station 140+60 to 155+40 has exposed pipe when the pipe drains. In 2013, a liner was installed starting at Station 143+30 heading west to Station 153+20. As a result, 270 feet of pipe remains unprotected starting from Station 140+60 to the lined pipe, and 220 feet of pipe remains unprotected from the lined pipe to Station 155+40. The existing pipe cannot be lowered in this location due to a conflicting stormdrain. Install 570 total LF of liner on both sides of existing liner and reinstate CARV.

Site 1





As Built Drawings
Date: October 2000

NO.	DATE	REVISIONS	BY	APPR.
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BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

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PLAN & PROFILE
STA 28+50 TO STA 39+00

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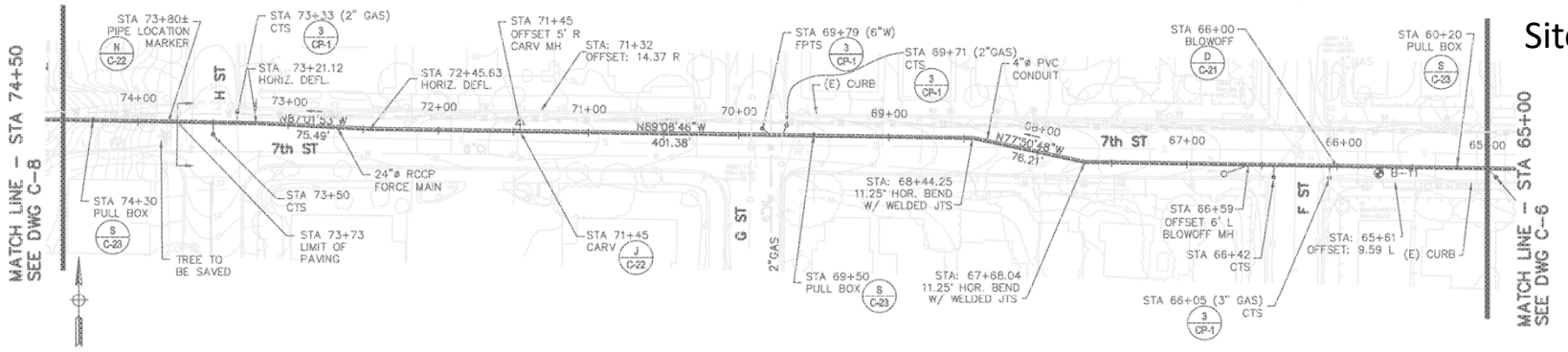
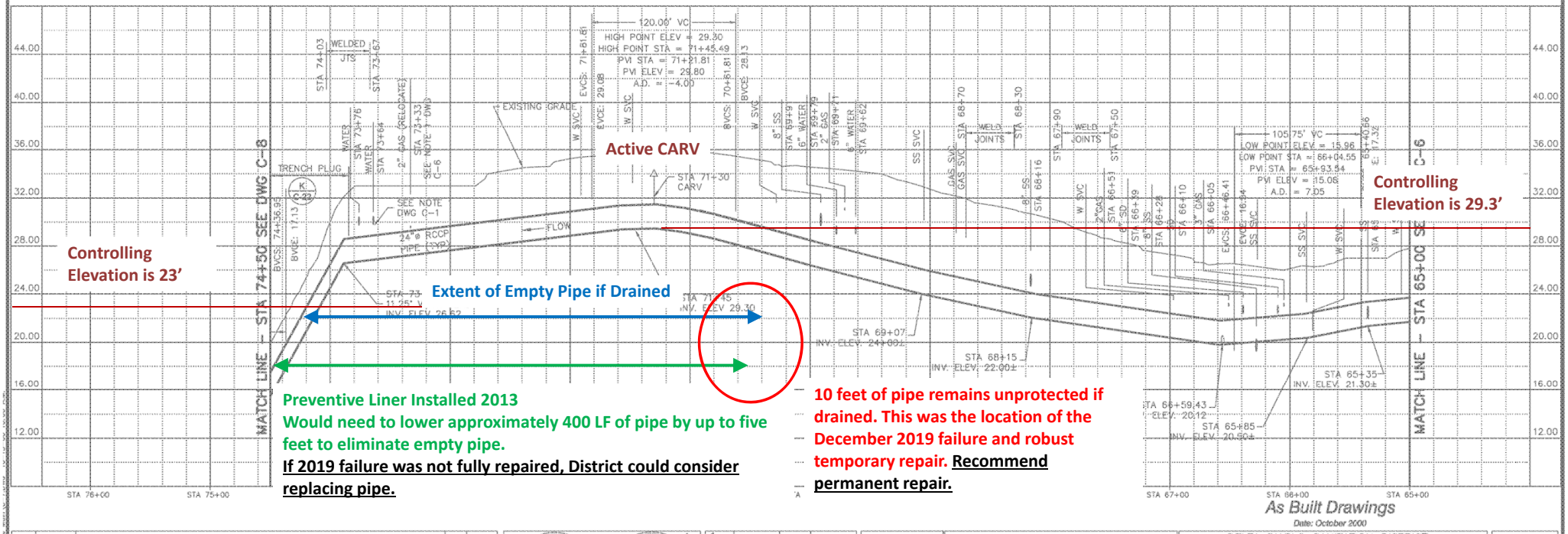
FC PERMIT 650-97
DRAWING C-3
SHT 6 OF 34

Site 2



PLAN
SCALE: 1"=40'



Controlling Elevation is 23'

Extent of Empty Pipe if Drained

Controlling Elevation is 29.3'

Preventive Liner Installed 2013
Would need to lower approximately 400 LF of pipe by up to five feet to eliminate empty pipe.
If 2019 failure was not fully repaired, District could consider replacing pipe.

10 feet of pipe remains unprotected if drained. This was the location of the December 2019 failure and robust temporary repair. Recommend permanent repair.

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STA 65+00 TO STA 74+50

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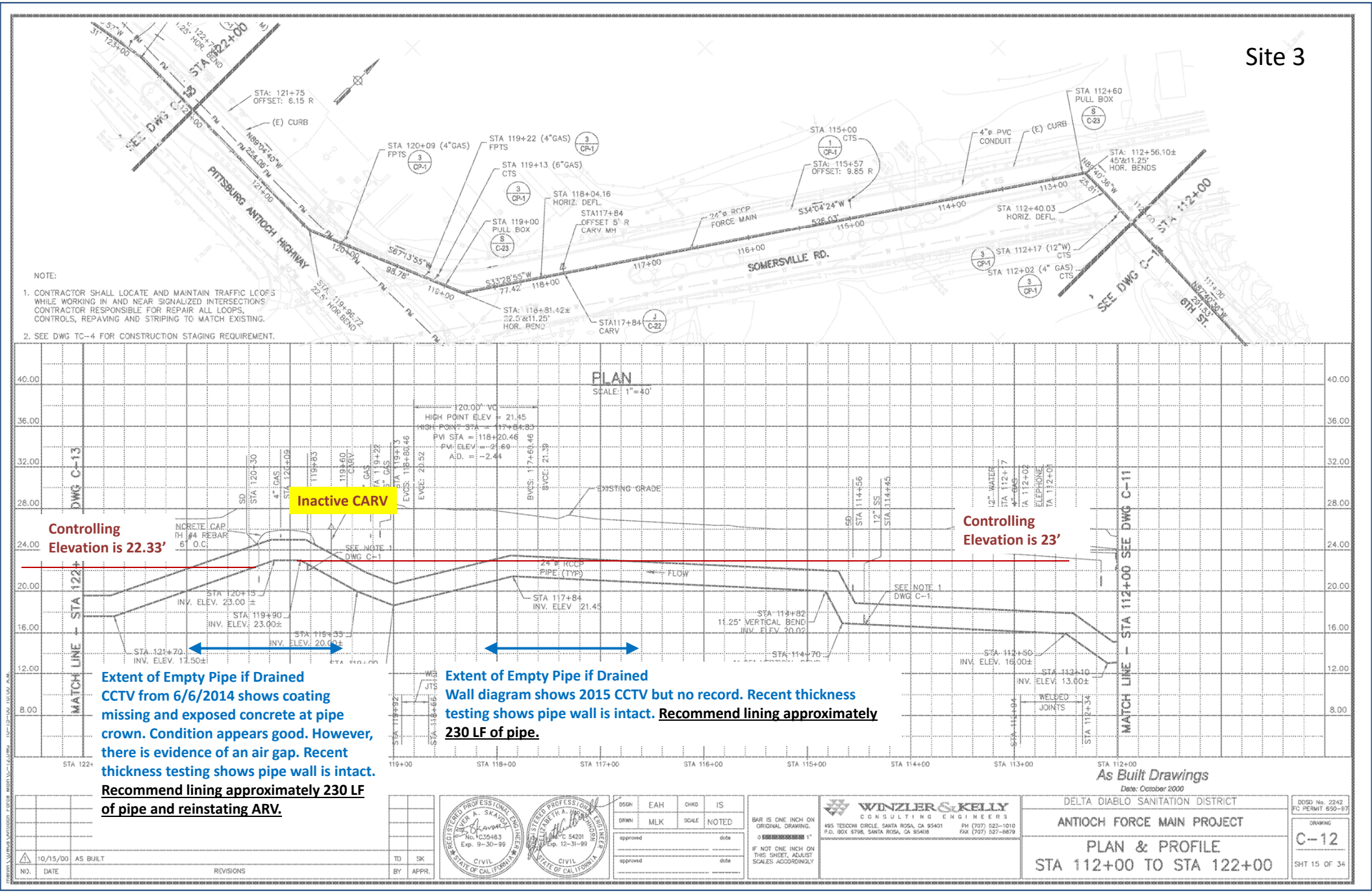
SHT 10 OF 34

Site 3



NOTE:

1. CONTRACTOR SHALL LOCATE AND MAINTAIN TRAFFIC LOOPS WHILE WORKING IN AND NEAR SIGNALIZED INTERSECTIONS CONTRACTOR RESPONSIBLE FOR REPAIR ALL LOOPS, CONTROLS, REPAVING AND STRIPING TO MATCH EXISTING.
2. SEE DWG TC-4 FOR CONSTRUCTION STAGING REQUIREMENT.

Extent of Empty Pipe if Drained
CCTV from 6/6/2014 shows coating missing and exposed concrete at pipe crown. Condition appears good. However, there is evidence of an air gap. Recent thickness testing shows pipe wall is intact. Recommend lining approximately 230 LF of pipe and reinstating ARV.

Extent of Empty Pipe if Drained
Wall diagram shows 2015 CCTV but no record. Recent thickness testing shows pipe wall is intact. Recommend lining approximately 230 LF of pipe.

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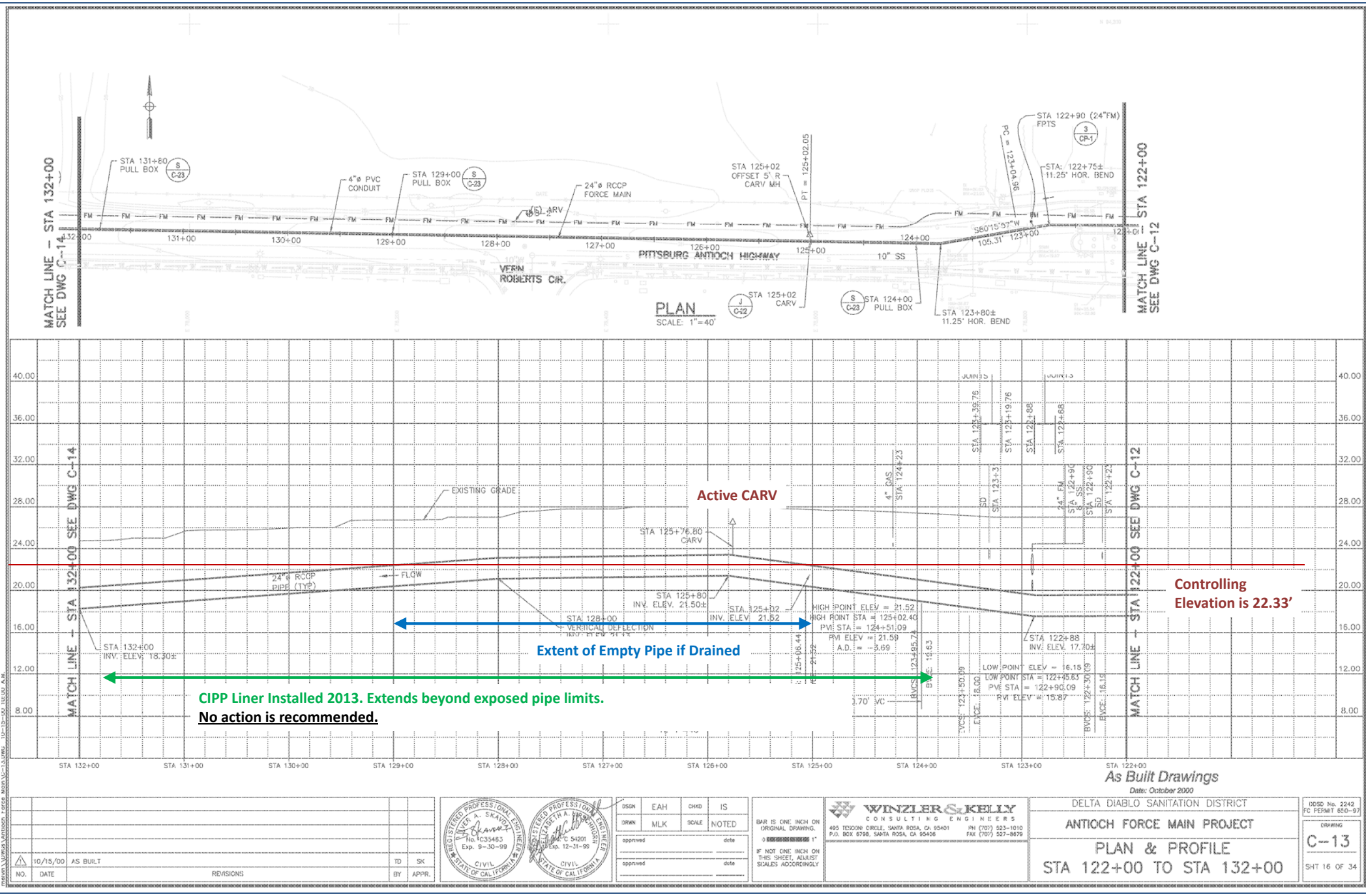
DRAWING C-12
SHT 15 OF 34



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Date: October 2000

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REGISTERED PROFESSIONAL ENGINEER — STEVEN A. SKAVDAL — No. 1C35463 — Exp. 9-30-99 — CIVIL — STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER — ELIZABETH A. HORSCHORN — No. C 54201 — Exp. 12-31-99 — CIVIL — STATE OF CALIFORNIA

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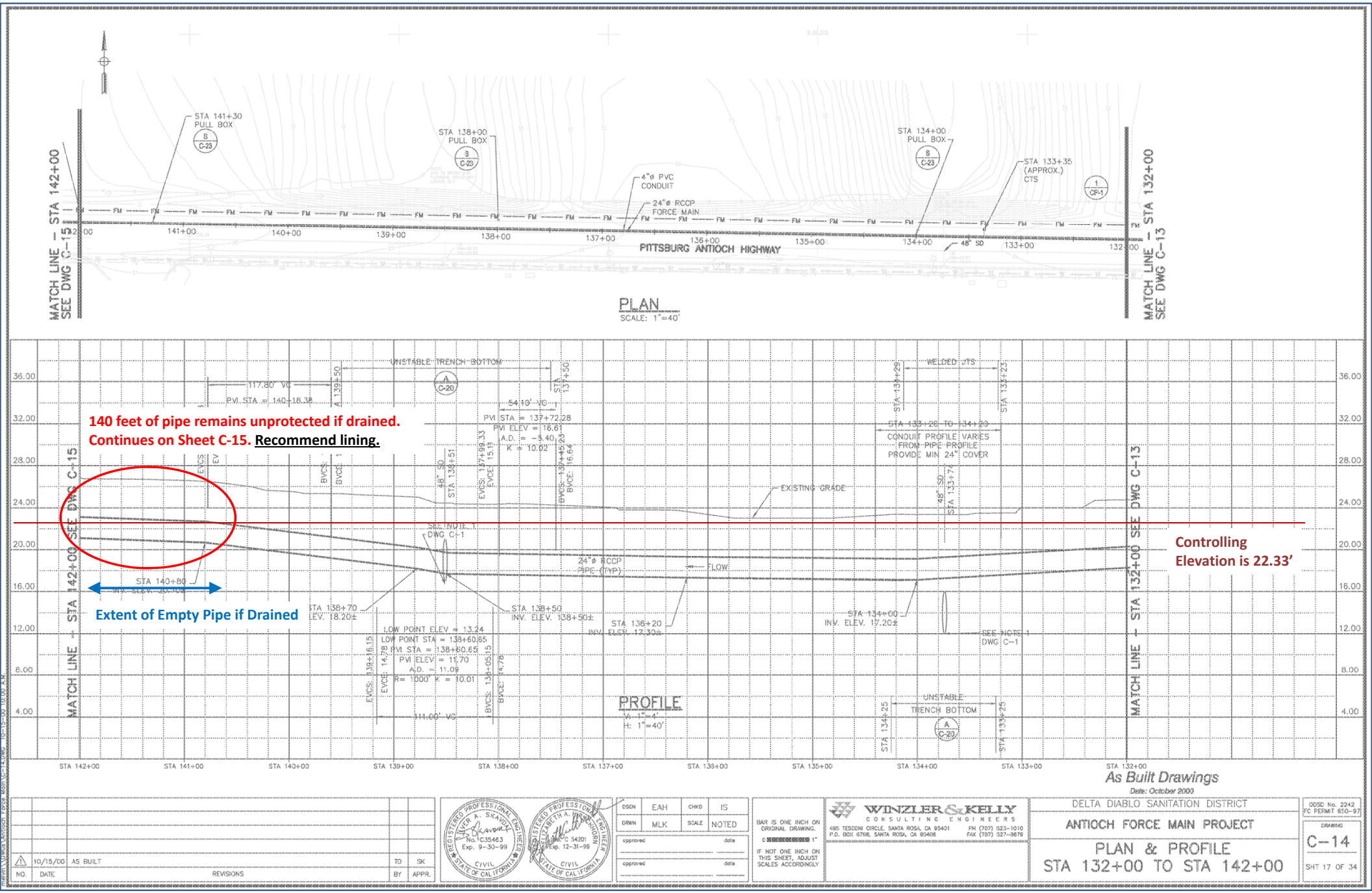
C-13

SHT 16 OF 34


MATCH LINE -- STA 142+00
SEE DWG C-15
STA 141+30
PULL BOX
STA 138+00
PULL BOX
STA 134+00
PULL BOX
4"ø PVC
CONDUIT
24"ø RCCP
FORCE MAIN
STA 133+35
(APPROX.)
CTS
PITTSBURG ANTIOCH HIGHWAY
48" SD
MATCH LINE -- STA 132+00
SEE DWG C-13
PLAN
SCALE: 1"=40'
140 feet of pipe remains unprotected if drained.
Continues on Sheet C-15. Recommend lining.
Extent of Empty Pipe if Drained
Controlling
Elevation is 22.33'
UNSTABLE TRENCH BOTTOM
117.80' VC
PVI STA = 140+18.39
54.10' VC
PVI STA = 137+72.28
PVI ELEV = 16.61
A.D. = 3.40
K = 10.02
WELDED JTS
STA 133+26 TO 134+20
CONDUIT PROFILE VARIES
FROM PIPE PROFILE
PROVIDE MIN 24" COVER
EXISTING GRADE
24"ø RCCP
PIPE (TYP)
FLOW
STA 140+80
INV. ELEV. 22.33±
STA 138+70
ELEV. 18.20±
STA 138+50
INV. ELEV. 18.50±
STA 136+20
INV. ELEV. 17.30±
STA 134+00
INV. ELEV. 17.20±
LOW POINT ELEV = 13.24
LOW POINT STA = 138+60.65
PVI STA = 138+80.65
PVI ELEV = 16.70
A.D. = 11.09
R= 1000' K = 10.01
111.00' VC
PROFILE
V: 1"=4'
H: 1"=40'
UNSTABLE
TRENCH BOTTOM
STA 142+00
STA 141+00
STA 140+00
STA 139+00
STA 138+00
STA 137+00
STA 136+00
STA 135+00
STA 134+00
STA 133+00
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As Built Drawings
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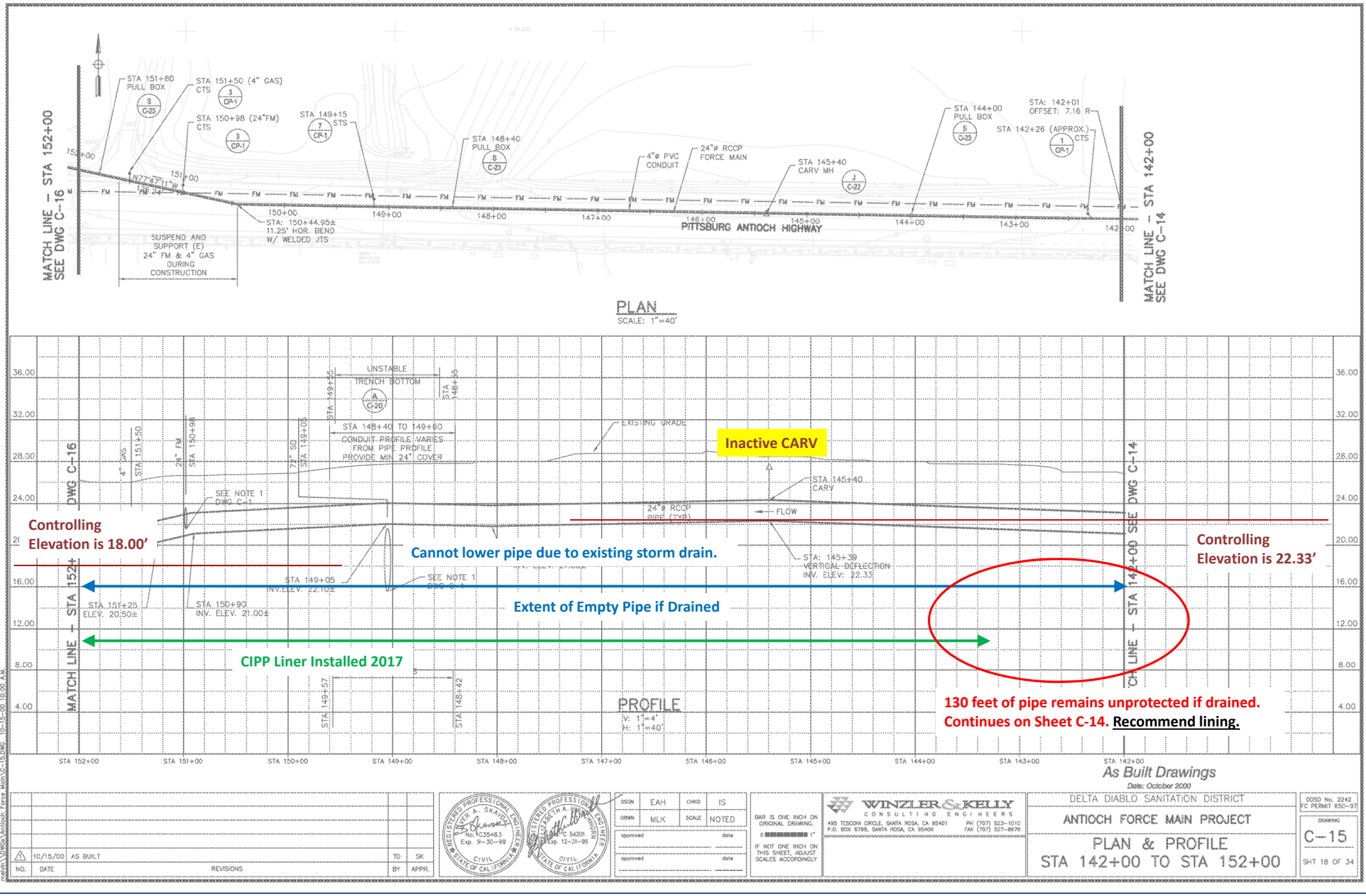
PLAN & PROFILE
STA 132+00 TO STA 142+00
DRAWING
C-14
SHT 17 OF 34


MATCH LINE -- STA 152+00
SEE DWG C-16
STA 151+80
PULL BOX
STA 151+50 (4" GAS)
CTS
STA 150+98 (24"FM)
CTS
STA 149+15
STS
STA 148+40
PULL BOX
4"ø PVC
CONDUIT
24"ø RCCP
FORCE MAIN
STA 145+40
CARV MH
STA 144+00
PULL BOX
STA: 142+01
OFFSET: 7.16' R
STA 142+26 (APPROX.)
CTS
N77°47'11"W
SUSPEND AND
SUPPORT (E)
24" FM & 4" GAS
DURING
CONSTRUCTION
STA: 150+44.95±
11.25° HOR. BEND
W/ WELDED JTS
PITTSBURG ANTIOCH HIGHWAY
MATCH LINE -- STA 142+00
SEE DWG C-14
PLAN
SCALE: 1"=40'
UNSTABLE
TRENCH BOTTOM
STA 148+40 TO 149+60
CONDUIT PROFILE VARIES
FROM PIPE PROFILE
PROVIDE MIN. 24" COVER
EXISTING GRADE
Inactive CARV
STA 145+40
CARV
24"ø RCCP
PIPE (TYP)
FLOW
SEE NOTE 1
DWG C-1
Controlling
Elevation is 18.00'
Cannot lower pipe due to existing storm drain.
STA: 145+39
VERTICAL DEFLECTION
INV. ELEV: 22.33
Controlling
Elevation is 22.33'
STA 149+05
INV.ELEV. 22.10±
STA 151+25
ELEV. 20.50±
STA 150+90
INV. ELEV. 21.00±
Extent of Empty Pipe if Drained
CIPP Liner Installed 2017
130 feet of pipe remains unprotected if drained.
Continues on Sheet C-14. Recommend lining.
PROFILE
V: 1"=4'
H: 1"=40'
MATCH LINE -- STA 152+
DWG C-16
MATCH LINE -- STA 144+00
SEE DWG C-14
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
STA 152+00
STA 151+00
STA 150+00
STA 149+00
STA 148+00
STA 147+00
STA 146+00
STA 145+00
STA 144+00
STA 143+00
STA 142+00
As Built Drawings
Date: October 2000
10/15/00 AS BUILT TD SK
NO. DATE REVISIONS BY APPR.
DSGN EAH CHKD IS
DRWN MLK SCALE NOTED
BAR IS ONE INCH ON ORIGINAL DRAWING.
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY
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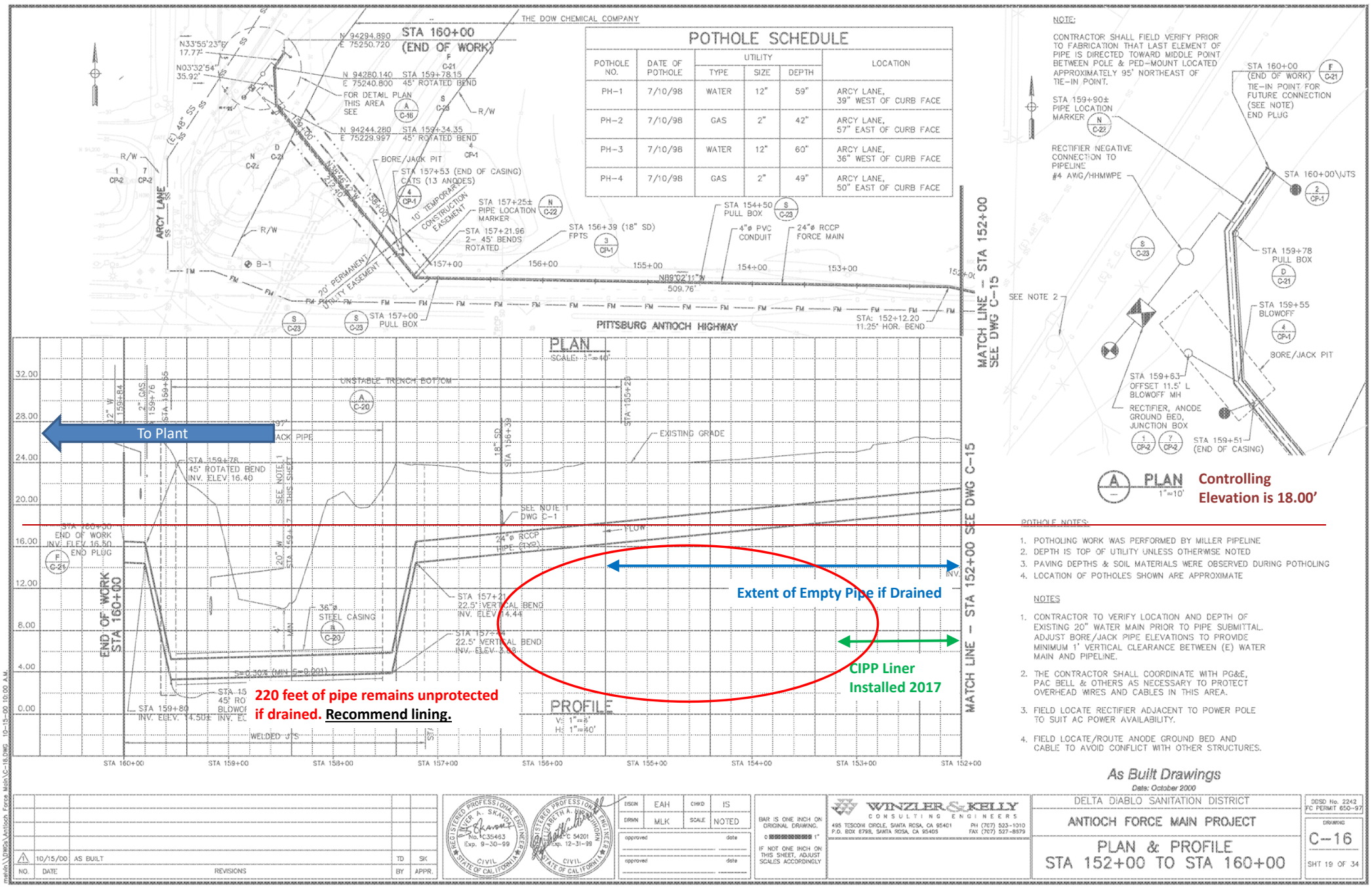
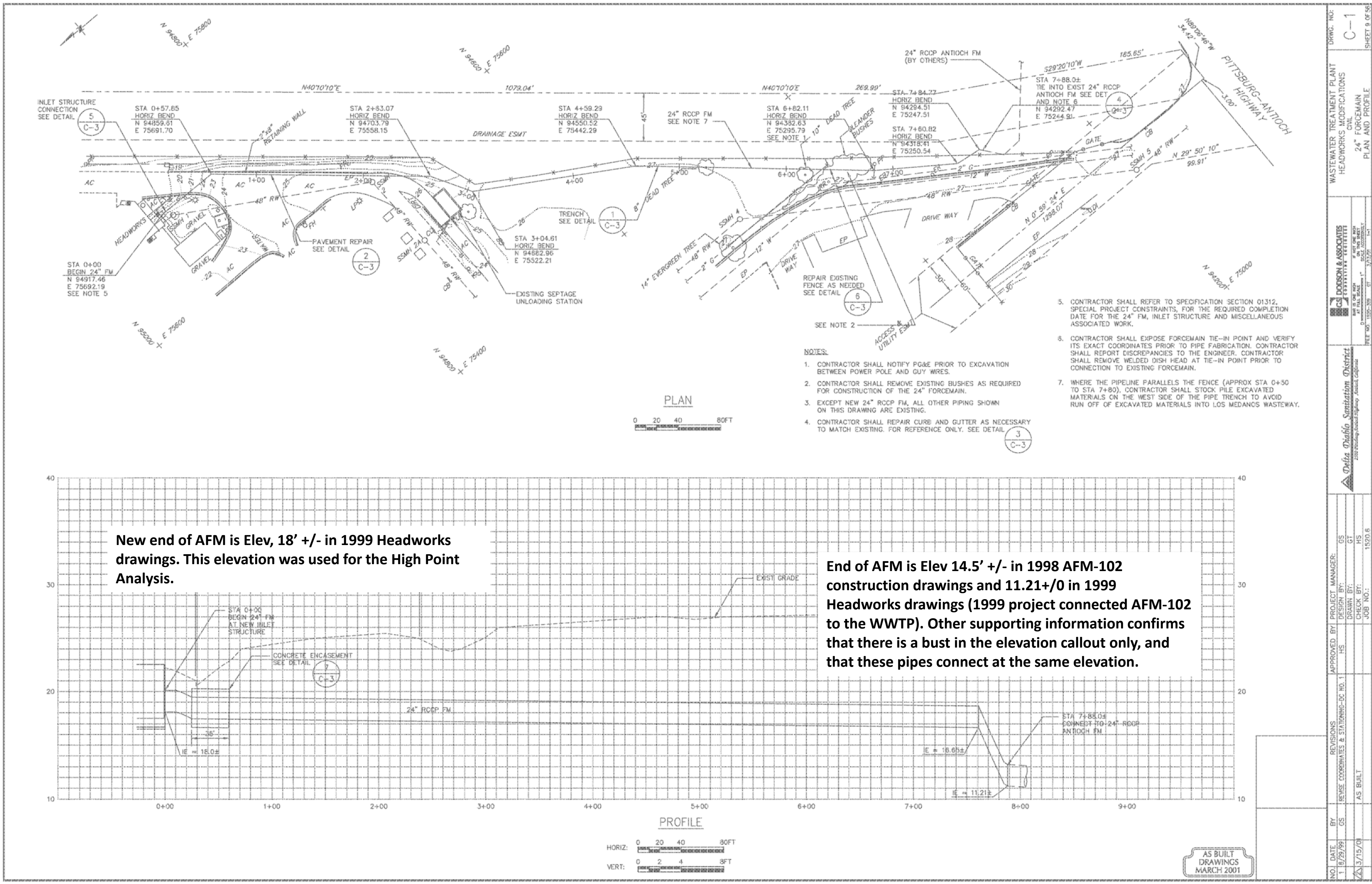
PH (707) 523-1010
FAX (707) 527-8679
DELTA DIABLO SANITATION DISTRICT
ANTIOCH FORCE MAIN PROJECT
PLAN & PROFILE
STA 142+00 TO STA 152+00
DOSD No. 2242
FC PERMIT 650-97
DRAWING
C-15
SHT 18 OF 34


POTHOLE SCHEDULE
POTHOLE NO. | DATE OF POTHOLE | UTILITY TYPE | UTILITY SIZE | UTILITY DEPTH | LOCATION
PH-1 | 7/10/98 | WATER | 12" | 59" | ARCY LANE, 39" WEST OF CURB FACE
PH-2 | 7/10/98 | GAS | 2" | 42" | ARCY LANE, 57" EAST OF CURB FACE
PH-3 | 7/10/98 | WATER | 12" | 60" | ARCY LANE, 36" WEST OF CURB FACE
PH-4 | 7/10/98 | GAS | 2" | 49" | ARCY LANE, 50" EAST OF CURB FACE
THE DOW CHEMICAL COMPANY
STA 160+00 (END OF WORK)
N 94294.890 E 75250.720
N 94280.140 E 75240.800 STA 159+78.15 45° ROTATED BEND
N 94244.280 E 75229.997 STA 159+34.35 45° ROTATED BEND
STA 157+53 (END OF CASING) CATS (13 ANODES)
STA 157+25± PIPE LOCATION MARKER
STA 157+21.96 2- 45° BENDS ROTATED
STA 156+39 (18" SD) FPTS
STA 154+50 PULL BOX
4"ø PVC CONDUIT
24"ø RCCP FORCE MAIN
STA 157+00 PULL BOX
STA: 152+12.20 11.25° HOR. BEND
PITTSBURG ANTIOCH HIGHWAY
ARCY LANE
BORE/JACK PIT
10' TEMPORARY CONSTRUCTION EASEMENT
20' PERMANENT UTILITY EASEMENT
MATCH LINE – STA 152+00 SEE DWG C-15
PLAN
SCALE: 1"=40'
UNSTABLE TRENCH BOTTOM
EXISTING GRADE
To Plant
STA 159+78 45° ROTATED BEND INV. ELEV. 16.40
STA 160+00 END OF WORK INV. ELEV. 16.50 END PLUG
END OF WORK STA 160+00
36"ø STEEL CASING
24"ø RCCP PIPE (TYP.)
FLOW
STA 157+21 22.5° VERTICAL BEND INV. ELEV. 14.44
STA 157+4 22.5° VERTICAL BEND INV. ELEV. 5.8
STA 159+80 INV. ELEV. 14.50±
WELDED JOINTS
Extent of Empty Pipe if Drained
CIPP Liner Installed 2017
220 feet of pipe remains unprotected if drained. Recommend lining.
PROFILE
V: 1"=8'
H: 1"=40'
MATCH LINE – STA 152+00 SEE DWG C-15
STA 160+00
STA 159+00
STA 158+00
STA 157+00
STA 156+00
STA 155+00
STA 154+00
STA 153+00
STA 152+00
NOTE:
CONTRACTOR SHALL FIELD VERIFY PRIOR TO FABRICATION THAT LAST ELEMENT OF PIPE IS DIRECTED TOWARD MIDDLE POINT BETWEEN POLE & PED-MOUNT LOCATED APPROXIMATELY 95' NORTHEAST OF TIE-IN POINT.
STA 160+00 (END OF WORK) TIE-IN POINT FOR FUTURE CONNECTION (SEE NOTE) END PLUG
STA 159+90± PIPE LOCATION MARKER
RECTIFIER NEGATIVE CONNECTION TO PIPELINE #4 AWG/HHMWPE
STA 160+00\IJTS
STA 159+78 PULL BOX
STA 159+55 BLOWOFF
BORE/JACK PIT
STA 159+63 OFFSET 11.5' L BLOWOFF MH
RECTIFIER, ANODE GROUND BED, JUNCTION BOX
STA 159+51 (END OF CASING)
SEE NOTE 2
A PLAN 1"=10'
Controlling Elevation is 18.00'
POTHOLE NOTES:
1. POTHOLING WORK WAS PERFORMED BY MILLER PIPELINE
2. DEPTH IS TOP OF UTILITY UNLESS OTHERWISE NOTED
3. PAVING DEPTHS & SOIL MATERIALS WERE OBSERVED DURING POTHOLING
4. LOCATION OF POTHOLES SHOWN ARE APPROXIMATE
NOTES
1. CONTRACTOR TO VERIFY LOCATION AND DEPTH OF EXISTING 20" WATER MAIN PRIOR TO PIPE SUBMITTAL. ADJUST BORE/JACK PIPE ELEVATIONS TO PROVIDE MINIMUM 1' VERTICAL CLEARANCE BETWEEN (E) WATER MAIN AND PIPELINE.
2. THE CONTRACTOR SHALL COORDINATE WITH PG&E, PAC BELL & OTHERS AS NECESSARY TO PROTECT OVERHEAD WIRES AND CABLES IN THIS AREA.
3. FIELD LOCATE RECTIFIER ADJACENT TO POWER POLE TO SUIT AC POWER AVAILABILITY.
4. FIELD LOCATE/ROUTE ANODE GROUND BED AND CABLE TO AVOID CONFLICT WITH OTHER STRUCTURES.
As Built Drawings
Date: October 2000
NO. | DATE | REVISIONS | BY | APPR.
1 | 10/15/00 | AS BUILT | TD | SK
DSGN EAH CHKD IS
DRWN MLK SCALE NOTED
BAR IS ONE INCH ON ORIGINAL DRAWING.
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY
WINZLER & KELLY CONSULTING ENGINEERS
495 TESCONI CIRCLE, SANTA ROSA, CA 95401 PH (707) 523-1010
P.O. BOX 6798, SANTA ROSA, CA 95405 FAX (707) 527-8879
DELTA DIABLO SANITATION DISTRICT
ANTIOCH FORCE MAIN PROJECT
PLAN & PROFILE
STA 152+00 TO STA 160+00
DDSD No. 2242
FC PERMIT 650-97
DRAWING
C-16
SHT 19 OF 34


WASTEWATER TREATMENT PLANT
HEADWORKS MODIFICATIONS
CIVIL
24" FORCEMAIN
PLAN AND PROFILE
DRWG. NO: C-1
SHEET 9 OF 56
Delta Diablo Sanitation District
DODSON & ASSOCIATES
PLAN
PROFILE
NOTES:
1. CONTRACTOR SHALL NOTIFY PG&E PRIOR TO EXCAVATION BETWEEN POWER POLE AND GUY WIRES.
2. CONTRACTOR SHALL REMOVE EXISTING BUSHES AS REQUIRED FOR CONSTRUCTION OF THE 24" FORCEMAIN.
3. EXCEPT NEW 24" RCCP FM, ALL OTHER PIPING SHOWN ON THIS DRAWING ARE EXISTING.
4. CONTRACTOR SHALL REPAIR CURB AND GUTTER AS NECESSARY TO MATCH EXISTING. FOR REFERENCE ONLY. SEE DETAIL 3 C-3
5. CONTRACTOR SHALL REFER TO SPECIFICATION SECTION 01312, SPECIAL PROJECT CONSTRAINTS, FOR THE REQUIRED COMPLETION DATE FOR THE 24" FM, INLET STRUCTURE AND MISCELLANEOUS ASSOCIATED WORK.
6. CONTRACTOR SHALL EXPOSE FORCEMAIN TIE-IN POINT AND VERIFY ITS EXACT COORDINATES PRIOR TO PIPE FABRICATION. CONTRACTOR SHALL REPORT DISCREPANCIES TO THE ENGINEER. CONTRACTOR SHALL REMOVE WELDED DISH HEAD AT TIE-IN POINT PRIOR TO CONNECTION TO EXISTING FORCEMAIN.
7. WHERE THE PIPELINE PARALLELS THE FENCE (APPROX STA 0+50 TO STA 7+80), CONTRACTOR SHALL STOCK PILE EXCAVATED MATERIALS ON THE WEST SIDE OF THE PIPE TRENCH TO AVOID RUN OFF OF EXCAVATED MATERIALS INTO LOS MEDANOS WASTEWAY.
STA 0+00 BEGIN 24" FM AT NEW INLET STRUCTURE
CONCRETE ENCASEMENT SEE DETAIL 7 C-3
EXIST GRADE
24" RCCP FM
IE = 18.0±
IE = 16.65±
IE = 11.21±
STA 7+88.0± CONNECT TO 24" RCCP ANTIOCH FM
AS BUILT DRAWINGS MARCH 2001

New end of AFM is Elev, 18' +/- in 1999 Headworks drawings. This elevation was used for the High Point Analysis.

End of AFM is Elev 14.5' +/- in 1998 AFM-102 construction drawings and 11.21+/0 in 1999 Headworks drawings (1999 project connected AFM-102 to the WWTP). Other supporting information confirms that there is a bust in the elevation callout only, and that these pipes connect at the same elevation.

V.W. HOUSEN
& ASSOCIATES

Appendix I. APS Improvements – Construction Cost Estimate

Antioch and Bridgehead Pump Station and Conveyance System Improvements - Phase II Summary - APS Improvements Preliminary Level Construction Cost Estimate	
Description	**APS Improvements (Does not include BHFM Extension, AFM102 Repairs/Improvements, or New Future 3rd Forcemain)**
Summary - Specification Divisions	
Division 1 - General Requirements	$2,622,525
Division 2 - Site Work	$1,117,845
Division 3 - Concrete	$359,110
Division 4 - Masonry	$0
Division 5- Metals	$214,550
Division 6 - Wood and Plastics	$32,500
Division 7 - Thermal and Moisture Protection	$10,000
Division 8 - Doors and Windows	$0
Division 9 - Finishes	$182,500
Division 10 - Specialties	$6,500
Division 11 - Equipment	$2,104,600
Division 12 - Furnishings	$0
Division 13 - Special Construction	$400,000
Division 14 - Conveying Systems	$0
Division 15 - Mechanical	$980,505
Divisions 16 & 17 - Electrical/I&C	$1,409,400
Subtotal	$9,440,035
Bond, Insurance, Overhead, and Profit (18%)	$1,699,206
Contingencies (30%)	$2,832,010
Total Cost (In 2021$s)[2]	$13,971,252
Total Cost (Escalated to Time of Construction)[1, 2]	$15,724,767
Total Cost (Escalated to Time of Construction) (Rounded)[1,2,3]	$15,725,000

[1] Costs are escalated to Year 2025 (mid-point of construction). Escalation at 3% per year. The construction cost estimating methodology used to prepare this estimate is consistent with what has been used in the past, which is to start with estimated materials and labor pricing for purchases now, with escalation added to account for nominal price increases to the time of actual purchase and delivery. This methodology remains sound, except the **District should add bottom-line adjustments to account for current bidding climate/inflation.** For long duration projects, pricing at all levels of the Contractors' organizations are subject to factors applied to account for uncertainties in future availability and cost of materials and labor. Due to current uncertainty volatility is high. The current bidding climate is seeing bids coming in significantly higher than the Engineer's Estimate.

[2]Estimated cost is for the contractor's bid price only. Cost does not include any costs associated with Engineering Services During Construction, construction management, District staff time, special inspections and testing, construction related costs outside of the Contractor's work, etc.

[3]Estimated savings if not install grinders is $200,000 plus markups = $340,000 off total construction cost.

Antioch and Bridgehead Pump Station and Conveyance System Improvements - Phase II
APS Improvements - Preliminary Level Construction Cost Estimate

Description	Quantity		Material Cost		Labor Cost		Total Cost	
	Number	Unit	Unit Cost	Total[2]	Unit Cost	Total	Unit Cost	Total
Division 1 - General Requirements								
Mobilization/Demobilization (5%)	1	LS					$449,525	$449,525
01990 General Construction Sequencing and Constraints								
Construction Sequencing and Constraints	1	LS					$25,000	$25,000
Bypass Pumping (Build Diversion PS and Grinder Structure)[5]	1	LS					$918,000	$918,000
Bypass Pumping (Replace APS Main Pumps, Electrical and I&C, and Generator)[6]	1	LS					$1,230,000	$1,230,000
Total Division 1								**$2,622,525**
Division 2 - Site Work								
02050 Demolition, Cutting and Patching								
Demolition	1	LS					$50,000	$50,000
02140 Dewatering								
Dewatering (Diversion PS & Grinder Structure)	1	LS					$150,000	$150,000
Dewatering (Gravity Sewers, MHs and Forcemain Piping)	1	LS					$30,000	$30,000
02200 Earthwork								
Earthwork - (Diversion PS & Grinder Structure)								
Excavation	1215	CY	$0	$0	$35	$42,525	$35	$42,525
Import	765	CY	$15	$11,475	$0	$0	$15	$11,475
Backfill & Compaction	765	CY	$0	$0	$20	$15,300	$20	$15,300
Removal of Excess	1215	CY	$0	$0	$10	$12,150	$10	$12,150
Earthwork - Gravity Sewers, MHs, and Forcemains								
Excavation	1777	CY	$0	$0	$35	$62,195	$35	$62,195
Import	1637	CY	$15	$24,555	$0	$0	$15	$24,555
Backfill & Compaction	1637	CY	$0	$0	$20	$32,740	$20	$32,740
Removal of Excess	1777	CY	$0	$0	$10	$17,770	$10	$17,770
Earthwork - Generator Pad								
Excavation	124	CY	$0	$0	$35	$4,340	$35	$4,340
Import	101	CY	$15	$1,515	$0	$0	$15	$1,515
Backfill & Compaction	101	CY	$0	$0	$20	$2,020	$20	$2,020
Removal of Excess	124	CY	$0	$0	$10	$1,240	$10	$1,240
Earthwork - Misc	1	LS					$5,000	$5,000
Geotextile Fabric								
Geotextile Fabric	1200	SY	$37	$44,400	$2	$2,400	$39	$46,800
02210 Controlled Low Strength Material (CLSM)								
Controlled Low Strength Material (CLSM) (Fill abandoned pipelines)	124	CY	$150	$18,600	$5	$620	$155	$19,220
02390 Shoring								
Shoring (Diversion PS & Grinder Structure)	1	LS					$125,000	$125,000
Shoring (FMs)	1	LS					$50,000	$50,000
Shoring (Gravity Sewer and MHs)	1	LS					$150,000	$150,000
02513 AC Pavement and Base								
AC Pavement	1500	SF	$2	$3,000	$3	$4,500	$5	$7,500
Base, Include elsewhere	0	CY	$15	$0	$65	$0	$80	$0
Fog Seal (Existing Pavement)	5000	SF	$1	$5,000	$1	$5,000	$2	$10,000
02600 Manholes								
8' Manhole (Risers) (Tie-in MHs)	1	EA	$15,000	$15,000	$15,000	$15,000	$30,000	$30,000
8' Manhole (Risers)	2	EA	$15,000	$30,000	$15,000	$30,000	$30,000	$60,000
5' Manholes (Risers) (Tie-in MHs)	1	EA	$8,000	$8,000	$9,000	$9,000	$17,000	$17,000
5' Manholes (Risers)	1	EA	$8,000	$8,000	$9,000	$9,000	$17,000	$17,000
Lining (Raven)	2300	SF	$30	$69,000	$20	$46,000	$50	$115,000
Manhole Covers	5	EA	$500	$2,500	$1,000	$5,000	$1,500	$7,500
Total Division 2								**$1,117,845**
Division 3 - Concrete								
03151 Anchorage to Concrete								
Anchorage to Concrete	1	LS					$5,000	$5,000
03302 Concrete and Grout								
Generator Pad	45	CY	$700	$31,500	$1	$45	$701	$31,545
Transformer Pad	4.5	CY	$700	$3,150	$1	$5	$701	$3,155
SE-1 FRP Building Pad	10	CY	$700	$7,000	$1	$10	$701	$7,010
Pump Pedestals	7	CY	$900	$6,300	$38	$266	$938	$6,566
Miscellaneous Grout	1	LS					$2,500	$2,500
Concrete - Diversion Pump Station and Grinder Structure								

Antioch and Bridgehead Pump Station and Conveyance System Improvements - Phase II
APS Improvements - Preliminary Level Construction Cost Estimate

Description	Quantity		Material Cost		Labor Cost		Total Cost	
	Number	Unit	Unit Cost	Total[2]	Unit Cost	Total	Unit Cost	Total
Slab on Grade	68	CY	$700	$47,600	$1	$68	$701	$47,668
Suspended Slab	15	CY	$1,270	$19,050	$50	$750	$1,320	$19,800
Walls	167	CY	$900	$150,300	$38	$6,346	$938	$156,646
Concrete - Generator Building (Misc. Wall Fill at Louvers)								
Generator Building (Misc. Wall Fill at Louvers)	1	LS					$10,000	$10,000
Manholes (5)								
Bases	53	CY	$700	$37,100	$1	$53	$701	$37,153
Collars/Top Slab	13	CY	$1,270	$16,510	$50	$650	$1,320	$17,160
Electrical Pads	7	CY	$700	$4,900	$1	$7	$701	$4,907
03348 Concrete Finishing and Repair of Surface Defects								
(included in 03302)								
03400 Precast Concrete Structures								
Miscellaneous Electrical	1	LS					$5,000	$5,000
03600 Grout								
Miscellaneous Grout	1	LS					$5,000	$5,000
Total Division 3								**$359,110**
Division 4 - Masonry (Not Used)								
Total Division 4								**$0**
Division 5 - Metals								
05030 Hot Dip Galvanizing								
Hot Dip Galvanizing	1	LS					$2,500	$2,500
05060 Pipe Welding								
(Included with Steel Pipe)								
05070 Hatches								
Hatches (Type 316 SST)								
Hatch for Diversion PS								
(3'X5')(SST)	1	EA	9000	$9,000	4000	$4,000	13000	$13,000
(3'x2')(SST)	3	EA	5500	$16,500	2500	$7,500	8000	$24,000
Hatch for Grinder Structure								
(4'X8')(SST)	1	EA	16500	$16,500	5000	$5,000	21500	$21,500
(3'x3')(SST)	1	EA	6500	$6,500	2500	$2,500	9000	$9,000
05505 Metal Fabrications								
Grating (Alum)								
Diversion PS (Vault)								
Grating	130	SF	66	$8,580	3	$390	69	$8,970
Banding	121	LF	21	$2,541	3	$363	24	$2,904
Supports	1	LS					10000	$10,000
Grating (Type 316 SST)								
Grinder Structure								
Grating	154	SF	66	$10,164	3	$462	69	$10,626
Banding	125	LF	21	$2,625	3	$375	24	$3,000
Supports	1	LS					10000	$10,000
Weir Plate								
Diversion PS								
Weir Plate (Type 316 SST)	1	LS					7500	$7,500
Grinder Structure								
Weir Plate (Type 316 SST)	1	LS					1000	$1,000
Fasteners	1	LS					$10,000	$10,000
Ladder Rungs								
Rungs w/ Ladder up safety post	1	LS					6000	$6,000
Miscellaneous Metalwork	1	LS					$10,000	$10,000
Electrical Panel Seismic Bracing (All New - included with Electrical Equipment)								
Bollards	13	EA	$250	$3,250	$100	$1,300	$350	$4,550
Generator stairs and platform (alum)	1	LS					$30,000	$30,000
Drywell spiral stairs, platform and handrail (alum)	1	LS					$30,000	$30,000
05522 Aluminum Railings								
Included in 05505								

Antioch and Bridgehead Pump Station and Conveyance System Improvements - Phase II
APS Improvements - Preliminary Level Construction Cost Estimate

Description	Quantity		Material Cost		Labor Cost		Total Cost	
	Number	Unit	Unit Cost	Total[2]	Unit Cost	Total	Unit Cost	Total
Total Division 5								**$214,550**
Division 6 - Wood and Plastics (Not Used)								
06600 FRP Modular Building								
SE-1 Building (Includes lights, ventilation and outlets)	1	EA	$27,000	$27,000	$5,500	$5,500	$32,500	$32,500
Total Division 6								**$32,500**
Division 7 - Thermal and Moisture Protection								
07110 Damp Proofing								
Damp Proofing (Misc.)	1	LS					$5,000	$5,000
07900 Joint Sealants								
Sealants and Caulking	1	LS					$5,000	$5,000
Total Division 7								**$10,000**
Division 8 - Doors and Windows (Not used)								
Total Division 8								**$0**
Division 9 - Finishes								
09800 Protective Coatings								
Protective Coatings	1	LS					$25,000	$25,000
09810 Protective Coating for Diversion PS and Grinder Structure								
Wetwell	3150	SF	$30	$94,500	$20	$63,000	$50	$157,500
Total Division 9								**$182,500**
Division 10 - Specialties								
10400 Identification Devices								
Identification Devices	1	LS					$3,000	$3,000
10444 Signage								
Signage	1	LS					$1,000	$1,000
10520 Fire Protection Specialties								
Fire Extinguishers	1	LS					$2,500	$2,500
Total Division 10								**$6,500**
Division 11 - Equipment								
11000 Equipment, General								
(included in other sections)								
11080 Standby Generator System								
1000 kW Standby Generator (includes acoustic enclosure (72 dBA at 23'), Tier 4 After Treatment Equipment includes DPF, SCR, Urea Tank and Pump, Etc., load bank, and 24 hour subbase fuel tank), and startup and testing	1	EA	$685,000	$685,000	$25,000	$25,000	$710,000	$710,000
11200 Pumps, General								
(included in other sections)								
11310 Sump Pumps								
Sump Pumps (Diversion Pump Station)	1	EA	$5,000	$5,000	$1,000	$1,000	$6,000	$6,000
11330 Sewage Pumps								
Main Pumps - Dry Pit Submersible (Flygt NT3312/766, 480mm, 280Hp)	4	EA	$210,000	$840,000	$25,000	$100,000	$235,000	$940,000
Mfr Services (training, startup and testing)	1	LS					$10,000	$10,000
Spare Parts	1	LS					$20,000	$20,000
Vibration Testing	1	LS					$5,000	$5,000
Pressure Gauges	8	EA	$500	$4,000	$100	$800	$600	$4,800
Diversion Pumps - Submersible (Flygt NP3153MT, 434mm, 20Hp)	3	EA	$30,000	$90,000	$5,000	$15,000	$35,000	$105,000
Spare parts (included above)								
Mfr Services (included above)								
Pressure Gauges	3	EA	$500	$1,500	$100	$300	$600	$1,800
11390 Channel Grinders (includes explosion proof immersible motors, power cable, guide rails, frames, stop gates, lifting chain and controller enclosure)								
Grinder Structure[4]	2	EA	141000	$282,000	10000	$20,000	151000	$302,000

Antioch and Bridgehead Pump Station and Conveyance System Improvements - Phase II
APS Improvements - Preliminary Level Construction Cost Estimate

Description	Quantity		Material Cost		Labor Cost		Total Cost	
	Number	Unit	Unit Cost	Total[2]	Unit Cost	Total	Unit Cost	Total
Total Division 11								**$2,104,600**
Division 12 - Furnishings (Not Used)								
Total Division 12								**$0**
Division 13 - Special Construction (Not Used)								
13600 Surge Tank (includes placeholder for surge protection at the APS)	1	LS					$400,000	$400,000
Total Division 13								**$400,000**
Division 14 - Conveyance Systems (Not Used)								
Total Division 14								**$0**
Division 15 - Mechanical								
15050 Piping, General								
12-inch Flex Connector	4	EA	$1,250	$5,000	$1,500	$6,000	$2,750	$11,000
16-inch Flex Connector	4	EA	$1,700	$6,800	$1,500	$6,000	$3,200	$12,800
Sleeve-type Couplings (48" Ø) for GS	4	EA	$5,000	$20,000	$1,500	$6,000	$6,500	$26,000
Sleeve-type Couplings (8- inch)	8	EA	$500	$4,000	$500	$4,000	$1,000	$8,000
15061 Ductile Iron Pipe (fittings)								
6" x 8"diameter increaser (eccentric) (FLxFL)	3	EA	$650	$1,950	$500	$1,500	$1,150	$3,450
8" diameter (90 degree elbow FLxFL)	4	EA	$750	$3,000	$250	$1,000	$1,000	$4,000
18 x 16"diameter eccentric reducer (FLxFL)	3	EA	$4,000	$12,000	$1,000	$3,000	$5,000	$15,000
16" x 12"diameter increaser (FLxFL) (eccentric)	3	EA	$1,500	$4,500	$750	$2,250	$2,250	$6,750
Vic Couplings and Caps	1	LS					$10,000	$10,000
15062 Steel Pipe								
Fabricated Pump Suction Bells	4	EA	$10,000	$40,000	$5,000	$20,000	$15,000	$60,000
Fabricated Steel Piping and Fittings								
16" diameter (9"L - FL/vic spool)	12	EA	$1,500	$18,000	$500	$6,000	$2,000	$24,000
16" diameter fabricated 60 degree bend (FL/vic)	8	EA	$3,500	$28,000	$1,000	$8,000	$4,500	$36,000
16" diameter (3'L - FL/FL spool)	4	EA	$2,000	$8,000	$500	$2,000	$2,500	$10,000
16"FL x 16"vic x 16"FL tee	4	EA	$10,000	$40,000	$2,500	$10,000	$12,500	$50,000
16" diameter (12'L - FL/vic spool)	1	EA	$1,500	$1,500	$1,500	$1,500	$3,000	$3,000
16" diameter (6'L - FL/vic spool)	1	EA	$750	$750	$750	$750	$1,500	$1,500
16" FM welded	110	LF	$100	$11,000	$125	$13,750	$225	$24,750
16" 45 degree bend (PE)	4	EA	$3,500	$14,000	$1,000	$4,000	$4,500	$18,000
14" FM welded	125	LF	$90	$11,250	$125	$15,625	$215	$26,875
14" 45 degree bend (PE)	3	EA	$3,000	$9,000	$750	$2,250	$3,750	$11,250
14" 90 degree bend (PE)	1	EA	$3,500	$3,500	$1,000	$1,000	$4,500	$4,500
14" x 14" x 8" wye (flat bottom)	3	EA	$1,750	$5,250	$750	$2,250	$2,500	$7,500
8" diameter (7.5'L - FL/FL spool)	6	EA	$1,000	$6,000	$1,000	$6,000	$2,000	$12,000
8" diameter (3.5'L - FL/Vic spool - wall pipe)	3	EA	$500	$1,500	$500	$1,500	$1,000	$3,000
8" diameter (1.5'L - FL/Vic spool)	4	EA	$500	$2,000	$250	$1,000	$750	$3,000
8" diameter (9"L - FL/Vic spool)	6	EA	$500	$3,000	$200	$1,200	$700	$4,200
8" diameter (3.5'L - FL/PE spool - wall pipe)	3	EA	$500	$1,500	$500	$1,500	$1,000	$3,000
8" diameter (1.5'L - PE/PE spool)	5	EA	$500	$2,500	$250	$1,250	$750	$3,750
8" diameter (1'L - PE/PE spool)	3	EA	$500	$1,500	$250	$750	$750	$2,250
8" diameter (14.5'L - FL/PE spool - wall pipe)	1	EA	$1,500	$1,500	$1,500	$1,500	$3,000	$3,000
8" diameter (10'L - PE/PE spool)	1	EA	$1,250	$1,250	$1,250	$1,250	$2,500	$2,500
8" diameter (7'L - Vic/PE spool - wall pipe)	3	EA	$1,000	$3,000	$1,000	$3,000	$2,000	$6,000
8" diameter (2.5'L - PE/PE spool)	1	EA	$500	$500	$500	$500	$1,000	$1,000
8" 90 degree bend (PE)	1	EA	$750	$750	$500	$500	$1,250	$1,250
8" 45 degree bend (PE)	3	EA	$750	$2,250	$500	$1,500	$1,250	$3,750
4" diameter Pipe (drain to wetwell - wall pipe)	2.5	LF	$250	$625	$200	$500	$450	$1,125
15065 Stainless Steel Pipe								
Sump Pump Piping and Fittings	1	LS					$5,000	$5,000
Vent Piping	1	LS					$7,500	$7,500
15069 Reinforced Concrete Pipe								
36" Ø RCP (w/ T-Lock)	92	LF	240	$22,080	300	$27,600	540	$49,680
48" Ø RCP (w/ T-Lock)	226	LF	300	$67,800	400	$90,400	700	$158,200
15070 Miscellaneous Piping Specialties								
15090 Pipe Support Systems								

Antioch and Bridgehead Pump Station and Conveyance System Improvements - Phase II
APS Improvements - Preliminary Level Construction Cost Estimate

Description	Quantity		Material Cost		Labor Cost		Total Cost	
	Number	Unit	Unit Cost	Total[2]	Unit Cost	Total	Unit Cost	Total
Pipe Supports	1	LS					$25,000	$25,000
15100 Valves, General								
(included in other sections)								
15101 Valve Operators								
Operators included with gates and valves								
15105 Check Valve								
Check Valve (16-inch)	4	EA	$28,500	$114,000	$5,000	$20,000	$33,500	$134,000
Check Valve (8-inch)	3	EA	$9,500	$28,500	$3,500	$10,500	$13,000	$39,000
Check Valves (sump pump)	1	EA	$500	$500	$100	$100	$600	$600
15106 Ball Valves								
1/2-inch SST ball valve (Pump PGs)	11	EA	$225	$2,475	$100	$1,100	$325	$3,575
1-inch SST ball valve (Pump vent piping)	4	EA	$500	$2,000	$100	$400	$600	$2,400
15108 Knife Gate Valves								
16-inch Knife Gate Valve (Manual)	4	EA	$7,500	$30,000	$5,000	$20,000	$12,500	$50,000
15109 Plug Valves								
Plug Valve (18" manual actuator) w/handwheel	4	EA	$8,250	$33,000	$5,500	$22,000	$13,750	$55,000
Plug Valve (8" manual actuator) w/ 2" nut	4	EA	$2,000	$8,000	$1,000	$4,000	$3,000	$12,000
Plug Valve (4" SST manual) Suction Drain Piping - Dry Pit Submersible Pumps	4	EA	$2,700	$10,800	$250	$1,000	$2,950	$11,800
Plug Valve (manual) sump pump	1	EA	$500	$500	$250	$250	$750	$750
15110 Misc. Valves								
Duckbill check valve (Vault Drain)	1	EA	$1,500	$1,500	$300	$300	$1,800	$1,800
Total Division 15								**$980,505**
Divisions 16 & 17 - Electrical and Instrumentation								
General Conditions, etc.	1	LS					$15,000	$15,000
Electrical and I&C planning, workshops, shop drawings	1	LS					$25,000	$25,000
Demolition, electrical and I&C	1	LS					$20,000	$20,000
Electrical sequencing and temporary provisions	1	LS					$25,000	$25,000
Temporary Generator (500 KW, 3 months)	1	LS					$25,000	$25,000
PG&E fees (Paid by District)								
PG&E transformer pad, underground infrastructure	1	LS					$15,000	$15,000
Bollards	6	EA					$500	$3,000
SE-1, materials and installation	1	EA					$150,000	$150,000
SE-1, fiberglass enclosure	1	EA					$15,000	$15,000
ATS, materials and installation	1	EA					$100,000	$100,000
SWBD-A, materials and installation	1	EA					$75,000	$75,000
MCC-1, materials and installation	1	EA					$100,000	$100,000
MCC-2, materials and installation	1	EA					$80,000	$80,000
300-hp VFD's	4	EA					$50,000	$200,000
Pump/motor monitoring provisions	1	LS					$20,000	$20,000
Electrical in support of standby generator	1	LS					$10,000	$10,000
Power panelboards	2	EA					$1,500	$3,000
480-volt feeders	1	LS					$30,000	$30,000
Branch circuits	1	LS					$15,000	$15,000
Lighting, inside	1	LS					$6,000	$6,000
Lighting, outside	1	LS					$5,000	$5,000
HVAC and fan feeders	1	LS					$2,000	$2,000
PLC control panel, including hardwired logic	1	EA					$60,000	$60,000
Programming, factory testing	1	LS					$40,000	$40,000
Modifications to supervisory system	1	LS					$10,000	$10,000
Field startup and testing support	1	LS					$40,000	$40,000
Level control panel	1	EA					$20,000	$20,000
Hardwired backup system	1	LS					$10,000	$10,000
Flowmeter (Replace Existing on AFM101 in vault)	1	EA	$10,000	$10,000	$15,000	$15,000	$25,000	$25,000
Pressure transmitters with seals	6	EA					$1,000	$6,000
Other instruments	1	LS					$10,000	$10,000
Gas detection	1	LS					$25,000	$25,000
Intrusion alarm system	1	LS					$5,000	$5,000
Fire alarm system	1	LS					$5,000	$5,000
Spare parts	1	LS					$15,000	$15,000
Electrical (Additional for Grinder Structure)	1	LS					$50,000	$50,000
I&C (Additional for Grinder Structure) Some costs included elsewhere	1	LS					$30,000	$30,000
Unlisted	1	LS					$15,000	$15,000
Subtotal Divisions 16 & 17								$1,305,000
Electrical Markup on Equipment (4%)								$52,200
Electrical Markup on I&C Sub (4%)								$52,200

Antioch and Bridgehead Pump Station and Conveyance System Improvements - Phase II APS Improvements - Preliminary Level Construction Cost Estimate								
Description	Quantity		Material Cost		Labor Cost		Total Cost	
	Number	Unit	Unit Cost	Total[2]	Unit Cost	Total	Unit Cost	Total
Total Divisions 16 & 17								**$1,409,400**
Subtotal								$9,440,035
Bond, Insurance, Overheard, & Profit (18%)								$1,699,206
Contingencies (30%)								$2,832,010
Total Cost (2021$s) [2]								$13,971,252
Total Cost (Escalated to Time of Construction)[1,2]								$15,724,767
Total Cost (Escalated to Time of Construction) (Rounded)[1,2,4]								$15,725,000

[1] Costs are escalated to Year 2025 (mid-point of construction). Escalation at 3% per year. The construction cost estimating methodology used to prepare this estimate is consistent with what has been used in the past, which is to start with estimated materials and labor pricing for purchases now, with escalation added to account for nominal price increases to the time of actual purchase and delivery. This methodology remains sound, except the **District should add bottom-line adjustments to account for current bidding climate/inflation.** For long duration projects, pricing at all levels of the Contractors' organizations are subject to factors applied to account for uncertainties in future availability and cost of materials and labor. Due to current uncertainty volatility is high. The current bidding climate is seeing bids coming in significantly higher than the Engineer's Estimate.

[2]Estimated cost is for the contractor's bid price only. Cost does not include any costs associated with Engineering Services During Construction, construction management, District staff time, special inspections and testing, construction related costs outside of the Contractor's work, etc.

[3]Material Cost includes Tax

[4]Estimated savings if not install grinders is $200,000 plus markups = $340,000 off total construction cost.

[5]Bypass pumping assumes 4 months (PDWF (APS+BHPS flows)). Estimate provided by Rain for Rent. $672,000 of estimate is contributed to 2 person 24/7 pump watch.

[6]Bypass pumping assumes 6 months (PDWF (APS flows only)). Estimate provided by Rain for Rent. $1,008,000 of estimate is contributed to 2 person 24/7 pump watch.