REQUEST FOR PROPOSALS
FOR CONSULTING ENGINEERING SERVICES

BALL PUMP STATION PHASE I REHABILITATION
CASTLE HILL PUMP STATION REPLACEMENT

ECWA Project No. 202000046

General

The Erie County Water Authority (Authority) is seeking Professional Services Proposals for consulting engineering services for rehabilitation of the Ball Pump Station and the replacement of the Castle Hill Pump Station.

The Authority reserves the right to modify or cancel this Request for Proposals and/or the projects; to reject any or all proposals; and to waive any or all irregularities. This Request for Proposals does not obligate the Authority to award a contract for any of the projects or to reimburse any costs associated with the preparation of any proposal.

The Request for Proposal (RFP) is being conducted pursuant to the New York State Finance Law §§139-j and 139-k and the Erie County Water Authority's Procurement Disclosure Policy. The Procurement Disclosure Policy is available by accessing the Erie County Water Authority's web site – http://www.ecwa.org, under the caption "Doing Business with ECWA".

Project Description

The projects consist of engineering services for the design and construction of improvements at the Ball Pump Station and Castle Hill Pump Station. The work will be performed through multiple projects under two separate contracts. The consultant may submit a proposal for either or both projects.

A. Project A - Ball Pump Station Phase I Rehabilitation

The Richard F. Ball Pumping Station and Ground Storage Tanks are located along Sweet Home Road adjacent to the SUNY at Buffalo North Campus in the Town of Amherst, New York and were built in the mid 1970's. The site is between 6 and 7 acres and contains the pump station, two ground storage tanks, associated yard piping and an electrical substation. The Van de Water Treatment Plant in the Town of Tonawanda pumps finished water to the two storage tanks at the pump station. The tanks supply water to five pumps in the pump station which range in size from 700 HP to 1,500 HP.

The Authority recently completed a capital improvement plan for the Ball Pump Station. A copy of the Capital Improvement Plan Report, dated February 2020, is included as Attachment 1.

The current firm capacity of the pump station is 71 MGD, with the largest pump out of service. Pumps 1, 2, and 3 are constant speed pumps that do not provide the Authority with the operational flexibility that is provided by Pumps 4 and 5, which are equipped with variable

frequency drives (VFDs). The larger capacity, constant speed pumps, are typically used during periods of high system demand and will often sit idle for several years. The pump station has space available to install three additional pumps. Newer, more efficient, properly sized pumps will provide greater operational flexibility to the Authority.

This project has three main components: Pump System Improvements, Yard Piping Improvements, and HVAC System/Miscellaneous Improvements. Pump system improvements include, but are not limited to, the following:

- Replace all five pumps with new 1,000 – 1,250 HP horizontal split-case pumps (all of similar capacity) equipped with VFDs to expand preferred operating ranges and improve operations and maintenance activities.
- Design pump station to meet a current firm capacity of 71 MGD that is expandable to 82.5 MGD by the addition of a sixth pump.
- New conditioned room to protect VFDs from ambient temperature and humidity fluctuations.
- Replacement of pump suction and discharge piping in between isolation butterfly valves.
- New cushioned check valves for each pump.
- Surge relief system improvements.
- All electrical equipment (power, cable, conduit, etc.) associated with the replacement pumps and VFDs
- SCADA integration associated with the replacement pumps and VFDs

Yard Piping Improvements include, but are not limited to (refer to Figure 1 [Attachment 2] – Site Piping Plan, as developed by Arcadis, for a general proposed piping layout):

- Replacement of the buried 48-inch and 54-inch piping between the two water storage tanks (North and South), west of the pump station building.
- Replacement of sections of the buried 60-inch inlet pipe located south of the pump station building with 48-inch piping and an additional parallel 48-inch pipe to provide redundancy.
- Addition of a parallel main and other piping improvements to remove a single point of failure of the current 48-inch transmission main east of the pump station building.
- Replacement of the piping associated with the venturi meters, located east of the pump station building.
- All new piping shall be installed to a depth to be directly supported on competent rock (approximate depth of 580). Average grade elevation around the Ball Pump Station is 600.
- Location of tie-in points, pipe fittings, pipe alignments, and pipe diameters shall be confirmed by the Consultant during basis of design.

HVAC System and Miscellaneous Improvements component includes, but is not limited to:

- Replacement of gas unit heaters, exhaust fan components, and other outdated HVAC components
- New 2-inch water supply line within the pump station building
- Replacement of sump pumps within the three Venturi pits
- New instrumentation conduit between the pump station and the three Venturi pits
- Replacement of the existing sanitary sewer service lateral

- New access man-door on the east side of the building near Pump 1
- New electrical, PLC, and associated controls (SCADA) for the pumps and HVAC

The Ball Pump Station is a critical pump station and during pump replacement and yard piping improvements the pump station must remain in service. This may be accomplished by bypass pumping or by construction sequencing and equipment/piping isolation in a manner that allows the pump station to provide water service.

Project A Completion Schedule (Tasks 1-6 detailed under Scope of Work below):

- Task 1 Basis of Design: 180 days from the date of the Signed Agreement
  - Task is complete when the Final Basis of Design Report is submitted to the Authority
- Task 2 Design Documents: 270 days from the date of submittal of Final Basis of Design Report
  - Task is complete when Bid Documents are submitted to the Authority

B. Project B - Castle Hill Pump Station Replacement

The Castle Hill Pump Station was recently acquired by the Authority from the Town of Aurora in 2019. The pump station was built around 1990 to serve residences within the Village of East Aurora (Village) and portions of the Town of Aurora. The pump station currently provides water to about 220 residents. The pump station consists of a below-grade precast concrete structure that houses four pumps, electrical panels, and associated valves and piping. The pump station houses three 20-25 HP duty pumps and one 60-HP fire flow pump. Only one duty pump currently operates at a time. All pumps are constant speed resulting in limited operational flexibility as the existing pumps are oversized for the current design conditions. The pumps are approximately 15 years old and are nearing the end of their useful lives. The pump suction header is tied into the 8-inch Castle Hill Tank inlet/outlet piping. Piping within the pump station ranges in diameter from 2-inch to 8-inch.

The existing pump station does not meet the Authority's needs from an operations and maintenance perspective as it is below-grade, small and has limited clearance between equipment, has limited access, has limited ventilation, and is prone to flooding. The Authority would like a new pump station to be built separate from the existing station. The new pump station shall include an above grade section to house the pumps and electrical equipment and a below grade section to house piping and valves. It is anticipated that the new pump station would be built as a new stand-alone structure, located adjacent to the existing below-grade pump station.

The consultant is required to perform a hydraulic analysis, based on data provided by the Authority, to properly size the new station's duty and fire flow pumps.

Drawings of the existing pump station are included as Attachment 3.

This project includes, but is not limited to, the following upgrades:

- New pump building with below grade and above grade sections
- New pumps to replace the existing four pumps

- VFDs for the new pumps
- New PLC and control logic to operate the new pumps
- New piping, valves, and flow meter
- Investigation of existing electrical service and its ability to meet the new pump station's service requirements
- New electrical equipment associated with the new pump station
- New HVAC equipment associated with the new pump station
- Paving, grading, and drainage associated with the new pump station building

The Castle Hill Pump Station must remain in service during the pump station replacement . This may be accomplished by bypass pumping or by construction sequencing and equipment/piping isolation in a manner that allows the pump station to provide water service.

Project B Completion Schedule (Tasks 1-6 detailed under Scope of Work below):

- Task 1 Basis of Design: 90 days from the date of the Signed Agreement
    - Task is complete when the Final Basis of Design Report is submitted to the Authority
- Task 2 Design Documents: 180 days from the date of submittal of Final Basis of Design Report
    - Task is complete when Bid Documents are submitted to the Authority

Scope of Work

The design work is scheduled to commence in 2020 with construction beginning in 2021-2022 for each project.

The general scopes of work are summarized below. The methods of payment shall be per the Authority standard form of Professional Services Contract, a copy of which is available upon request. The scope of work for this project shall be as follows.

Task 1 - Basis of Design

This task of the project will be to complete the basis of design documents for each project, including:

1. Review reports, plans, specifications, operation manuals and other records furnished by the Authority.
    a) Conduct project kickoff meeting with Authority personnel and provide associated meeting minutes. Provide meeting minutes to the Authority within 5 business days of the meeting date.
2. Verify site conditions.
3. Prepare preliminary design documents for the pump station improvements. Preliminary design documents shall include:
    a) Final design criteria including but not limited to equipment selection, pump capacity, and hydraulics analysis.
        - The desktop hydraulic analysis will be performed based on information and data provided by the Authority for present and future demand conditions.

b) Preliminary drawings including:
   - Process Flow Diagram
   - Process and Instrumentation Drawing
   - Plan view of pump station
   - Elevations/Sections/Details required to relay the design intent

c) Equipment/motor list for all electrical equipment. Identify code compliance requirements for electrical components.
d) Control narrative for operation and monitoring of the system.
e) List of required technical specifications for final design.
f) Construction sequencing (maintenance of pumping operations).
g) Opinion of probable project costs.
h) Project schedule identifying the duration of final design, bid, and construction phases.

4. Identify locations of suspected hazardous materials (lead paint, asbestos, etc.) or concerning environmental conditions, based on known/assumed age and type of construction of the pump station. The pipe insulation contains asbestos. Material sampling and testing is considered as a Special Service when authorized under Task 7 below.
5. Preparation of Basis of Design Report, including the information listed above. Provide four (4) copies of the report package along with a digital .pdf file.
6. Conduct a review meeting with the Authority on the Basis of Design Report and incorporate all comments into a final version. Provide up to ten (10) copies of the final report package along with a digital .pdf file.

Task 2 – Design Documents

This task of the project will be to complete design documents for the each project. The work under this task shall include:

1. Obtain field topographic survey data for the preparation of construction plans required for final design of the project. Survey data is to be according to NAD83 and NGVD29 standards.
   a) In addition to the field topographic survey, provide a site boundary survey to confirm property lines and property corners for Project B (Castle Hill Pump Station Replacement).
2. Visit the site as needed to assist in preparing the drawings and specifications
3. Prepare detailed design drawings, specifications and contract documents at 60%, 90%, and 100% design stages. Tasks include, but are not limited to:
   b) Meetings with Authority engineers and operators (minimum of three meetings) and providing associated meeting minutes for each meeting. Provide meeting minutes to the Authority within 5 business days of the meeting date.
   c) Conferences with the Authority, regulatory agencies, etc.
   d) Review of available drawings and records furnished by the Authority
   e) Preparation of base drawings in AutoCAD version 2014 from the survey data obtained in the survey phase and the available records furnished by the Authority.

f) Preparation of engineering calculations to support the design of the improvements, including related civil, mechanical, electrical/instrumentation, structural, and architectural features of the project.
g) Submission of the plans to various utility companies and regulatory agencies as required.
h) Preparation of final plans, profiles, and job specific detail drawings that include editing of the Authority's standard detail drawings where appropriate.
    i. Preparation of a Process Flow schematic for the upgraded pump station.
    ii. Preparation of Process and Instrumentation diagrams for the upgraded pump station.
    iii. Preparation of control descriptions and PLC system for the upgraded pump station.
i) Preparation of contract specifications that include editing of the Authority's standard "front end" specifications and standard technical specifications where appropriate and preparation of additional technical specifications as required.
    - Including a Maintenance of Pumping Operations specification.
j) Obtaining New York State Wage Rates and inserting them into the specifications.
k) Preparation of a quantity take-off and opinion of probable construction cost.
l) Submission of the Task 1 Basis of Design Report with contract specifications, drawings, application forms and fees to Erie County Health Department for approval.

4. Furnish to the Authority four (4) hardcopy sets of review copies of the drawings, specifications and other contract documents, to the Authority during 60%, 90%, and 100% design. Provide digital .pdf file version of each set of documents.
5. Prepare documentation for compliance with New York State SEQR (Type II actions) and SWPPP (as applicable).
6. Assist Authority in filing applications for permits with applicable regulatory agencies, having jurisdiction to review and approve the design; assist Authority in consultations with such agencies; and revise the drawings and specifications in response to directives from such agencies, as appropriate. Submit final copies of the revised report, drawings, and specifications to the appropriate regulatory agencies.
7. Assist Authority in assembling known reports and drawings of existing conditions, and identifying the technical data contained in such reports and drawings upon which bidders may rely.

Task 3 - General Services

This task of the project will be to complete bidding and construction services for each project. The work under this task shall include:

Bidding Services

1. Furnish twenty (20) sets of final construction documents (contract drawings, final specifications, and other documents) required for bidding and construction purposes. Furnish digital .pdf file of final construction documents.
2. Conduct a pre-bid meeting and distribute minutes, when appropriate.
3. Prepare and distribute addenda as required to clarify, correct, or change the issued documents.

4. If the contract documents require, the Engineer shall evaluate and determine the acceptability of "or equals" and substitute materials and equipment proposed by prospective contractors, prior to award of contracts for the work.
5. Provide assistance to the Authority in securing bids, tabulating bid results, analyzing bid results, and making recommendations on the award of each construction contract.

Construction Services

1. Conduct a pre-construction meeting and distribute minutes.
2. Supply an approved contractor's schedule for construction of the project.
3. Receive, review, and determine the acceptability of any and all schedules that the Contractor is required to submit to Engineer, including: Progress Schedule, Schedule of Submittals, and Schedule of Values.
4. Provide detailed initial stakeout (once only), including bench marks, reference and axis lines along the routes of the construction or where necessary.
5. Give consultation and advice to the Authority during construction.
6. Prepare elementary sketches and supplementary sketches, if required, to resolve actual field conditions encountered.
7. Interpret contract documents and resolve problems as to amount, quality, acceptability, and fitness.
8. Review the contractor's submittals of material and/or equipment for compliance with the Consultant's design concept and take appropriate action such as but not limited to: "approved", "approved as corrected", "revise and resubmit"; or "not approved".
9. Schedule and attend progress meetings at a minimum every two (2) weeks.
10. Report to the Authority monthly on the progress of the work with a written monthly summary including daily inspector reports.
11. Defective Work: Reject Work if, on the basis of Engineer's observations, Engineer believes that such Work is defective under the terms and standards set forth in the Contract Documents. Provide recommendations to Authority regarding whether Contractor should correct such Work or remove and replace such Work, or whether Authority should consider accepting such Work as provided in the Contract Documents.
12. Compatibility with Design Concept: If Engineer has express knowledge that a specific part of the Work that is not defective under the terms and standards set forth in the Contract Documents is nonetheless not compatible with the design concept of the completed Project as a functioning whole, then inform Authority of such incompatibility, and provide recommendations for addressing such Work.
13. Clarifications and Interpretations: Accept from Contractor and Authority submittal of all matters in question concerning the requirements of the Contract Documents (requests for information or interpretation - RFIs), or relating to the acceptability of the Work under the Contract Documents. With reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents.
14. Differing Site Conditions: Respond to any notice from Contractor of differing site conditions, including conditions relating to underground facilities such as utilities, and hazardous environmental conditions. Promptly conduct reviews and prepare findings, conclusions, and recommendations for Owner's use.
15. Substitutes and "Or-equal": Evaluate and determine the acceptability of substitute or "or-equal" materials and equipment proposed by Contractor.

16. Change Orders: Notify the Authority when a change in the work is proposed which will cause an adjustment in the contract cost. Evaluate whether the proposed change is justified and reasonable, and if necessary prepare change orders, field directives, and make recommendations for approval. Discuss changes in the plans or procedures authorized by the Consultant with the Authority prior to implementation. Obtain approval for all change orders from the Board of Commissioners prior to implementation.
17. Change Proposals and Claims: (a) Review and respond to Change Proposals. Review each submitted Change Proposal from Contractor and either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to the Authority and Contractor. If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer will not resolve the Change Proposal. (b) Provide information or data to Authority regarding engineering or technical matters pertaining to Claims.
18. Applications for Payment: Based on Engineer's observations and on review of Applications for Payment and accompanying supporting documentation:
    a) Determine the amounts that Engineer recommends Contractor be paid. Recommend reductions in payment based on the provisions stated in the Construction Contract. Such recommendations of payment will be in writing and will constitute Engineer's representation to Authority, based on such observations and review, that, to the best of Engineer's knowledge, information and belief, Contractor's Work has progressed to the point indicated, the Work is generally in accordance with the Construction Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, and to any other qualifications stated in the recommendation), and the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work. In the case of unit price Work, Engineer's recommendations of payment will include final determinations of quantities and classifications of the Work (subject to any subsequent adjustments allowed by the Contract Documents).
19. Contractor's Completion Documents: Receive from Contractor, review, and transmit to Owner maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance required by the Contract Documents, certificates of inspection, tests and approvals, and Shop Drawings, Samples, and other data as required. Receive from Contractor, review, and transmit to Authority the annotated record documents which are to be assembled by Contractor in accordance with the Construction Contract Documents to obtain final payment.
20. Substantial Completion: Promptly after notice from Contractor that Contractor considers the entire Work ready for its intended use, in company with Authority and Contractor, visit the Site to review the Work and determine the status of completion. Follow the procedures in the Contract regarding the preliminary certificate of Substantial Completion, punch list of items to be completed, Authority's objections, notice to Contractor, and issuance of a final certificate of Substantial Completion. Assist Authority regarding any remaining engineering or technical matters affecting Authority's use or occupancy of the Work following Substantial Completion.

21. Final Notice of Acceptability of the Work: Conduct a final visit to the Project to determine if the Work is complete and acceptable so that Engineer may recommend, in writing, final payment to Contractor. Accompanying the recommendation for final payment, Engineer shall also provide a notice to Authority and Contractor that the Work is acceptable to the best of Engineer's knowledge, information, and belief, and based on the extent of the services provided by Engineer under this Agreement.
22. Standards for Certain Construction-Phase Decisions: Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth in the Contract for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Authority or Contractor, and will not be liable to Authority, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.
23. Check installation for preparation of record drawings.
24. Other Tasks: Perform or provide the following other Construction Phase tasks or deliverables:
    a) The Engineer is not responsible for the construction means, methods, techniques, sequences or procedures, time of performance, programs or for any safety precautions in connection with the construction work. The Engineer is not responsible for the Contractor's failure to execute the work in accordance with the construction Contract.
    b) Notify the Owner of all permanent work which does not conform to the result required in the Construction Contract, prepare a written report describing any apparent non-conforming permanent work and make recommendations to the Owner for its correction and; at the request of the Owner have recommendations implemented by the Contractor.

Task 4 - Resident Inspection

Upon authorization from the Authority, the Consultant shall complete the following services for the each project.

1. Provide technical inspection of construction by a full-time resident engineer and/or inspectors as required, who will:
    a) Inspect all work to determine the progress, quality, quantity and conformance of the work in accordance with contract documents.
    b) Notify any affected third parties in writing prior to start of construction.
    c) Prepare daily inspector reports.
    d) Review, verify and approve requests for monthly and final payments to contractors, based on quantities of work put in place.
    e) Provide bi-weekly updates summarizing the Resident Inspection costs and projecting future Resident Inspection costs for the duration of the project.
2. For Resident Inspection services, the Consultant shall provide an hourly rate that is fully loaded (direct hourly rate, overhead and profit). Overtime premium will be paid at 50% of the Resident Inspectors' direct hourly rate. Consultant shall breakdown its direct hourly rate, its audited overhead rate for inspection services and its profit percentage.

Consultant shall provide an estimate of the number of hours for resident inspection in the proposal.

3. Once a contractor bid has been awarded, the contract will set an estimated amount and a not-to-exceed amount for Resident Inspection services. Before reaching the not-to-exceed amount for Resident Inspection, the Consultant must seek approval from the Authority's Board of Commissioners to increase the amount of the Resident Inspection based on the realistic number of hours to complete such services.

Task 5 - Record Drawings

This task of the project will be to complete record drawings and Authority program/procedure updates for each project, including:

1. Provide electronic record drawings in AutoCAD version 2014 and digital .pdf file of all completed work on a DVD or flash drive. One full size set and one half set of hard copies of these drawings shall also be provided to the Authority.
2. Submit record drawings no later than one month after final payment is recommended for approval and in accordance with Authority Standards.

Task 6 - Authority Program/Procedure Updates

1. Revise the Authority's Standard Operating Procedures (SOPs) for each pump station. Revisions shall be done in accordance with the Authority's existing format.
2. Revise the Authority's Arc Flash program for each pump station. Revisions shall be done in accordance with the Authority's existing format.
3. Revise the Authority's Lock-out Tag-out (LOTO) program documentation for each pump station. Revisions shall be done in accordance with the Authority's existing format.

Task 7 - Special Services

The Authority may require one or more of the following special services in carrying out the project.

1. Soils/Geotechnical Investigations - including test borings, pavement cores, and the related analysis.
2. Detailed mill, shop and/or laboratory inspection of materials and equipment.
3. Land surveys, maps, plates, descriptions and title investigations which may be required to acquire lands, easements, and rights-of-way for the proposed facilities.
4. Additional copies of reports, contract drawings and documents.
5. Extra travel and subsistence for the Consultant and his staff beyond that normally required under ordinary circumstances, when authorized by the Authority.
6. Assistance to the Authority serving as an expert witness in litigation arising from project development or construction.
7. New York State SEQR (Type I and Unlisted Actions).
8. Air, water, and/or soil sampling, testing, and/or analysis.
9. Operation and maintenance manuals.

10. Start-up services.
11. Hazardous material testing and assessment.
12. Wetlands investigations, delineation, and mitigation.
13. Storm Water Pollution Prevention Plans
14. Applications for NYSDEC permitting.
15. Assistance with grant research, completion of grant applications, and reporting/documentation after award.
16. Legal services.

Progress Reporting

The Consultant shall provide the following information with regard to the progress of the work for all tasks listed above, for each project:

1. Report to the Authority bi-weekly on the progress of the work via email, with the information listed below. After the Contract is awarded, the Authority will provide a standard document for the Consultant to fill in on a bi-weekly basis.
   a) Work performed over the last two weeks.
   b) Work scheduled for the next two weeks.
   c) Schedule status/deliverable status (refer to item No. 2 below).
      i. No. of weeks behind based on original project schedule and justification for delays.
   d) Budget status/percent project complete.
   e) Input needed from ECWA or others.
   f) Upcoming meetings.
   g) Other issues/concerns.
   h) Scope changes.

2. Prepare a project schedule for the project utilizing horizontal bar chart format and 24" x 36" size paper. The project schedule shall be updated and provided to the Authority on a bi-weekly basis. Schedule shall identify all project milestones and current project status. At a minimum, the project schedule shall include:
   a) Meetings with the Authority
   b) Basis of Design
      i. Draft and Final BOD submissions
   c) Design
      i. 60%, 90%,and 100% Phases
      ii. Bid Documents complete
   d) Regulatory Agency submission/review/approval
   e) Bidding
   f) Construction
      i. Award of Contract
      ii. Construction Phase
      iii. Equipment Procurement
      iv. Substantial and Final Completion

Information Requests

All questions and requests for information are to be directed to the designated ECWA Contact Person, Clayton Johnson, PE at 716-685-8218, in accordance with New York State Finance Law §§139-j and 139-k. An optional pre-proposal meeting will be held on Tuesday, March 10, 2020 at the Ball Pump Station (1193 Sweet Home Road, Amherst, NY 14228) at 10:00 AM. local time, followed by a meeting at the Castle Hill Pump Station (179 Castle Hill Road, East Aurora, NY 14052) at 11:30 A.M. local time, to view the work locations and discuss the projects.

Proposal Requirements

Firms may submit proposals for any or all projects. Separate proposals are not required. Proposals are to be concise, specific and straightforward. All pertinent information is to be contained in the proposal. The use of artwork, special covers, and extraneous information in the proposals is discouraged. Proposals are to remain valid for a minimum of 60 days. Each proposal is to include the following:

Item 1 - Qualifications and related experience, particularly on the type of projects outlined above. Include a minimum of three references for similar work including project name, location, contact person, budget, date of completion and state the relevance to this project.

Item 2 - Project understanding, technical approach and detailed scope of services. Identify any suggested revisions to and expand upon the detail of the general scope of work as outlined herein.

Item 3 - Project staffing for all key personnel and subcontractors; current workload; and office location(s) where work will be performed for each project. Provide resumes of proposed personnel with listed experience applicable to this project. Indicate the role of proposed personnel on the projects listed under Item 1 above and identify the proposed role on this project.

Item 4 - Qualifications of resident inspector(s) including applicable education, training, experience, and NICET certification.

Item 5 - Work performed for the Water Authority in 2017, 2018, and 2019.

Item 6 - Current remaining workload with the Water Authority.

Item 7 - Completed attachment titled Section 139 of State Finance Law per attached.

Item 8 - Proof of insurance in accordance with the attached Erie County Water Authority Insurance Requirements for Professional Services per attached.

Item 9 - Proposed project schedule, showing preliminary design through construction completion.

Item 10 - Fee proposal which is to include a breakdown of engineering fees for each task showing personnel, hours, hourly rates, overhead rates, and subcontractor costs for each task. A separate fee table shall be provided for each project (Ball Pump Station and Castle Hill Pump Station). All consultants shall include Special Services lump sum costs for the purposes of this proposal.

Proposals shall include the following forms, for each project (Ball Pump Station and Castle Hill Pump Station) separately, for comparison purposes:

Project 202000046 – RFP Ball Pump Station Phase I Rehabilitation	
Task 1 - Basis of Design Report	**$**
Task 2 – Design Documents	**$**
Task 3 - General Services	**$**
Task 4 - Resident Inspection	**$**
Task 5 - Record Drawings	**$**
Task 6 – Authority Program/Procedure Updates	**$**
Task 7 - Special Services	**$ 50,000.00**
TOTAL:	**$**

Project 202000046 – RFP Castle Hill Pump Station Replacement	
Task 1 - Basis of Design Report	**$**
Task 2 – Design Documents	**$**
Task 3 - General Services	**$**
Task 4 - Resident Inspection	**$**
Task 5 - Record Drawings	**$**
Task 6 – Authority Program/Procedure Updates	**$**
Task 7 - Special Services	**$ 20,000.00**
TOTAL:	**$**

Proposals will be accepted until 4:00 p.m. on May 1, 2020. Five hard copies of the proposal and one digital .pdf file (on a USB flash drive) are to be delivered to Erie County Water Authority, 3030 Union Road, Cheektowaga, New York 14227 to the attention of Mr. Leonard F. Kowalski, PE, Executive Engineer. Proposals received after this time will not be considered and will be returned unopened. All proposals being mailed (including Federal Express, UPS, Priority Mail, etc.) or hand delivered shall be directed to the attention of Mr. Kowalski in a sealed envelope and be clearly marked on the outside of the mailing or hand delivered envelope as follows: "PROPOSAL – BALL PUMP STATION PHASE I REHABILITATION and CASTLE HILL PUMP STATION REPLACEMENT".

Evaluation and Selection

All proposals will be evaluated by a small in-house committee made up of Water Authority personnel familiar with the proposed project. Interviews and/or presentations of the proposals will be requested if needed. The proposals will be evaluated based on the criteria listed above. The final scope of work and fee for the engineering services for the project will be negotiated with the selected firm(s). Professional Service Contracts will then be executed pending successful negotiation and authorization by the Water Authority Board of Commissioners. All firms submitting proposals will be notified of the selection results. It is anticipated that the selection process will be completed in May 2020, and that the agreement will be executed in June 2020.

FORMS A, B, and C

STATE FINANCE LAW REQUIREMENTS

The Erie County Water Authority (the "Authority") is a government entity, as that term is defined in State Finance Law §§ 139-j(1)(a) and 139-k(1)(a). When the Authority seeks to procure goods or services by means of an Invitation or Notice to Bid, or a Request for Proposals, the State Finance Law imposes certain restrictions on anyone who may wish to offer goods or services to the Authority as an Offerer, as that term is defined in §§ 139-j(1)(h) and 139-k(1)(h).

During the Restricted Period, as defined in §§ 139-j(1)(f) and 139-k(1)(f), when bids or proposals are being solicited, the Authority will designate a contact person with whom the Offerer may contact for information and other authorized purposes as set forth in §139-j of the State Finance Law. The designated contact is identified in the Notice to Bidders, or in the Request for Proposal. An Offerer is authorized to contact the Authority's designated contact for such purposes as set forth in § 139-j(3).

Pursuant to the State Finance Law, the Authority is also required to make certain findings before making any determinations as to the qualifications and eligibility of those seeking a procurement contract, as that term is defined in State Finance Law §§ 139-j(1)(g) and 139-k(1)(g). Certain findings of non-responsibility can result in rejection for contract award and in the event of two findings of non-responsibility occurring within a 4-year period, the Offerer will be debarred from obtaining procurement contracts with the Authority. Further information about these requirements can be found in §§139−j and 139−k of the New York State Finance Law and the Erie County Water Authority's Procurement Disclosure Policy.

The following forms will be used by the Authority to make such findings:

Form A - Offerer's Affirmation of Understanding of, and Agreement to Comply with, the Authority's Permissible Contact Requirements During the Restricted Period.

Form B - Offerer's Certification of Compliance with State Finance Law.

Form C - Offerer's Disclosure of Prior Non-Responsibility Determinations.

FORM A

Offerer's Affirmation of Understanding of, and Agreement to Comply with, the Permissible Contact Requirements During the Restricted Period

Instructions:

The Erie County Water Authority (the "Authority") is a government entity, as that term is defined in State Finance Law §§ 139-j(1)(a) and 139-k(1)(a). The Authority must obtain a written affirmation of understanding and agreement to comply with procedures regarding permissible contacts with the Authority in the restricted period for a procurement contract in accordance with State Finance Law §139−j and §139−k. It is required that this affirmation be obtained as early as possible in the procurement process, but no later than when the Offerer submits its proposal.

Offerer affirms that it understands and agrees to comply with the procedures of the Authority relative to permissible contacts as required by State Finance Law §139−j(3) and §139−j(6)(b).

By: _____ Date: _____

Name: _____

Title: _____

Contractor Name: _____

Contractor Address: _____

_____

_____

FORM B

Offerer's Certification of Compliance
With State Finance Law §139−k(5)

Instructions:

The Erie County Water Authority (the "Authority") is a government entity, as that term is defined in State Finance Law §§ 139-j(1)(a) and 139-k(1)(a). The Authority must obtain a Certification that the information submitted for a procurement contract is complete, true, and accurate regarding any prior findings of non-responsibility, such as non-responsibility pursuant to State Finance Law §139−j. The Offerer must agree to sign the Certification, under penalty of perjury, and to provide the Certification to the Authority. The Certification should be obtained as early as possible in the process, but no later than when an Offerer submits its proposal.

Offerer Certification:

I certify that all information provided to the Authority relating to the awarding of a procurement contract is complete, true, and accurate.

By: _____ Date: _____

Name: _____

Title: _____

Contractor Name: _____

Contractor Address: _____

_____

_____

FORM C

Offerer's Disclosure of Prior Non-Responsibility Determinations

Background:

The Erie County Water Authority (the "Authority") is a government entity, as that term is defined in State Finance Law §§ 139-j(1)(a) and 139-k(1)(a). New York State Finance Law §139−k(2) obligates the Authority to obtain specific information regarding prior non-responsibility determinations with respect to State Finance Law §139−j. In accordance with State Finance Law §139−k, an Offerer must be asked to disclose whether there has been a finding of non-responsibility made within the previous four (4) years by any Governmental Entity due to: (a) a violation of State Finance Law §139−j; or (b) the intentional provision of false or incomplete information to a Government Entity.

The terms "Offerer" and "Governmental Entity" are defined in State Finance Law §§139−j(1). and §139−k(1), These sections also set forth detailed requirements about the restrictions on contacts during the procurement process. A violation of State Finance Law §139−j includes, but is not limited to, an impermissible contact during the restricted period (for example, contacting a person or entity other than the designated contact person, when such contact does not fall within one of the exemptions).

As part of its responsibility determination, State Finance Law §139−k(3) mandates consideration of whether an Offerer fails to timely disclose accurate or complete information regarding the above non-responsibility determination. In accordance with law, no Procurement Contract shall be awarded to any Offerer that fails to timely disclose accurate or complete information under this section, unless a finding is made that the award of the Procurement Contract to the Offerer is necessary to protect public property or public health safety, and the Offerer is the only source capable of supplying the required Article of Procurement, as that term is defined in State Finance Law §§ 139-j(1)(b) and 139-k(1)(b), within the necessary timeframe. See State Finance Law §139−j(10)(b) and §139−k(3).

Instructions:

The Authority must include a disclosure request regarding prior non-responsibility determinations in accordance with State Finance Law §139−k in its solicitation of proposals or bid documents or specifications or contract documents, as applicable, for procurement contracts. The attached form is to be completed and submitted by the individual or entity seeking to enter into a Procurement Contract. It shall be submitted to the Authority conducting the Governmental Procurement no later than when the Offerer submits its proposal.

FORM C (Continued)

Offerer's Disclosure of Prior Non-Responsibility Determinations

Name of Individual or Entity Seeking to Enter into the Procurement Contract:

_____

Address: _____

_____

Name and Title of Person Submitting this Form: _____

_____

Contract Procurement Number: _____

Date: _____

1. Has any Governmental Entity made a finding of non-responsibility regarding the individual or entity seeking to enter into the Procurement Contract in the previous four years? (Please circle): No Yes

   If yes, please answer the next questions:

2. Was the basis for the finding of non-responsibility due to a violation of State Finance Law §139−j (Please circle): No Yes

3. Was the basis for the finding of non-responsibility due to the intentional provision of false or incomplete information to a Governmental Entity? (Please circle) No Yes

4. If you answered yes to any of the above questions, please provide details regarding the finding of non-responsibility below.

Governmental Entity: _____

Date of Finding of Non-Responsibility: _____

Basis of Finding of Non-Responsibility: _____

_____

_____

_____

_____

_____

(Add additional pages as necessary)

FORM C (Continued)

5. Has any Governmental Entity or other governmental agency terminated or withheld a Procurement Contract with the above-named individual or entity due to the intentional provision of false or incomplete information? (Please circle): No Yes

6. If yes, please provide details below.
   Governmental Entity: _____

   Date of Termination or Withholding of Contract: _____

   Basis of Termination or Withholding:
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   (Add additional pages as necessary)

Offerer certifies that all information provided to the Erie County Water Authority with respect to State Finance Law §139−k is complete, true, and accurate.

By: _____ Date: _____
Signature

Name: _____

Title: _____

CONTRACT TERMINATION PROVISION

Instructions:

A Contract Termination Provision will be included in each procurement contract governed by State Finance Law §139−k. New York State Finance Law §139-k(5) provides that every procurement contract award subject to the provisions of State Finance Law §§139−k and 139−j shall contain a provision authorizing the governmental entity to terminate the contract in the event that the certification is found to be intentionally false or intentionally incomplete. This statutory contract language authorizes, but does not mandate, termination. "Government Entity" and "procurement contract" are defined in State Finance Law §§ 139 j(1) and 139−k(l).

This required clause will be included in a covered procurement contract.

A sample of the Termination Provision is included below. If a contract is terminated in accordance with State Finance Law §139−k(5), the Erie County Water Authority, as a governmental entity, is required to include a statement in the procurement record describing the basis for any action taken under the termination provision.

Sample Contract Termination Provision

The Erie County Water Authority, as a governmental entity, reserves the right to terminate this contract in the event it is found that the certification filed by the Offerer in accordance with New York State Finance Law §139−k was intentionally false or intentionally incomplete. Upon such finding, the Authority may exercise its termination right by providing written notification to the Offerer in accordance with the written notification terms of this contract.

SECTION 139-L OF THE STATE FINANCE LAW
STATEMENT RELATING TO SEXUAL HARASSMENT POLICY

1. "Bidder" has the same meaning as the term, "Offerer," as that terms is defined in State Finance Law § 139-k(1)(h), and includes anyone who submits a bid or proposal.

2. Every proposal or bid hereafter made and submitted to the Erie County Water Authority, where competitive bidding or a sealed proposal is required by statute, rule or regulation, for work or services performed or to be performed or goods sold or to be sold, shall contain the following statement subscribed by the Bidder and affirmed by such Bidder as true under penalty of perjury:

SEXUAL HARASSMENT BIDDING CERTIFICATION

(a) "By submission of this bid/proposal, EACH BIDDER AND EACH PERSON SIGNING ON BEHALF OF ANY BIDDER CERTIFIES, AND IN THE CASE OF A JOINT BID EACH PARTY THERETO CERTIFIES AS TO ITS OWN ORGANIZATION, under penalty of perjury, that the Bidder has and has implemented a written policy addressing sexual harassment prevention in the workplace and provides annual sexual harassment prevention training to all its employees. Such policy shall, at a minimum, meet the requirements of Section two hundred one-g of the Labor Law."

3. A bid/proposal shall not be considered for award nor shall any award be made to a Bidder who has not complied with subdivision one of this section; provided, however, that if in any case the Bidder cannot make the foregoing certification, the Bidder shall so state and shall furnish with the bid/proposal a signed statement which sets forth in detail the reasons therefore.

The undersigned CERTIFIES, under penalty of perjury, that he is authorized to make this bid/proposal and execute this statement on sexual harassment; that he is familiar with the statements contained in ¶2(a) of this document, as well as the provisions of State Finance Law §139-L and Labor Law §201-g, and such statements are true and have been complied with by the Bidder.

_____
(Name of Individual, Partnership or Corporation)

By _____
(Person authorized to sign)

(SEAL)

REQUEST FOR PROPOSALS
FOR CONSULTING ENGINEERING SERVICES

BALL PUMP STATION PHASE 1 REHABILITATION
AND CASTLE HILL PUMP STATION REPLACEMENT

ECWA PROJECT No. 202000046

Insurance Specs:

The following minimum insurance requirements shall apply to vendors providing services to the Erie County Water Authority (ECWA). If a service or project, in the opinion of ECWA, represents an unusual or exceptional risk, ECWA may establish additional insurance requirements for that service or project. All insurance required herein shall be obtained at the sole cost and expense of the contractor, including deductibles and self-insured retentions, and shall be in full force and effect on the contract commencement date and for the duration of the contract. These requirements include but are not limited to the minimum insurance requirements.

Insurance Requirements:

a. Workers Compensation:
Part 1: Workers Compensation: Statutory
Part 2: Employers Liability: $1,000,000.
Note: If New York State domiciled employees are used, coverage to be New York Statutory for both Parts 1 and 2

b. **New York Disability Benefits Liability:** Statutory coverage if New York State domiciled employees are used.

c. Commercial General Liability:
- $2,000,000. General Aggregate
- $2,000,000. Products/Completed Operations Aggregate
- $1,000,000. Each Occurrence
- $1,000,000. Personal Injury/Advertising Liability
- Erie County Water Authority to be scheduled as an Additional Insured for both on-going and completed operations (attach Additional Insured endorsement to Certificate of Insurance)
- Insurance to be primary and non-contributory

d. Automobile Liability:
- $1,000,000. Each Accident
- Erie County Water Authority to be scheduled as an Additional Insured.

e. Umbrella Liability:
- $1,000,000. Each Occurrence
- $1,000,000. Aggregate

- Erie County Water Authority to be scheduled as an Additional Insured

f. Professional Liability

- $2,000,000 Per Claim
- $2,000,000 Aggregate

Certificates of Insurance to be provided to **ECWA** prior to start of work as follows:

ACORD 25 including copy of Additional Insured Endorsement Note: If coverage provided for NYS domiciled employees require Forms C 105.2 and DB 120.1 for Workers Compensation and NYS DBL.

Certificates of Insurance, on forms approved by the New York State Department of Insurance, must be submitted to ECWA prior to the award of contract. Renewals of Certificates of Insurance, on forms approved by the New York State Department of Insurance, must be received by ECWA 30 days prior to the expiration of the insurance policy period.

Certificates of Insurance and renewals, on forms approved by the New York State Department of Insurance, must be submitted to ECWA prior to the award of contract. Each insurance carrier issuing a Certificate of Insurance shall be rated by A. M. Best no lower than "A-" with a Financial Strength Code (FSC) of at least VII. The professional service provider shall name ECWA, its officers, agents and employees as additional insured on a Primary and Non-Contributory Basis, including a Waiver of Subrogation endorsement (form CG 20 26 11 85 or equivalent), on all applicable liability policies. Any liability coverage on a "claims made" basis should be designated as such on the Certificate of Insurance. Such insurance shall continue through the term of this Agreement and vendor shall purchase at his sole expense either 1) an Extended Reporting Endorsement (also, known as Tail Coverage); or 2) Prior Acts Coverage from new insurer with a retroactive date back to the date of, or prior to, the inception of this Agreement; or 3) demonstrate through Certificates of Insurance that vendor has Maintained continuous coverage with the same or original insurer. Coverage provided under items; 1), 2), or 3) will continue as long as the law allows.

To avoid confusion with similar insurance company names and to properly identify the insurance company, please make sure that the insurer's National Association of Insurance Commissioners (N.A.I.C.) identifying number or A. M. Best identifying number appears on the Certificate of Insurance. Also, at the top of the Certificate of Insurance, please list the project number.

Acceptance of a Certificate of Insurance and/or approval by ECWA shall not be construed to relieve the outside vendor of any obligations, responsibilities or liabilities.

Certificates of Insurance should be e-mailed to mmusarra@ecwa.org or mailed to Ms. Molly Jo Musarra, ECWA Claim Representative/Risk Manager Erie County Water Authority, 295 Main Street – Room 350, Buffalo, New York 14203-2494, or If you have any questions you can contact Ms. Musarra by e-mail or phone (716) 849-8465.

ARCADIS Design & Consultancy for natural and built assets

Erie County Water Authority

CAPITAL IMPROVEMENT PLAN
BALL PUMP STATION

February 2020

CAPITAL IMPROVEMENT PLAN – BALL PUMP STATION

Prepared for:

Erie County Water Authority

295 Main Street, Room 350

Buffalo, New York 14203

Prepared by:

Arcadis of New York, Inc.

50 Fountain Plaza

Suite 600

Buffalo, NY 14202

Tel 716 667 0900

Fax 716 842 2612

Our Ref.:

00041053.MP80

Date:

February 2020

Table of Contents

TABLES

FIGURES

APPENDICES

ACRONYMS AND ABBREVIATIONS

AACE	Association for the Advancement of Cost Engineering
AOR	Allowable Operating Range
BEP	Best Efficiency Point
BRE	Business Risk Exposure
CIP	Capital Improvement Plan
ECWA	Erie County Water Authority
Ft	Feet
Hp	Horsepower
HVAC	Heating, Ventilation, and Air Conditioning
MGD	Million Gallons per Day
NPV	Net Present Value
O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
POR	Preferred Operating Range
RFP	Request for Proposals
ROI	Return on Investment
RPM	Revolutions per Minute
TBL	Triple Bottom Line
VFD	Variable Frequency Drive

EXECUTIVE SUMMARY

The Erie County Water Authority's (ECWA) Richard F. Ball Pumping Station and Ground Storage Tanks (Ball Pump Station) was constructed in the 1970's and put into service upon the completion of the Van de Water Treatment Plant and the 48-inch transmission mains that supply water from Van de Water Treatment Plant to Ball Pump Station. This Capital Improvement Plan (CIP) presents a proposed fifteen-year plan to assist ECWA in securing adequate investments and funding for sustaining its obligations to the public and environment.

Over 164 assets were identified, inventoried and assessed. Overall, the evaluation revealed that the Ball Pump Station facility is in relatively good condition with 76 percent of the assets having physical condition ratings of 1 (excellent) to 2 (good), and 96 percent having process condition ratings of 1 (excellent) to 3 (moderate). Figure ES-1 summarizes the total risk score of the assessed Ball Pump Station assets.

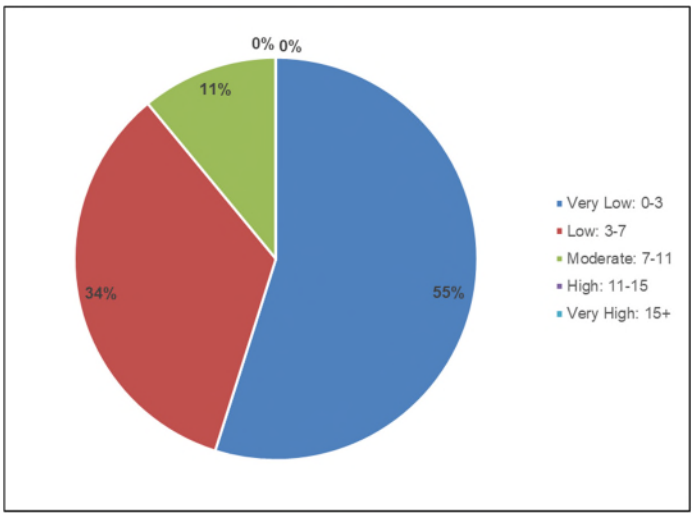


Figure ES-1: Summary of Total Risk Score

Seven projects were identified through the condition assessment activities and CIP development process. These projects, listed below, are in addition to projects that are either ongoing or in the planning stages.

1. Pumping System Improvements
2. HVAC System and Miscellaneous Improvements
3. Exterior Piping Improvements
4. Interior Piping Improvements
5. Land Acquisition and Maintenance Facility Addition
6. Building Exterior Improvements
7. Paving Improvements

Table ES-1 describes the projected cash flow of the seven CIP projects over the 15-year CIP:

Table ES-1: Projected Cash Flow Summary

Year	Years 0-5 (2025)		Years 5-10 (2030)			Years 10-15 (2035)	
	Project No. 1: Pumping System Improvements	Project No. 2: HVAC and Misc. Improvements	Project No. 3 Exterior Piping Improvements	Project No. 5: Land Acquisition and Maintenance Facility	Project No. 7 Paving Improvements	Project No. 4: Interior Piping Improvements	Project No. 6: Building Exterior Improvements
2020	$ 600,000						
2021	$ 6,120,000						
2022	$ 3,120,000						
2023	$ 1,460,000						
2024	$ 1,300,000						
2025	$ 860,000						
2026	$ 640,000		$ 610,000				
2027			$ 1,920,000				
2028			$ 2,170,000				
2029			$ 1,080,000				
2030			$ 840,000				
2031						$ 870,000	
2032						$ 2,800,000	
2033						$ 2,940,000	
2034						$ 1,320,000	
2035						$ 910,000	
Escalated Total	$ 14,100,000		$ 6,620,000			$ 8,840,000	

Note: Total estimate assumes Project 1A selected. Annual Inflation Rate = 2%.

1 INTRODUCTION AND OVERVIEW

1.1 Background and Purpose

This Capital Improvement Plan (CIP) provides ECWA with capital project identification, project prioritization, and budgetary capital expenditures for improvements to ECWA's Ball Pump Station. This CIP was jointly prepared by Arcadis of New York, Inc. (Arcadis) and ECWA personnel. The information presented in the CIP is intended to support forward-looking and proactive capital investment strategies.

This CIP report presents a formal approach for considering the long-term costs of rehabilitating and replacing water storage, and pumping assets as they age or become obsolete, because all assets eventually reach the end of their useful life where:

- Asset condition and risk of failure is unacceptable.
- Assets can no longer provide required capacity or performance.
- Assets become obsolete.
- Assets become financially inefficient to operate and maintain.

This CIP provides a sound basis for identifying and prioritizing projects, together with budgetary opinions of probable project costs and predictions of the timing and probable cost of future capital investments based on current available information. Using this information, ECWA can ensure that financial and funding plans are in place to meet the expected capital needs. In addition, this report presents valuable information that can be shared with elected officials, ECWA staff, the public, and other stakeholders. This CIP was prepared in collaboration with ECWA, building on other available information, and available financial data provided by ECWA.

The overall goals of this CIP are to:

- Support appropriate long-term planning and budgeting for capital renewal, enhancement, and growth projects.
- Provide a prioritization, preliminary schedule, and preliminary budget range for capital projects anticipated through approximately 2035.
- Support reliable, measured, and planned capital expenditures that in turn support ECWA's investment and financial policies, foster adequate user rates and funding plans, and appropriate, detailed annual cash-flow forecasts.
- Strengthen public support for proactive maintenance and capital investment practice to ensure that assets' expected lives, reliability, and regulatory performance are maintained.
- Provide a repeatable methodology and templates for preparing asset inventories, condition assessments, and capital investment planning that ECWA can update on an ongoing basis.
- Foster a dynamic and repeatable CIP process that can respond over time to ECWA's changing business needs and drivers.

This CIP presents a proposed fifteen-year plan to assist ECWA in securing adequate investments and funding for sustaining its obligations to the public and environment. This approach supports rational investment decisions and presents to stakeholders a strong case for required capital investments. This CIP is, however, a "living" document that should be revisited and updated regularly—preferably annually or biennially. Drivers such as business needs, financial considerations, regulatory requirements, asset condition, and technology trends can change rapidly and can have a significant impact on prioritization of capital expenditures.

1.2 Scope of Capital Improvement Plan

This CIP encompasses ECWA's water storage, and pumping assets at Ball Pump Station, and does not address other ECWA assets outside of the Ball Pump Station site. The CIP does not include projects that are already funded or that are currently under construction.

The following tasks were performed during the development of the Ball Pump Station CIP:

- **Inventory and Condition Assessment** – The project team developed an asset register and performed detailed site condition inspections. The condition assessment considered physical condition, performance reliability, redundancy, and the ability to meet future regulations and operating requirements.
- **Capital Project Identification and Alternatives Evaluations** – Findings from the inventory/condition assessments were used to identify a list of projects. Where applicable, high-level alternative solutions were evaluated, though more refined evaluations may be required during implementation of specific capital projects.
- **Capital Project Recommendations and Prioritization** – A series of workshops were held to understand the short- and long-term goals of the ECWA. A list of recommended projects was developed and prioritized to assist ECWA with maintaining regulatory compliance, water distribution, and/or safety.

This CIP summarizes aforementioned tasks and is prepared for use over a period of approximately 15 years, to 2035. Although this CIP focuses in part on defining projects that address currently at-risk assets and existing projects already in the planning process to formulate an initial fifteen-year CIP, future CIP updates may be based on a different timeframe, especially as future projects are evaluated and their scope and probable costs refined, as recommended in the CIP development methodology.

1.3 Report Organization

The report is organized as follows:

- **Section 1, Introduction and Overview**.
- **Section 2, Project Identification** – Describes how the list of projects presented in the CIP was identified and developed, including a discussion of the asset inventory and preliminary evaluation of assets prepared as part of the CIP's development activities.
- **Section 3, Capital Project Summary** – Presents information on and assumptions behind development of the projects' opinions of probable cost, discussion of project categories, and project prioritization.
- **Section 4, Capital Project Summary Tables** – Presents, in tabular format, summary information for planned capital projects through approximately 2035 including: general implementation schedules and preliminary opinions of probable project cost.
- **Appendices** – Presents various supporting data, tables, and information used in developing the CIP.

2 PROJECT IDENTIFICATION

2.1 Pumping Station and Ground Storage Tanks Background

Ball Pump Station is located along Sweet Home Road adjacent to the SUNY at Buffalo North Campus in the Town of Amherst, New York. The facility was constructed in the 1970's upon completion of the Van de Water Treatment Plant and the 48-inch transmission mains that supply water from Van de Water to Ball Pump Station. The pump station was sized based on significant growth in the northtowns, but the population has not expanded as expected and three large constant speed pumps are only used during periods of high demand and may sit idle for several years. A summary of the existing DeLaval pumps is provided in Table 2.1.

Table 2.1: Summary of Existing Pumps

Pump No.	Pump Type, and Size	Rated Capacity (MGD)	Rated Total Dynamic Head (ft)	Rated Motor Horsepower (hp)	Rated Motor Speed (RPM)
Pump 1	P16/14 D	12.5	255	700	1,185
Pump 2	T20/18 AD	23.0	255	1,250	890
Pump 3	T20/18 AD	28.8	255	1,500	890
Pump 4	P18/16 D	17.7	255	1,000	1,185
Pump 5	P18/16 D	17.7	255	1,000	1,185

The firm capacity of the pump station is 71 MGD, defined as the maximum pumping capacity with the largest pump out of service. Pumps 1, 2 and 3 are constant speed pumps that do not provide ECWA with the operational flexibility that they receive from Pumps 4 and 5, which are equipped with variable frequency drives (VFDs). The capacity of Pump 3 is so large that it has only been operated for a few hours over the last 20 years.

Additional items that were identified during the initial meeting site walk-through to consider as part of the CIP include the following:

- Evaluate and develop improvements for the building and ancillary equipment including new doors, interior and exterior lighting, ventilation, bridge crane upgrades and electrical controls, bathroom upgrades including sewer drain that frequently plugs, electrical equipment for HVAC and other secondary system.
- Investigate the interior and exterior piping to:
    - Replace the existing dome style access hatches on the suction piping with blind flanges.
    - Identify if the existing altitude valves are necessary and whether they should be replaced, repaired or removed.

  - Determine if the existing surge relief system is sufficient and if upgrades are necessary to adequately protect the discharge piping.
  - Replace the right-angle pump control valves with swing check valves.
  - Evaluate the pump station meter vaults. Provide new conduits to venturi meter vault No. 1. Consider options to improve meter accuracy at low and high flows.
- Evaluate options to enclose the VFD's for Pumps No. 4 and No. 5 in a conditioned environment to improve ambient air conditions surrounding the drives.

2.2 Asset Inventory and Condition Assessment

2.2.1 Methodology and Scoring Criteria

As part of the CIP preparation activities, a condition assessment of the major pumping and storage assets and the generator building, and grounds was performed. Arcadis established a hierarchy and identification standard to provide a standard naming convention for all assets that were assessed by Arcadis (Appendix A).

The condition assessment identified assets that were categorized as "at-risk" for failure, thus requiring improvement or replacement within five years. Principal evaluation criteria were the asset's physical condition and process condition, however, factors such as redundancy and likely failure mode were also considered in determining the "at-risk" assets to be included in the CIP. Arcadis visited the Ball Pump Station facility, reviewed record drawings and operation and maintenance (O&M) information, interviewed ECWA personnel, and gave scores to each asset. For each asset, scores were assigned using criteria presented in Tables 2.2 through 2.5.

Table 2.2: Physical Condition Grade – Rating Guidelines

Score	Description
1 – Excellent	Fully operable, well maintained, and consistent with current standards. Little wear shown and no further action required.
2 – Good	Sound and well maintained but may be showing slight signs of early wear. Delivering full efficiency with little or no performance deterioration. Only minor renewal or rehabilitation may be needed in the future.
3 – Moderate	Functionally sound and acceptable and showing normal signs of wear. May have minor failures or diminished efficiency and with some performance deterioration or increase in maintenance cost. Moderate renewal or rehabilitation needed.
4 – Poor	Functions but requires a high level of maintenance to remain operational. Shows abnormal wear and is likely to cause significant performance deterioration in the near term. Near term scheduled replacement or rehabilitation needed.
5 – Very Poor	Effective life exceeded and/or excessive maintenance cost incurred. A high risk of breakdown or imminent failure with serious impact on performance. No additional life expectancy with immediate replacement or rehabilitation needed.

Table 2.3: Process Condition Grade – Rating Guidelines

Score	Description
1 – Excellent	Meets all design and legal/regulatory requirements in all demand conditions – i.e., capacity exceeds maximum designed flow and adequate standby or emergency protection provided. Overall performance excellent and will likely meet expected future requirements.
2 – Good	Meets all design and legal/regulatory requirements. May have minor risk under extreme conditions Overall performance excellent will likely meet expect future requirements.
3 – Moderate	Generally meets all design requirements, but can expect some failures in performance under normal operation conditions. Current performance is acceptable to marginal but would likely not meet future additional requirements or increased demand.
4 – Poor	Has expected performance failures under normal operation conditions. Current performance is marginal and does not meet future additional requirements or increased demand.
5 – Very Poor	Current performance unacceptable and does not meet operational criterial. Recurring and expected continued failures against performance standards.

Table 2.4: Redundancy – Rating Guidelines

Score	Description
(0) No Redundancy	No system backup or redundancy. Asset failure will have immediate impact on performance, level of service, etc.
(1) Partial Redundancy	Partial redundancy exists. For example, asset failure will not have an impact during base load conditions but there is not enough redundancy to handle failure during peaks or for specific functions.
(2) Full Redundancy	Full (100% or greater) functional redundancy exists at expected peak design load level. Due to the level of redundancy, an asset failure is not expected to have an impact on performance or level of service.

Table 2.5: Most Likely Failure Mode – Rating Guidelines

Failure Modes	Definitions	Typical Drivers	Management Strategy
(P) Physical Mortality	Asset deterioration reduces performance below an acceptable level	Age, usage, operational stresses, acts of nature	Renewal, O&M, optimization
(C) Capacity	Demand exceeds design capacity	Growth and system expansion	Re-design
(L) Level of Service	Functional and reliability requirements exceed design capacity	Regulations, permit, quality, safety, client service, noise, odor	Re-design, O&M, optimization
(D) Financial Efficiency	Cost of operations exceeds feasible alternatives	New technology, wear, spare parts	Replace

Each asset has core and ancillary criteria which were used to score the assets. The core criteria are those that are fundamental to the operation and longevity of the asset. Only the core criteria have been used for the purposes of this analysis – the maximum of which indicates the physical condition of the asset. For each asset the maximum physical condition assigned to the core criteria was selected as its overall physical condition score. The core criteria for each inspection/asset type are included in Table 2.6.

Table 2.6: Asset Core Criteria

Electrical	Heating, Ventilating, and Air Conditioning (HVAC) / Mechanical	Structural
Concrete Pedestals	Concrete Pedestals	Concrete/Masonry Damage
Concrete Pedestal Anchorages	Concrete Pedestal Anchorages	Doors
Corrosion	Corrosion	Joint Damage
Dielectric Leakage	Electrical Connections	Leakage
Electrical Damage	Field Instruments	Roof
Steel Supports	Insulation	Settling
Steel Support Anchorages	Leakage	Wood Damage
	Local Panels	Steel Supports
	Motors	Support Base
	Piping/Valves	Walkways
	Steel Supports	
	Vibration	

2.2.2 Assessment Summary

On March 6th, 7th, and 29th, 2019, Arcadis performed the initial visual assessment on the selected asset inventory. The scope of work included Ball Pump Station building itself, the two 4.2-million-gallon storage tanks, generator building, and the associated processes and grounds. Major observations of these assessments and discussions with Authority staff include the following:

- Insulated pipe in the basement of the pump station has visible surface corrosion most likely due to trapped moisture by the insulation.
- The 54-inch buried pipe south of the facility has deteriorated significantly. This was observed by Authority staff during a recent butterfly valve installation on this segment of pipe.
- The four altitude valves are currently non-functional.
- One surge relief valve is positioned close to the interior wall, making maintenance activities difficult.
- The drain valves on the header piping in the basement are due to be replaced.
- Pump 4 and Pump 5 were originally built by DeLaval and were rebuilt and reconditioned but DeLaval is no longer in business. This makes it difficult to obtain replacement parts if any problems arise.
- Two of the sump pumps in the venturi pits are not functional. The discharge piping from the sump pumps releases the water just outside of the venturi pit hatches, allowing backflow into the system.
- The door on the southwest corner of the pump station is difficult to properly close, occasionally causing the security alarm to sound. The double doors on the east side of the generator building require exceptional effort to fully secure.
- There is a general concern for the integrity of the exterior surface of the pump station, the current sheet metal with foam panels are outdated.

Over 164 assets were identified, inventoried and assessed. Overall, the evaluation revealed that the Ball Pump Station facility is in relatively good condition with 76 percent of the assets having physical condition ratings of 1 (excellent) to 2 (good), and 96 percent having process condition ratings of 1 (excellent) to 3 (moderate). Figures 2.1 through 2.4 present a graphical summary of the condition assessment. A table showing the results of the condition assessment is provided in Appendix B.

Assets that received scores of 4 or 5 (poor or very poor) for physical condition or process condition, or assets that had a likely failure mode of "(L) Level of Service" coupled with a "Redundancy" rating of (0) and a negative remaining useful life, were identified as "at-risk". At-risk assets were then grouped together into specific projects in the CIP and are presented in Table 2.7. Information on each proposed project is presented in Section 2.3.

Table 2.7: Summary of "At-Risk" Assets

Asset Name	New CMMS ID	Total Risk Score
Check Valve 3 (Pump 3, 24")	BAL-PMPG-VCK-03	4.8
Surge Relief Valve 1	BAL-PMPG-VSR-01	10.15
Surge Relief Valve 2	BAL-PMPG-VSR-02	10.15
Surge Relief Valve 3	BAL-PMPG-VSR-03	10.15
Surge Relief Valve 4	BAL-PMPG-VSR-04	10.15
Surge Relief Valve 5	BAL-PMPG-VSR-05	10.15
Rising Stem Gate Valve 1	BAL-PMPG-VGA-01	8.05
Rising Stem Gate Valve 2	BAL-PMPG-VGA-02	8.05
Rising Stem Gate Valve 3	BAL-PMPG-VGA-03	8.05
Rising Stem Gate Valve 4	BAL-PMPG-VGA-04	8.05
Rising Stem Gate Valve 7	BALPMPG-VGA-07	8.05
Rising Stem Gate Valve 8	BAL-PMPG-VGA-08	8.05
Rising Stem Gate Valve 9	BAL-PMPG-VGA-09	8.05
Altitude Valve 1	BAL-PMPG-VAL-01	4.55
Altitude Valve 2	BAL-PMPG-VAL-02	5.2
Altitude Valve 3	BAL-PMPG-VAL-03	5.2
Altitude Valve 4	BAL-PMPG-VAL-04	4.55
36" Piping	BAL-PMPG-PIP-03	9.1
Sump Pump (Venturi Pits 1)	BAL-PMPG-SPM-03	7.65
Sump Pump (Venturi Pits 2)	BAL-PMPG-SPM-04	7.65
Sump Pump (Venturi Pits 3)	BAL-PMPG-SPM-05	4.25

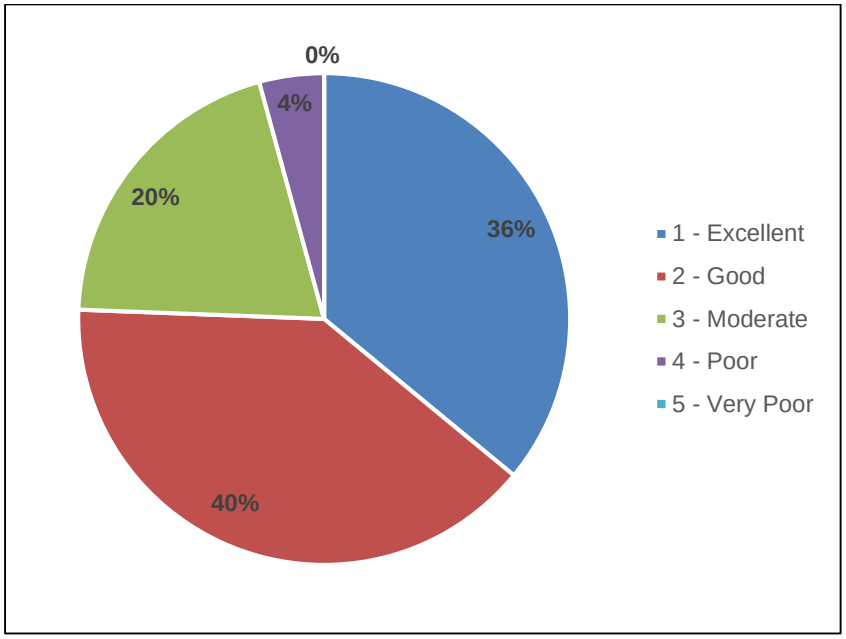


Figure 2.1: Summary of Asset Condition Results - Physical Condition Scoring

Sixty-two percent of the facility assets have what was considered for this CIP as full redundancy, through the use of multiple units that could be used in the event that one or more of the units are out of service. Approximately thirty-two percent of the facility assets have partial redundancy, indicating that there is existing equipment that could be operated to achieve similar results when the principal equipment items is unavailable. Approximately 5% of the facility assets were designated for this CIP as having no redundancy. When these assets are out of service, there is typically no way of operating without installing temporary or replacement equipment at the same (or similar) locations. Structural components including the pump station 1st floor, basement and roof, are not realistic assets for redundancy but were assessed as having “no redundancy” for consistency purposes.

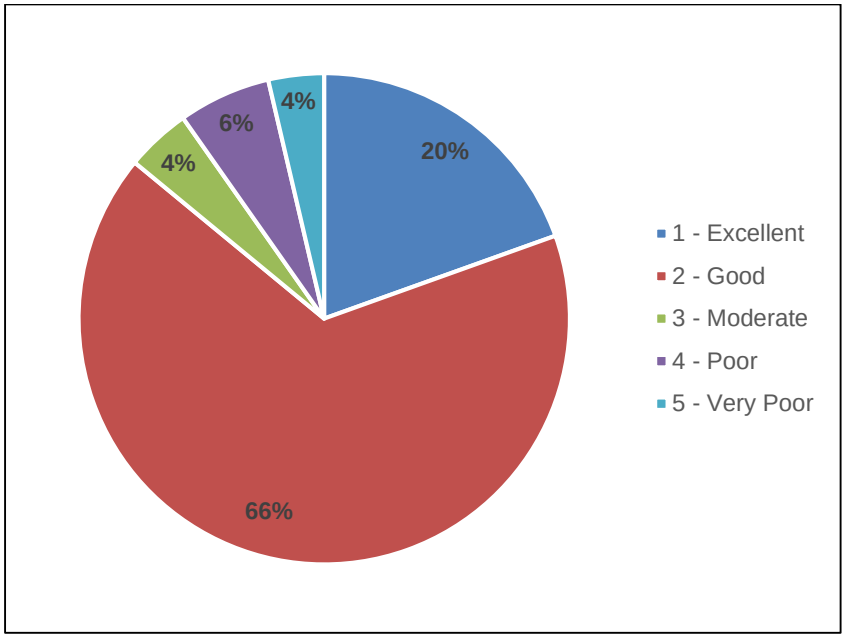


Figure 2.2: Summary of Asset Condition Results - Process Condition Scoring

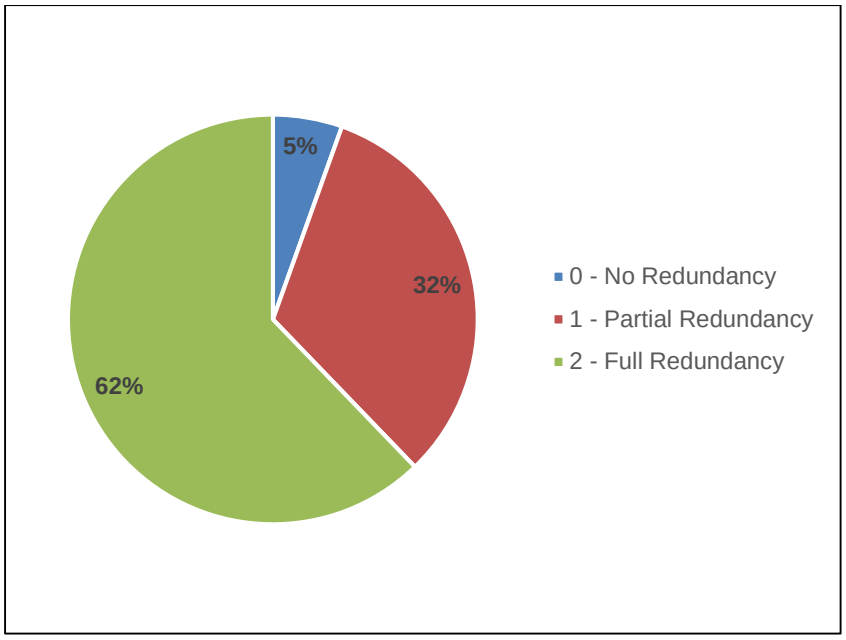


Figure 2.3: Summary of Asset Condition Results - Redundancy Levels

While four potential failure modes were identified, the facility assets generally seemed to fall into only two of the four categories, as presented in Figure 4: “physical mortality” (70 percent) and “level-of-service” (30 percent). 89% of assets have “low” or “very low” total risk scores, 0% were rated as “high” or very “high”.

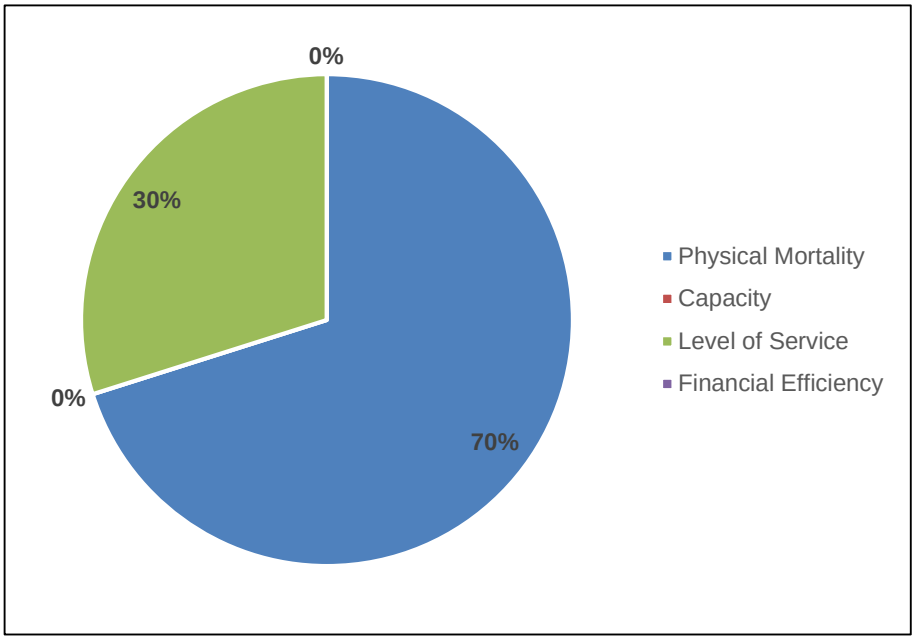


Figure 2.4: Summary of Asset Condition Results - Most Likely Failure Mode

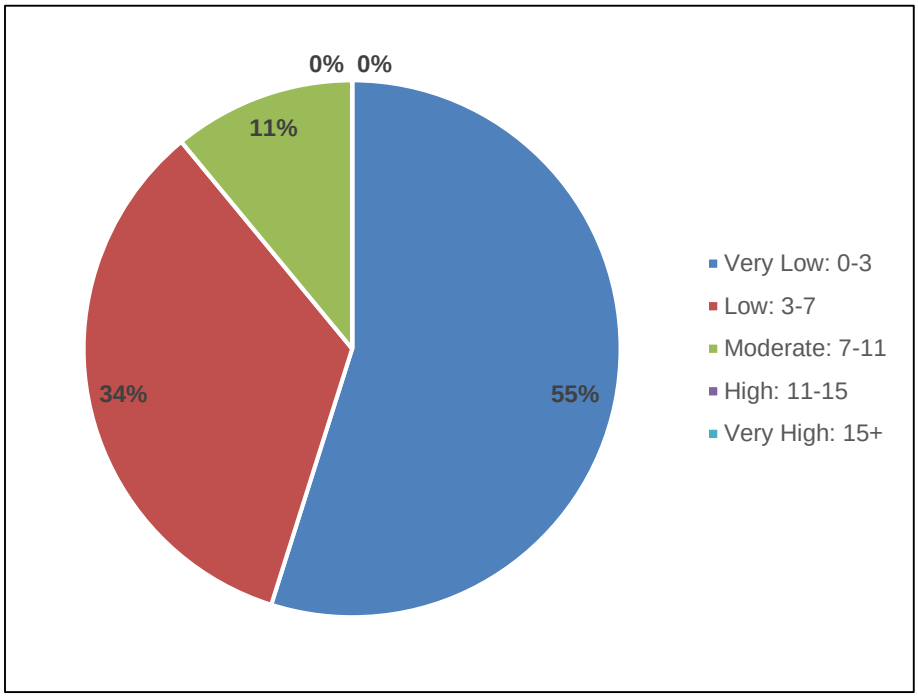


Figure 2.5: Summary of Total Risk Score

2.2.3 Key Insights

The condition assessment performed for this CIP provided several important insights that helped to identify projects as described in Section 2.3. Information collected in the condition assessment can also be used as a tool for predicting future CIP needs. For example, assets that scored between 3 and 5, as represented in Figure 2.1 or Figure 2.2, can be monitored as part of ongoing capital planning efforts.

2.3 Project Identification

Projects included in the CIP were identified from the following sources:

- The Authority's CIP request for proposal (RFP) dated February 2018, and discussions with Authority personnel at the pre-proposal meeting in March 2018.
- Projects identified following completion of condition assessments of the facility assets, as described in Section 2.2 of this report.
- Workshops with ECWA personnel on May 22nd, June 28th, and August 1st, 2019, (following the condition assessments and evaluation of potential alternatives for capital projects).

As a result, 7 projects were identified, as listed below; information for each project is presented in Sections 2.3.1 through 2.3.7 of this report. Opinions of probable project cost are summarized in Table ES-1, Table 4.1, and Appendix D.

Projects Identified via CIP Development and Condition Assessment Activities:

1. Pumping System Improvements
2. HVAC System and Miscellaneous Improvements
3. Exterior Piping Improvements
4. Interior Piping Improvements
5. Land Acquisition and Maintenance Facility Addition
6. Building Exterior Improvements
7. Paving Improvements

Subsequent sections provide a general description of identified projects including several figures which provide visual descriptions of the proposed improvements.

2.3.1 Project No. 1: Pumping System Improvements

Project Description: Currently, Pumps 1, 2, and 3 are constant speed pumps that provide limited operational flexibility compared to Pumps 4 and 5 which are equipped with VFDs. Pumps 4 and 5 are used to maintain stable pressure within the northern service area by adjusting pump speed based on diurnal daily water demand. Arcadis conducted a desktop hydraulic evaluation and developed preliminary cost estimates for improvements that will increase energy efficiency, redundancy, and operational flexibility. Discussions with Authority staff indicate that additional capacity may be necessary to support new bulk water sale customers and expansion of the Ball PS service area. This project includes

improvements to satisfy historical peak pumping rates and provide for the future addition of pumps should it be necessary to accommodate an expanded service area with higher system demands. Improvements include the following major items for this project:

- Four new 1,250 HP pumps equipped with VFDs to expand preferred operating ranges and improve operations and maintenance activities. The two remaining slots at the pumping station will remain open until system demands necessitate the need for additional pumping capacity.
- New conditioned room that can accommodate a total of six VFDs to provide protection from temperature and humidity fluctuations.
- Replacement of suction and discharge piping between each pump's isolation butterfly valves.
- New cushioned swing check valves for each pump.
- Surge relief system improvements.

Refer to Figure 1 for a schematic layout of the proposed pumps.

Alternative Project Description: Alternatively, the addition of 1,000 HP pumps was evaluated as an option for the pumping system improvements. 1,000 HP pumps would be similarly sized to the existing Pump No. 4 and 5. This alternative would need to be further evaluated during this project's basis of design to confirm that sufficient pumping capacity could be provided to meet future demands.

Budgetary proposals were received from qualified vendors. Pump horsepower for each option was selected based on the existing electrical system power rating. Total dynamic head and flow design points were selected based on historic data and a desktop hydraulic evaluation, further described in Section 3.4.

For the purposes of this CIP, four pumps and VFDs sized for the current operating conditions were selected. However, future strategic pursuits by the Authority may necessitate additional pumps and VFDs rated to meet higher capacity demands. Considerations for future Ball PS service area growth are further described in Section 3.5.

2.3.2 Project No. 2: HVAC System and Miscellaneous Improvements

Project Description: Various HVAC improvements were identified as many of these assets are outdated. The other improvements listed below are necessary to support operation and maintenance activities by Authority staff. Improvements include the following major items for this project:

- New unit heaters and the replacement of exhaust fan components and other outdated HVAC assets.
- New access door on the east side of the building, near existing Pump 1.
- New 2-inch water supply line within the pump station building.
- Replacement of the existing sump pumps in the venturi pits.
- New 480V motor control centers.
- New instrumentation conduit between the pump station and venturi pits.
- Replacement of the existing sanitary sewer service lateral.

2.3.3 Project No. 3: Exterior Piping Improvements

Project Description: The existing suction and discharge piping on the exterior of the facility has deteriorated at several locations due to poor installation practices. A section of 60-inch suction piping presents a single point of failure and significant risk to the long-term operation of the facility. Limits of the proposed exterior piping replacement were aligned with ongoing and recently completed ECWA projects. This includes replacement of a 36-inch section of transmission main to the south and overflow piping replaced as part of the Ball South Tank project and what will be replaced as part of the Ball North Tank project. Improvements include the following major items for this project:

- Replacement of the buried 48-inch and 54-inch piping between the two storage tanks, west of the pump station.
- Replacement of the sections of buried 60-inch pipe located from the west to the south side of the pump station with a 48-inch pipe and additional parallel 48-inch pipe to eliminate a single point of failure and provide redundancy.
- Installation of two check valves and concrete vaults on the 48-inch transmission mains to prevent backflow from Ball Tank to Van de Water Treatment Plant in the event of a power outage at the treatment plant.
- Removal of non-functioning altitude valves.
- Micropiles for piping support and cathodic protection, if necessary.

Refer to Figure 1 for a schematic of the proposed exterior piping improvements.

2.3.4 Project No. 4: Interior Piping Improvements

Project Description: Proposed interior piping improvements include completing a discharge piping loop to improve the redundancy and process layout within the pump station. Access hatches on the suction/discharge piping and drain valves are corroded and in need of replacement. Improvements include the following major items for this project:

- Replacement of all the existing main suction/discharge header piping and isolation valves that were not included under Project No. 1.
- Installation of new access hatches and drain valves on the suction and discharge piping.

Refer to Figure 1 for a schematic of the proposed interior piping improvements.

2.3.5 Project No. 5: Land Acquisition and New Maintenance Facility

Project Description: The acquisition of land adjacent to Ball PS and addition of a new building was evaluated to provide ECWA's Line Maintenance Department dedicated space for equipment and material storage. An assessed value of $80,000 was obtained from the Erie County Department of Real Property Tax Services for the parcel shown in Figure 2.7. Improvements include the following major items for this project:

- Purchasing land north of facility, bordering Sweet Home Road and the Ball Pump Station access road.
- Construction of a new 30 ft. x 50 ft. maintenance facility for use by ECWA Line Maintenance personnel.
- Utility services to the new maintenance facility including gas, electric and water services.
- Site improvements including a new paved access drive and an area for material stockpiles such as stone, asphalt, and spoils from excavations.

Refer to Figure 3 for a site plan showing the proposed parcel location.

2.3.6 Project No. 6: Building Exterior Improvements

Project Description: Improvements include:

- Replacement of the sheet metal and foam exterior of the building with a concrete masonry unit and brick exterior.
- New doors, windows, louvers, and minor improvements to the in-place plumbing.

2.3.7 Project No. 7: Paving Improvements

Project Description: To improve site access to Sweet Home Road and provide another egress to the facility, paving improvements are recommended which include:

- Removal and replacement of the existing parking lot and driving surfaces up to the facility entrance with Sweet Home Road.
- Installation and paving of a new access drive from the south side of Ball Pump Station to Sweet Home Road.

Refer to Figure 4 for a schematic of the proposed paving improvements.

N.

48" INLET
48" INLET
CHECK VALVE CHAMBER
CHECK VALVE CHAMBER
48" OVERFLOW
48" INLET
54" OUTLET
54"x48" REDUCER
48"
FUTURE PUMP NO. 6
FUTURE PUMP NO. 5
SUCTION PIPING
DISCHARGE PIPING
SOUTH TANK
NORTH TANK
54"
54"
54"
54"
54"
54"x48" REDUCER
30" PUMP NO.1
30" PUMP NO.2
30" PUMP NO.3
30" PUMP NO.4
30"
48"
48"
BALL PUMP STATION
48"x42" REDUCER
48"x42" REDUCER
48"x30" REDUCER
42" DISCHARGE
42" DISCHARGE
30" DISCHARGE
48" OVERFLOW
36" OVERFLOW
60" OVERFLOW
36" DISCHARGE
36" DISCHARGE
48" DISCHARGE
Service Center Rd

LEGEND:
- EXISTING
- PROJECT NO.3
- PROJECT NO.4

ARCADIS Design & Consultancy for natural and built assets

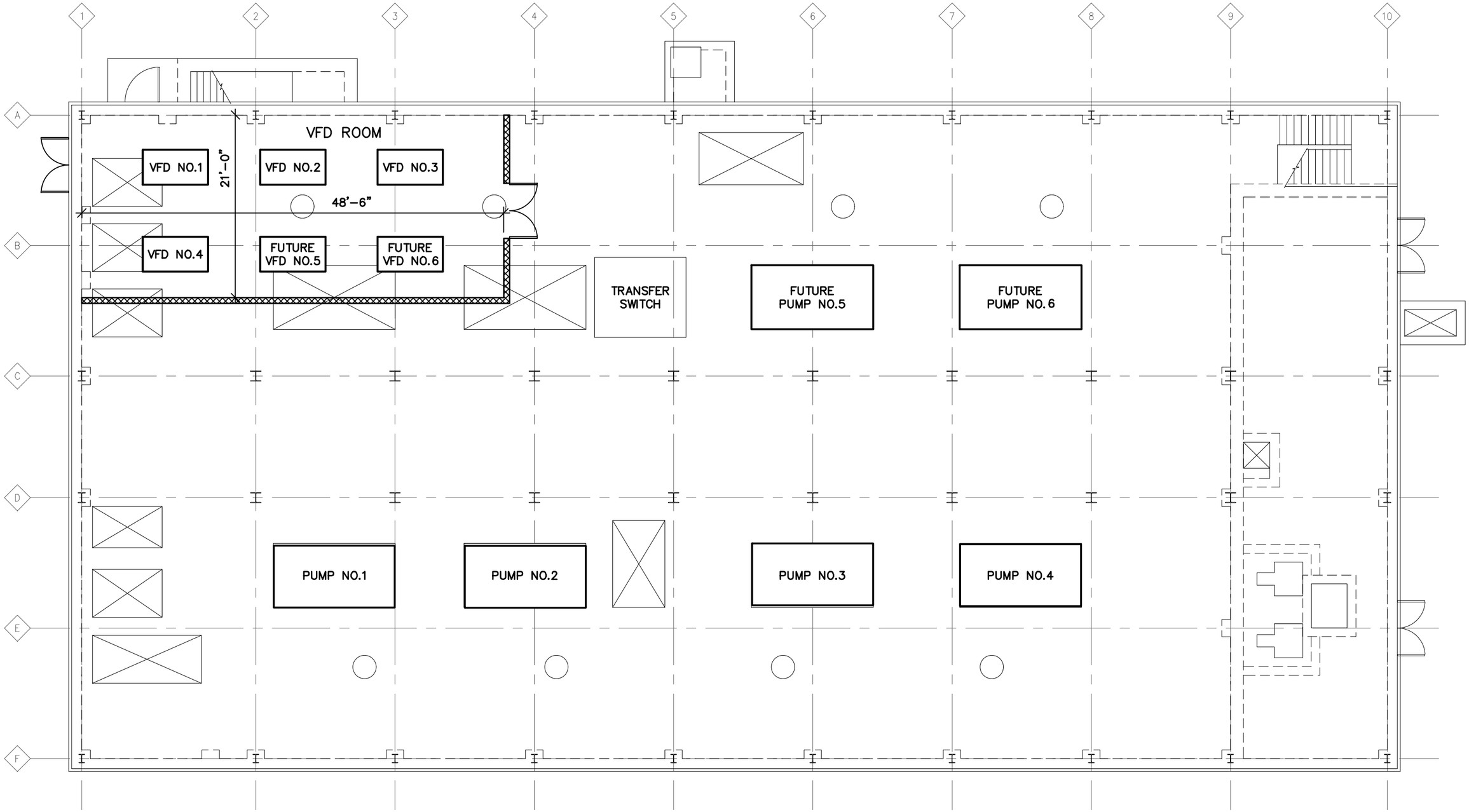
ERIE COUNTY WATER AUTHORITY

BALL PUMP STATION CAPITAL IMPROVEMENTS PLAN
PROJECT NO. 3 EXTERIOR PIPING IMPROVEMENTS

BALL PUMP STATION
SITE PIPING PLAN
NOT TO SCALE

JANUARY 2020

FIGURE 1



ARCADIS Design & Consultancy for natural and built assets

ERIE COUNTY WATER AUTHORITY

BALL PUMP STATION CAPITAL IMPROVEMENTS PLAN
PROJECT NO. 3 EXTERIOR PIPING IMPROVEMENTS

BALL PUMP STATION
OPERATING FLOOR PLAN

NOT TO SCALE

JANUARY 2020

FIGURE 2

Erie County Water Authority
Ball Pump Station
Capital Improvement Plan

Project 5:
Land Acquisition and
Storage Facility Addition

Legend

- Property to Purchase
- Parcel Boundary

0 50 100
Feet

Data Source: ESRI, ArcGIS Online, Aerial Imagery

Coordinate System: New York State Plane West
Datum: NAD83
Units: Feet

FIGURE 3

Erie County Water Authority
Ball Pump Station
Capital Improvement Plan

Project 7:
Paving Improvements

Legend

Approximate Limits of New Electrical Substation

Proposed Paving Limits

0 50 100
Feet

Data Source: ESRI, ArcGIS Online, Aerial Imagery

Coordinate System: New York State Plane West
Datum: NAD83
Units: Feet

FIGURE 4

3 CAPITAL PROJECTS SUMMARY

3.1 Introduction and Overview

Projects included in the CIP are identified in Section 2 of this report, including a brief summary of each project's scope.

The opinion of probable project cost ("point estimate") of implementing all the projects included in the CIP is approximately $25.8 million (in 2019 dollars) over twenty years. As described in Sections 3.2 and 3.3 of this report, the projects are classified by both category and priority.

The information compiled for this evaluation and the opinions of probable cost included in this CIP are consistent with an Association for the Advancement of Cost Engineering (AACE) International estimate. Unless otherwise indicated, the opinions of probable cost are AACE Class 5 estimates, where project definition is between zero percent and two percent. The typical purpose of this level of estimate is for conceptual screening. Class 5 estimates are prepared for strategic business planning, such as, but not limited to, market studies, assessment of initial viability, evaluation of alternate schemes, project screening, project location studies, evaluation of resource needs and budgeting, and long-range capital planning. Class 5 estimates,

> "are generally prepared based on very limited information, and subsequently have wide accuracy ranges. As such, some companies and organizations have elected to determine that due to the inherent inaccuracies, such estimates cannot be classified in a conventional and systemic manner. Class 5 estimates, due to the requirements of end use, may be prepared within a very limited amount of time and with little effort expended...Often, little more than proposed plant type, location, and capacity are known at the time of estimate preparation."[1]

AACE Class 5 estimates are stochastic in nature (i.e., they are based on inferred or statistical relationships between similar projects and/or equipment quotes with additional factors applied rather than a deterministic estimate that would rely on detailed quantity take-offs and unit costs), and are typically accurate between -20 to -50 percent below the point estimate and +30 to +100 percent above the point estimate, depending on the technological complexity of the project, appropriate reference information, and other risks; for this CIP, the cost estimates for each project were refined to reflect a low range of -30 percent and a high range of +50 percent relative to the point estimate. With awareness that the actual project cost may vary within the typical accuracy of the point or probable construction cost estimate (i.e., -30 percent to +50 percent) these estimates can successfully be used by owners for strategic planning purposes such as capital improvements planning. AACE recommends that only after the project definition is advanced to 10 percent to 40 percent, and a Class 3 (or more accurate) cost estimate can be developed, should an authorization or project control budget be established. Owners should consider adding a separate contingency dollar amount to a Class 5 (strategic planning) and Class 4 (study phase) estimates if budget authorization or bonding must be obtained prior to the project proceeding to a more detailed level of engineering.

[1] Christensen, Peter, and Dysert, Larry R., "AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries", November 29, 2011, pp. 5.

The following assumptions were used to prepare the opinions of probable cost:

- The range of accuracy of the opinion of probable cost is described above for AACE Class 5 estimates. The level of detail and cost range will be refined as each project's scope is further developed through the feasibility study and design stages.
- The opinions of probable costs are based on October 2019 dollars and escalated to the associated, projected midpoint construction using an assumed annual rate of inflation of 2.0 percent.
- Each project's opinion of probable cost includes a suggested allocation for engineering, financing, legal, and administrative of 25 percent of the probable construction cost.
- Each project's opinion of probable cost includes a 25 percent contingency to account for scope uncertainty.
- Each project's opinion of probable cost includes a suggested five percent owner's construction contingency, intended to cover typical construction-phase change orders due to unanticipated field conditions and owner revisions in project scope.

Salvage value of the existing equipment, if any, is not included in the opinions of probable costs.

3.2 Project Categories

Projects were categorized by type as follows:

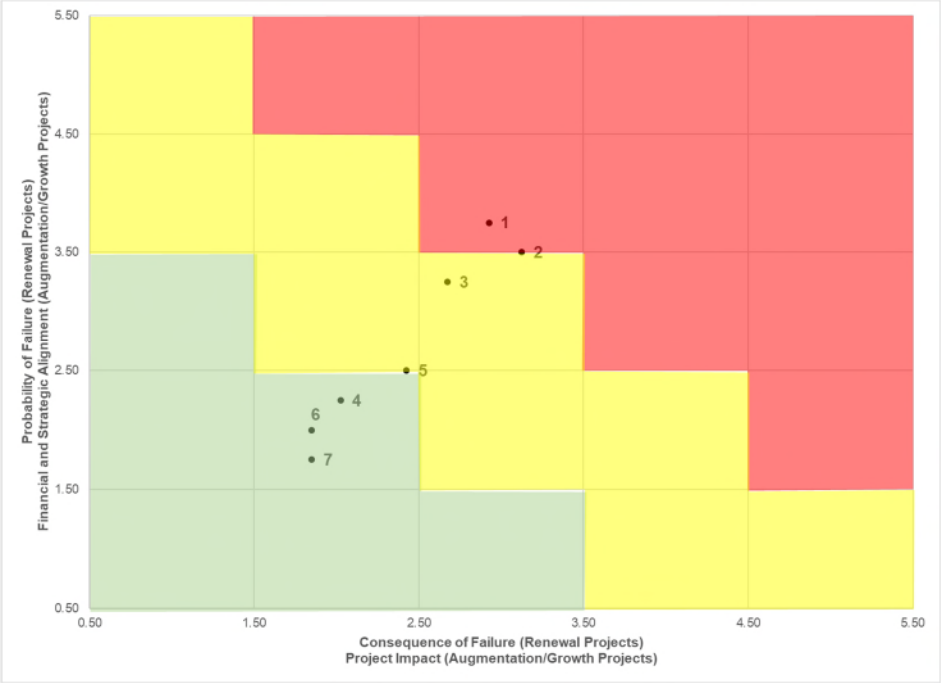
1. **Augmentation (Enhancements)** – Projects initiated to improve service level, reduce risk, improve efficiency, or comply with changing regulatory requirements.
2. **Renewal (Rehabilitation and/or Replacement)** – Projects aimed at replacing assets that are reaching the end of their useful lives based on condition, probability, and consequence of failure.

Due to their size, scope, or relative complexity, some projects or project components may be considered as more than one project type.

As presented in Figure 3.1, almost all of the CIP projects are designated as "renewal", for replacement of aging process, structural, mechanical, or electrical assets. The land acquisition and maintenance facility addition project was designated as an "augmentation" project. The remaining pumping system, HVAC, exterior piping, interior piping, building exterior and paving improvements were designated as "renewal" projects.

3.3 Development of Project Priority

Project priority was determined through a ranking and scoring process to determine a total business risk exposure (BRE) score for each project, using the project's associated probability of failure/project impact and consequence of failure/financial impact/alignment with strategic goals scores. After the BRE score was determined, each project was assigned a priority based on the total BRE, as represented by each project's placement on the matrix in Figure 3.2. Projects were ranked as low priority (green), medium priority (yellow), and high priority (red).



ID	Project Name
1	Pumping System Improvements
2	HVAC System and Miscellaneous Improvements
3	Exterior Piping Improvements
4	Land Acquisition and Maintenance Facility Addition
5	Interior Piping Improvements
6	Building Exterior Improvements
7	Paving Improvements

Figure 3.1: Business Risk Exposure Project Priority Matrix

The scoring system used for anticipating consequence of failure, probability of failure, project impact, financial and strategic alignment, and overall project priority for each of the projects is described below.

3.3.1 Scoring Criteria – Renewal Projects

Consequence of Failure (Horizontal Axis Criteria): Horizontal axis scoring for renewal projects is assessed through the expected consequence of failure on triple bottom line (TBL) attributes, including economic/financial consequences, environmental consequences, and social impacts and public image consequences as influenced by the major assets included in the project. For each project, consequence of failure scores were assigned using criteria presented in Tables 3.1 through 3.3, with weighting for each of these criteria for this CIP evaluation as follows:

- Economic/financial consequence – 30 percent
- Environmental consequence – 40 percent

- Social impacts and public image consequence – 30 percent

The consequence of failure analysis considers the triple bottom line (TBL) attributes, including economic, social, and environmental consequences of an asset failure. Economic consequences include repair costs, and impact to operations. Social consequences include social impact on the customer from a potential disruption of service. Environmental consequences include costs due to environmental degradation that results from a failure.

Economic/Financial Consequence: The criteria for evaluating direct economic impact considers cost of reactive maintenance/repairs (including labor hours, material costs, and need for outside expertise), impact on operations (loss of efficiency and/or redundancy, impacts to upstream and/or downstream processes), regulatory fines, loss of revenue, and/or loss of grants/funding.

Table 3.1: Consequence of Failure Grade – Economic Consequence

Score	Description
1 – Insignificant	Insignificant financial impact to the utility from revenue loss, repair/restoration cost, downtime, fines, damage, service interruptions, etc. Total revenue loss and cost to restore service <$500.
2 – Minor	Limited financial impact to the utility from revenue loss, repair/restoration cost, downtime, fines, damage, service interruptions, etc. Total revenue loss and cost to restore service $500 - $4,999.
3 – Moderate	Moderate financial impact to the utility from revenue loss, repair/restoration cost, downtime, fines, damage, service interruptions, etc. Unlikely to have wider budget implications. Total revenue loss and cost to restore service $5,000 - $49,000.
4 – Major	Significant current and future financial impact to the utility from revenue loss, repair/restoration cost, downtime, fines, damage, service interruptions, etc. Likely to have some budget implications requiring deferral or cutbacks in other areas. Total revenue loss and cost to restore service $50,000 - $249,000.
5 – Catastrophic	Serious current and future financial impact to the utility from revenue loss, repair/restoration cost, downtime, fines, damage, service interruptions, etc. Would result in major budget implications requiring deferral or cutbacks in other areas. Total financial impact >$250,000.

Environmental Consequence: The criteria for evaluating environmental impact considers permit and regulatory compliance, health advisories, water conservation, and overall negative environmental impacts. Consequences may also factor in positive “green” project components, such as recycling/reuse, emissions reductions, and energy use/conservation, along with historic information on permit violations and regulatory issues and the size/scope of the facility and assets involved.

Table 3.2: Consequence of Failure Grade – Environmental Consequence

Score	Description
1 – Insignificant	Any failure would result in negligible environmental impact at a very localized level (i.e., individual property), with no impact on wider ecosystem. Permits or regulatory requirements are not impacted. Project is not expected to have any positive impact on the overall environment via energy/emissions/conservation.
2 – Minor	Any failure would result in minor environmental impact at a localized site (i.e., small parcel), with limited to no impact on wider ecosystem. Would only have a minor impact on permits or regulatory requirements (i.e., limited to no risk of significant fines or enforcement). Any discharges or other consequences would be limited to a small local area. Project is not expected to have any significant impact on the overall environment via energy/emissions/ conservation.
3 – Moderate	Any failure would result in moderate environmental impact to a local neighborhood/geographic area, with possibility of an impact on wider ecosystem. Is likely to impact permits and/or regulatory requirements (i.e., fines or enforcement). Any discharges or other consequences would impact a local neighborhood/geographic area. Project would have a small but measurable impact on the overall environment via energy/emissions/conservation.
4 – Major	Any failure would result in significant negative environmental impact to a wide geographic area, with strong likelihood of an impact on wider ecosystem. Would entail significant permit violations and/or regulatory scrutiny (i.e., fines or enforcement). Any discharges or other consequences would impact a wide geographic area. Project would have a significant positive impact on the overall environment via energy/emissions/conservation.
5 – Catastrophic	Any failure would result in significant negative environmental impact on a regional level, with lingering or permanent/irreversible impact on wider ecosystem. Would entail major federal and/or state permit violations and/or regulatory scrutiny (i.e., fines or enforcement). Any discharges or other consequences would have regional impacts. Project would have a significant positive impact on the overall environment via energy/emissions/ conservation.

Social Impacts and Public Image Consequence: The criteria for evaluating social impacts and public image consider potential for physical injury, health and safety issues, overall public and community perception and expectations, aesthetic issues, good neighbor policy, potential lawsuits, and media coverage.

Table 3.3: Consequence of Failure Grade – Social Consequence

Score	Description
1 – Insignificant	Negligible potential for minor injury. Would only impact a limited number of people, if any. Event would only be of interest to individuals, if at all, with no impact or concerns for the community.
2 – Minor	Hazard with some potential for injury requiring medical attention or minor violations (i.e. OSHA and/or EPA regulations). May result in injury but would only impact a limited number of people. No formal investigation and local community discussion limited to a small group. No potential for formal lawsuits or damages,

3 – Moderate	Hazard with potential for serious injury and violations (i.e., OSHA and/or EPA regulations). Likely to result in serious injury or health hazard but not loss of life or epidemic. No formal investigation, but significant local community discussion and potential for local media coverage. Some potential for formal lawsuits or damages.
4 – Major	Significant hazard with potential for serious injury and major violations (i.e., OSHA and/or EPA regulations). Could result in loss of life or significant health epidemic. Initiates a public or government investigation with some national publicity, but mainly local media coverage. High potential for lawsuits with rulings and/or damages. Serious loss of community confidence in utility with some call for action.
5 – Catastrophic	Significant present hazard with imminent potential for serious injury and major violations (i.e., OSHA and/or EPA regulations). Very likely to result in loss of life or widespread health epidemic. Initiates a major public or government investigation with extensive national and local media coverage. Major lawsuit with the potential for significant rulings and/or damages with serious implications. Results in complete loss of community confidence in utility and demands for management accountability and leadership changes

Probability of Failure: Vertical axis scoring is assessed through a project's probability of failure, as determined by analysis of aggregate condition assessment information available for the assets. The probability of failure rating consists of two elements as follows:

- **Physical Condition** – The current state of repair and operation for the project assets as influenced by age, historical maintenance, and service/operating conditions.
- **Process Condition** – The ability of the asset to meet operational requirements now and in the future. Assessment ratings consider whether the asset is likely to continue to meet operating objectives or if obsolescence and/or capacity has induced unacceptable performance. Assessment can also consider safety or other hazards.

Ratings are completed on a standard scale from 1 to 5 as presented in Tables 2.1 and 2.3. Final probability of failure scores are determined using equal physical condition and process condition weighting (i.e., 50 percent for each physical condition and process condition score).

3.3.2 Scoring Criteria – Augmentation Projects

Project Impact (Horizontal Axis Criteria): Horizontal axis scoring is assessed through a growth or augmentation project's expected impact on service level and reliability, operations and maintenance, and efficiency or energy impact. For each project, project impact scores were assigned using criteria presented in Tables 3.4 through 3.6, with weighting for each of these criteria for this CIP evaluation as follows:

- Service level/reliability impact – 35 percent
- Operations and maintenance impact – 35 percent
- Efficiency/energy impact – 30 percent

Table 3.4: Project Impact – Service Level/Reliability Impact

Score	Description
1 – Minimal	Project will have a low to no measurable positive impact on service levels and/or system reliability, such as service disruptions, water quality complaints, low pressure, etc. Improvements may be expected to impact a few customers in the medium- to long-term.
2 – Low	Project will have a moderate to low positive impact on service levels and/or system reliability, such as service disruptions, water quality complaints, low pressure, etc. Improvements would be expected to impact a smaller number of customers (1% of customers) in the medium- to long-term.
3 – Moderate	Project will have a moderate positive impact on service levels and/or system reliability, such as service disruptions, water quality complaints, low pressure, etc. Improvements would be expected to impact a medium number of customers (2% to 4% of customers). Would expect to receive some positive public relations benefit based on future demonstrated improvements.
4 – Significant	Project will have a significant positive impact on service levels and/or system reliability, such as service disruptions, water quality complaints, low pressure, etc. Improvements would be expected to impact a large number of customers (4% to 9% of customers) or a specific significant customer. Would expect to receive positive public relations benefit based on future demonstrated improvements.
5 – Major	Project will have a major and measurable positive impact on service levels and/or system reliability, such as service disruptions, water quality complaints, low pressure, etc., and is related to specific goals. Improvements would be expected to impact a very large number of customers (10% to 20%+ of customers) and/or a specific critical customer. Would expect to receive much positive public relations benefit based on future demonstrated improvements.

Table 3.5: Project Impact – Operations and Maintenance Impact

Score	Description
1 – Minimal	Project will have a limited to low impact on O&M, including reduction in required preventive and corrective maintenance and inspections, and assets involved are not critical. Project is not expected to significantly impact any O&M issues. Measurable cost reductions (including labor and materials) are expected to be negligible. Safety issues not a concern.
2 – Low	Project will have a moderate to low positive impact on O&M, including reduction in required preventive and corrective maintenance and inspections, but assets involved are not specifically critical. Project may lessen ongoing O&M issues that could include frequent breakdowns, obsolete equipment, history of repeat failures, costly maintenance, etc. Measurable cost reductions (including labor and materials) are expected to be 2% to 4% per year of the current budget for that specific function or area. There are no major staff or safety issues or concerns to be addressed by the project.
3 – Moderate	Project will have a moderate positive impact on O&M, including reduction in required preventive and corrective maintenance and inspections. Project is likely to alleviate ongoing O&M issues that could include frequent breakdowns, obsolete equipment, history of repeat failures, costly maintenance, etc. Measurable cost reductions (including labor and materials) are expected to

	be 5% to 9% per year of the current budget for that specific function or area. May also address staff safety issues or concerns.
4 – Significant	Project will have a significant positive impact on O&M, including reduction in required preventive and corrective maintenance and inspections. Project will alleviate ongoing O&M issues that could include frequent breakdowns, obsolete equipment, history of repeat failures, costly maintenance, etc. Measurable cost reductions (including labor and materials) are expected to be 10% to 24% per year of the current budget for that specific function or area. May also address staff safety issues or concerns.
5 – Major	Project will have a major and measurable positive impact on O&M, including reduction in required preventive and corrective maintenance and inspections. Project will alleviate ongoing O&M issues that could include frequent breakdowns, obsolete equipment, history of repeat failures, costly maintenance, etc. Measurable cost reductions (including labor and materials) are expected to be 25% or greater per year than the current budget for that specific function or area. May also address staff safety issues or concerns.

Table 3.6: Project Impact – Efficiency/Energy Impact

Score	Description
1 – Minimal	Project will have a low to no impact on energy use, conservation, and/or environmental responsibility and sustainability. At most, the project could include slight reduction in electricity/gas consumption or a reduction of greenhouse gas emissions of less than 1%. Project will also have limited to no impacts on water reuse, effluent reuse/recycling are other sustainability initiatives.
2 – Low	Project will have a low to moderate positive impact on energy use, conservation, and/or environmental responsibility and sustainability. This could include reduction in electricity/gas consumption or a reduction of greenhouse gas emissions of 1% to 5%. Project could also have impacts on water reuse, effluent reuse/recycling are other sustainability initiatives.
3 – Moderate	Project will have a moderate positive impact on energy use, conservation, and/or environmental responsibility and sustainability. This could include reduction in electricity/gas consumption or a reduction of greenhouse gas emissions of 5% to 10%. Project could also have impacts on water reuse, effluent reuse/recycling are other sustainability initiatives.
4 – Significant	Project will have a significant positive impact on energy use, conservation, and/or environmental responsibility and sustainability. This could include reduction in electricity/gas consumption or a reduction of greenhouse gas emissions of 10% to 20%. Project could also have significant impacts on water reuse, effluent reuse/recycling or other sustainability initiatives.
5 – Major	Project will have a major and measurable positive impact on energy use, conservation, and/or environmental responsibility and sustainability. This could include reduction in electricity/gas consumption or a reduction of greenhouse gas emissions of 20%+, and also have a net financial benefit to the utility. Project could also have major impacts on water reuse, effluent reuse/recycling or other sustainability initiatives.

Financial and Strategic Alignment (Vertical Axis Criteria): Vertical axis scoring is assessed through a project's expected financial returns and the confidence in these projections, using net present value (NPV). In addition, alignment with ECWA strategic goals was evaluated.

For each project, financial and strategic alignment scores were assigned using criteria presented in Tables 3.7 and 3.8, with equal financial returns and strategic goal alignment weighting (i.e., 50 percent for each financial returns and strategic goals alignment score).

Table 3.7: Financial and Strategic Alignment – Financial Returns

Score	Description
1 – Minimal	Project has limited to no expected efficiency benefits, revenue, enhancements, or cost reductions with a small positive impact on future operating or capital costs. Have a moderate to low level of confidence in projections.
2 – Low	Project has expected efficiency benefits, revenue, enhancements, or cost reductions with a positive impact on future operating or capital costs. Have a moderate level of confidence in projections.
3 – Moderate	Project has expected and documented efficiency benefits, revenue, enhancements, or cost reductions with a moderate positive impact on future operating or capital costs. Have a moderate level of confidence in projections.
4 – High	Project has expected and documented efficiency benefits, revenue, enhancements, or cost reductions with a high positive impact on future operating or capital costs. Have a high to moderate level of confidence in projections.
5 – Very High	Project has expected and documented efficiency benefits, revenue, enhancements, or cost reductions with a very high positive impact on future operating or capital costs. Have a very high to high level of confidence in projections.

Table 3.8: Financial and Strategic Alignment – Alignment with ECWA Strategic Goals

Score	Description
1 – Not Aligned	Project is not directly aligned with ECWA goals and mission as described below, and may not have other positive impacts.
2 – Somewhat Aligned	Project is aligned with one or more ECWA strategic goals and/or mission as described below, and is somewhat articulated and justified in this CIP evaluation.
3 – Moderately Aligned	Project is aligned with one or more ECWA strategic goals and/or mission as described below, and is moderately articulated and justified in this CIP evaluation.
4 – Strongly Aligned	Project is aligned with two or more ECWA strategic goals and/or mission as described below, and is strongly articulated and justified in this CIP evaluation.
5 – Fully Aligned	Project is directly aligned with and will have a specific and measurable impact on many ECWA strategic goals, including continuing to providing high-quality potable water, protecting the public welfare, maintaining existing equipment in operational use, and minimizing rate impacts on the ratepayers. Project is directly aligned with the ECWA mission to provide customers with reliable, high-quality water services in a professional manner that is both fiscally and environmentally responsible.

3.4 Desktop Hydraulic Evaluation

A desktop evaluation was conducted to evaluate the current operating conditions of the pumping system. Five scenarios, described in Figures 3.3 – 3.6, were developed based on original pump performance testing data from DeLaval, historic flow and pressure data during low, average and peak day demands provided by ECWA, and Hydraulic Institute guidelines of 70% (lower bound) to 120% (upper bound) of best efficiency point (BEP) flow for the estimated preferred operating range (POR). When a pump is operating at its BEP, flows are constant and forces acting on the impeller are at a minimum. The POR represents the area of the pump operating curve where operation should occur, for good performance of the overall system. If the pump runs at conditions outside its POR at significantly increased or reduced flows, an imbalance of pressure can occur inside the pump. This imbalance can cause shaft deflection, excessive loads on bearings and mechanical seals, excessive vibration and heat, all of which significantly reduce the life of the pump and increase the likelihood of premature failure.

3.4.1 Average Flow Data Analysis

Average daily flow data was obtained from ECWA for 2012 - 2017. Figure 3.2 presents the frequency distribution curves for this time period, which shows the following:

- 20th Percentile: 13.6 MGD (i.e. 80% of the time the existing pumps operated at 13.6 MGD or higher)
- 50th Percentile (median, not average): 15.8 MGD (i.e. 50% of the time the existing pumps operated at 15.8 MGD or higher)
- 90th Percentile: 22.6 MGD
- Maximum: 41.75 MGD

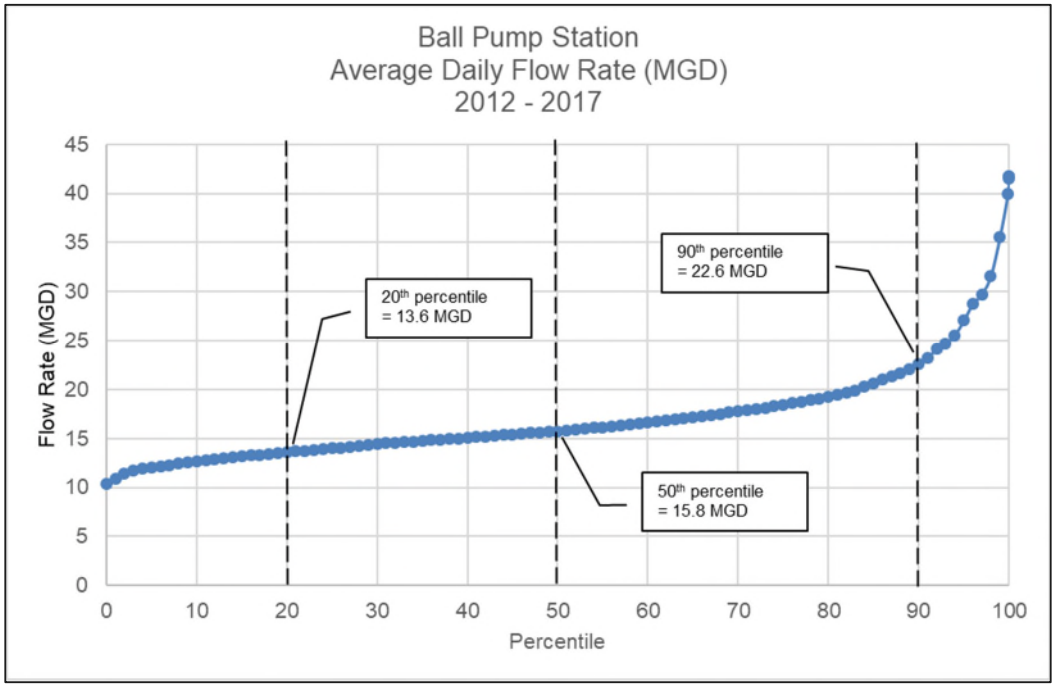


Figure 3.2 Probability Plot of 2012 - 2017 Average Daily Flow

3.4.2 Peak Flow Data Analysis

Arcadis reviewed the average daily flow data and selected several days that represented maximum, average, and minimum flow conditions as well as days when specific pump combinations were in operation. ECWA provided this more specific data for these selected days that included the following:

- Hourly flow data from Ball Pump Station
- Suction and discharge pressures at Ball Pump Station
- Tank levels for Ball North and South Tanks
- Indication of which pumps were operating
- Pump/motor speed for Pumps 4 or 5 if they were operating

The suction and pressure data was referenced to the shaft centerline of pumps 4 and 5. Please note that pumps 1, 2, and 3 have slightly different centerlines that are close to the centerline for pumps 4 and 5. We do not expect this minor difference to alter the final recommendations from the desktop evaluation. Minor losses were also estimated between the suction/discharge pressure gauges and each pump in order to calculate the total dynamic head (TDH) for the hourly flow data.

Arcadis prepared pump operating curves for the following pump combinations that are shown in Figures 3.3 through 3.5:

- Pumps 1, 4, and 5
- Pumps 2, 4, and 5
- Pumps 4 and 5

As shown in Figure 3.3, Pumps 1, 4 and 5 tend to operate outside the preferred operating range. They may be within the allowable operating range (AOR) which is typically defined by the pump manufacturer, but this information was unavailable. As shown in Figure 3.5, running Pumps 4 and 5 without Pump 1 or Pump 2 results in the pumps operating within their POR except during flows of approximately 5,000 gpm and less.

ECWA operates Pumps 4 and/or 5 almost exclusively except for periods of peak demand during the summer months. The data indicates these pumps are operated consistently within the 10,000 gpm to 14,000 gpm range (14 MGD to 20 MGD). Below 11,000 gpm (16 MGD), ECWA should consider reducing to one pump to stay within the POR. However, this decision should be weighed against transmission/distribution system pressure impacts when starting or stopping a pump. Operating two pumps below 11,000 gpm, and outside of the POR, for a short time period may be a better decision than creating a potential pressure surge or water hammer.

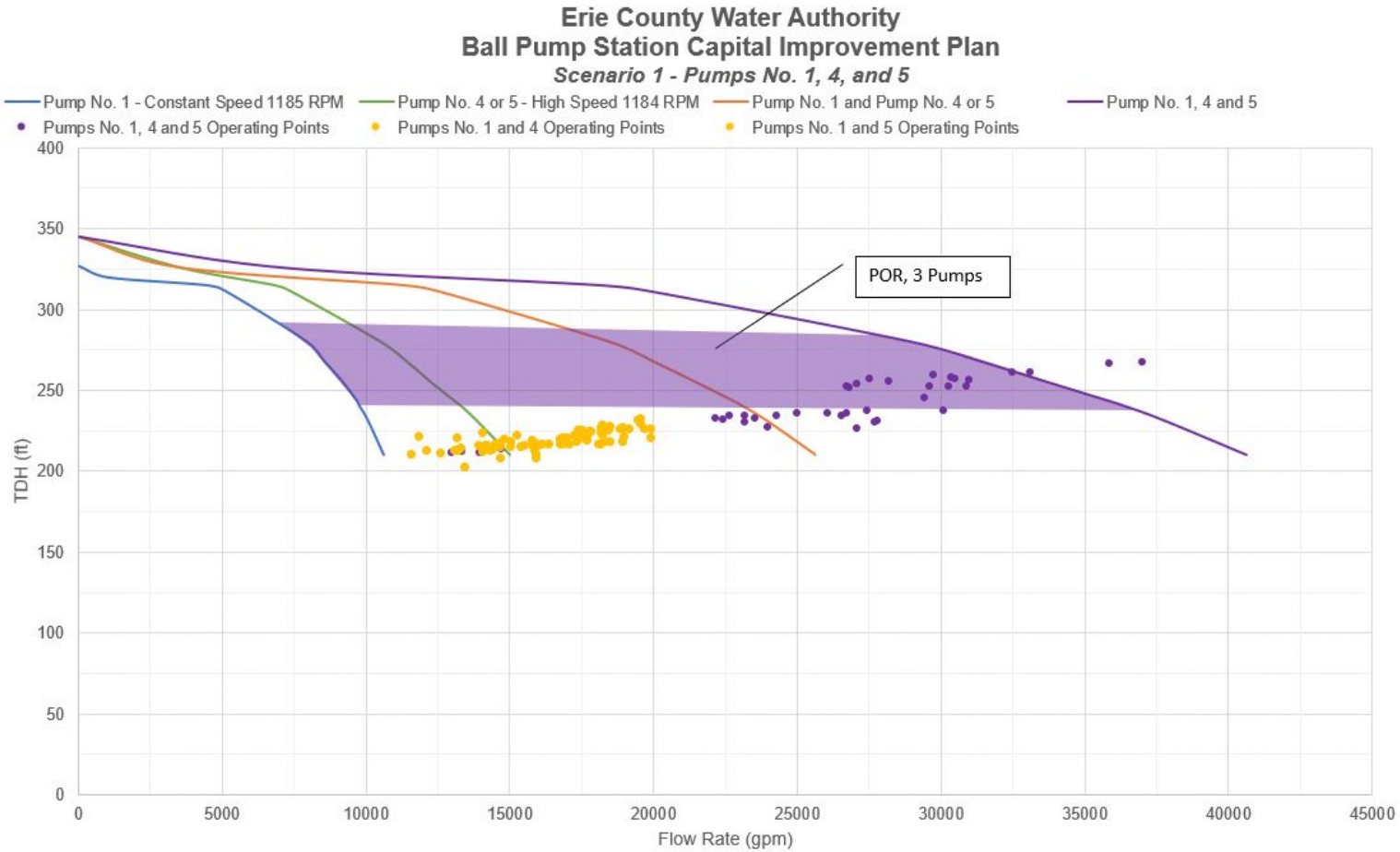


Figure 3.3: Figure Operating Scenario 1 – Pumps 1, 4, and 5

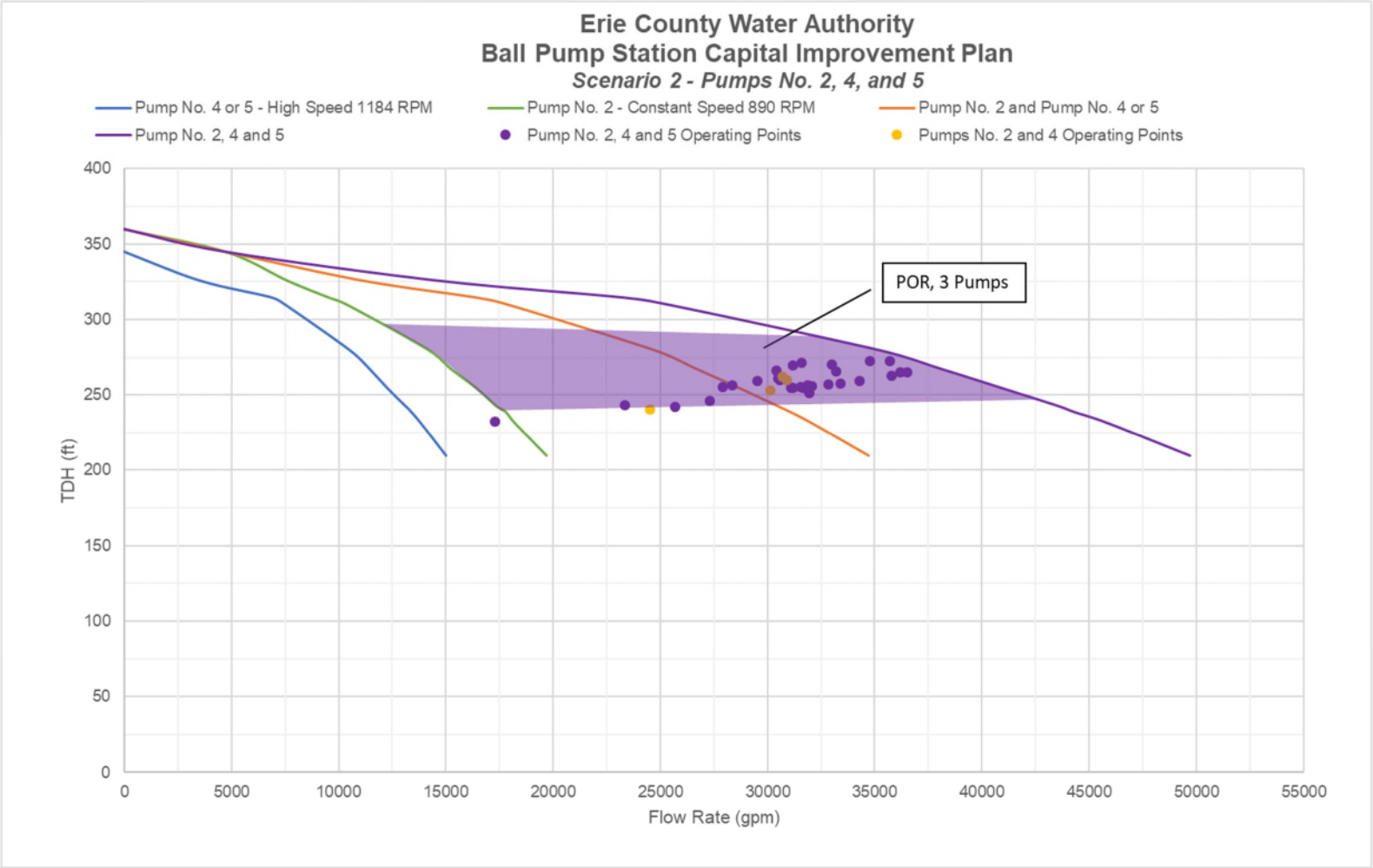


Figure 3.4: Operating Scenario 2 – Pumps 2, 4, and 5

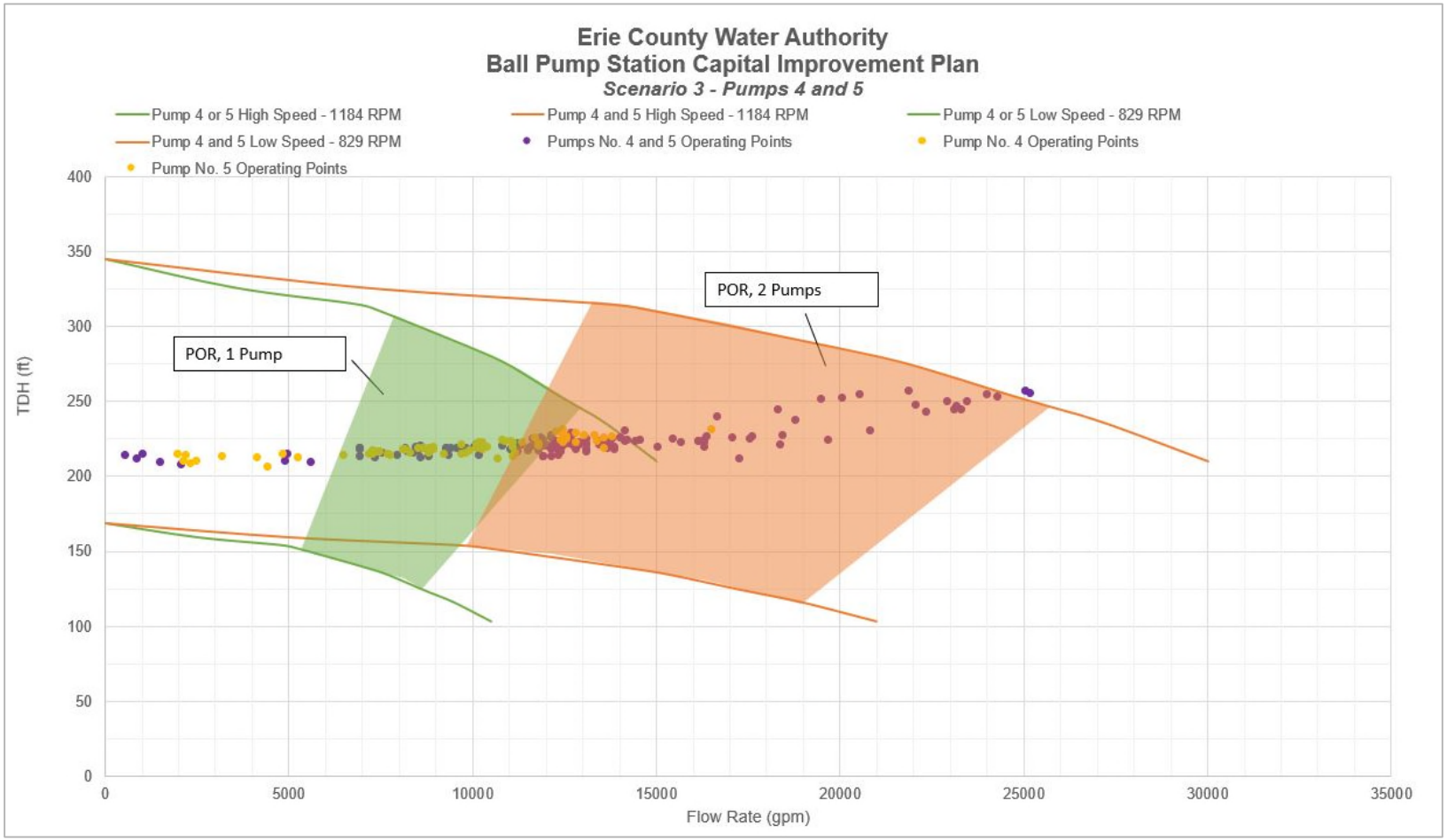


Figure 3.5: Operating Scenario 3 – Pumps 4 and 5

Arcadis developed two options for improving the operational flexibility and resiliency at Ball Pump Station by reducing the reliance on Pumps 4 and 5.

- Option 1 – provide N+1 redundancy assuming new pumps will be of similar size to the 1,000 hp Pumps 4 and 5.
- Option 2 – provide N+1 redundancy assuming new 1,250 hp pumps.

In determining the pump size for Option 2, Arcadis coordinated with Patterson Pump Company to select the most appropriate pump that could meet the operating points provided as part of the hourly flow data analysis. A summary of the selected Patterson pump is below with the detailed cut sheet provided in Appendix C. Should ECWA move forward with a pump replacement project, we recommend that a more detailed hydraulic analysis be performed during design to refine the final pump selection.

Table 3.9: Summary of Patterson 20x18 MABS-D Single Stage

Design Parameter	Value
Speed, (RPM)	1,200
Shutoff Head, (ft.)	338
Suction Diameter, (in.)	20
Discharge Diameter, (in.)	18
Motor Rating, (hp)	1,250
Impeller Size, (in.)	26.5625
Max Impeller Size (in.)	28
Non-Overloading Power (hp)	1,163

As shown in Figure 3.6, four pumps similar in size to Pumps 4 and 5 are required to meet the historical operating points provided by ECWA. This would require a fifth pump to be installed to provide N+1 redundancy and assure that ECWA can meet all operating conditions with one pump out of service. Figure 3.7 indicates that three 1,250 hp Patterson pumps would be required to meet these same operating conditions. To provide N+1 redundancy, a fourth Patterson would be necessary for ECWA to meet all operating conditions with one pump out of service.

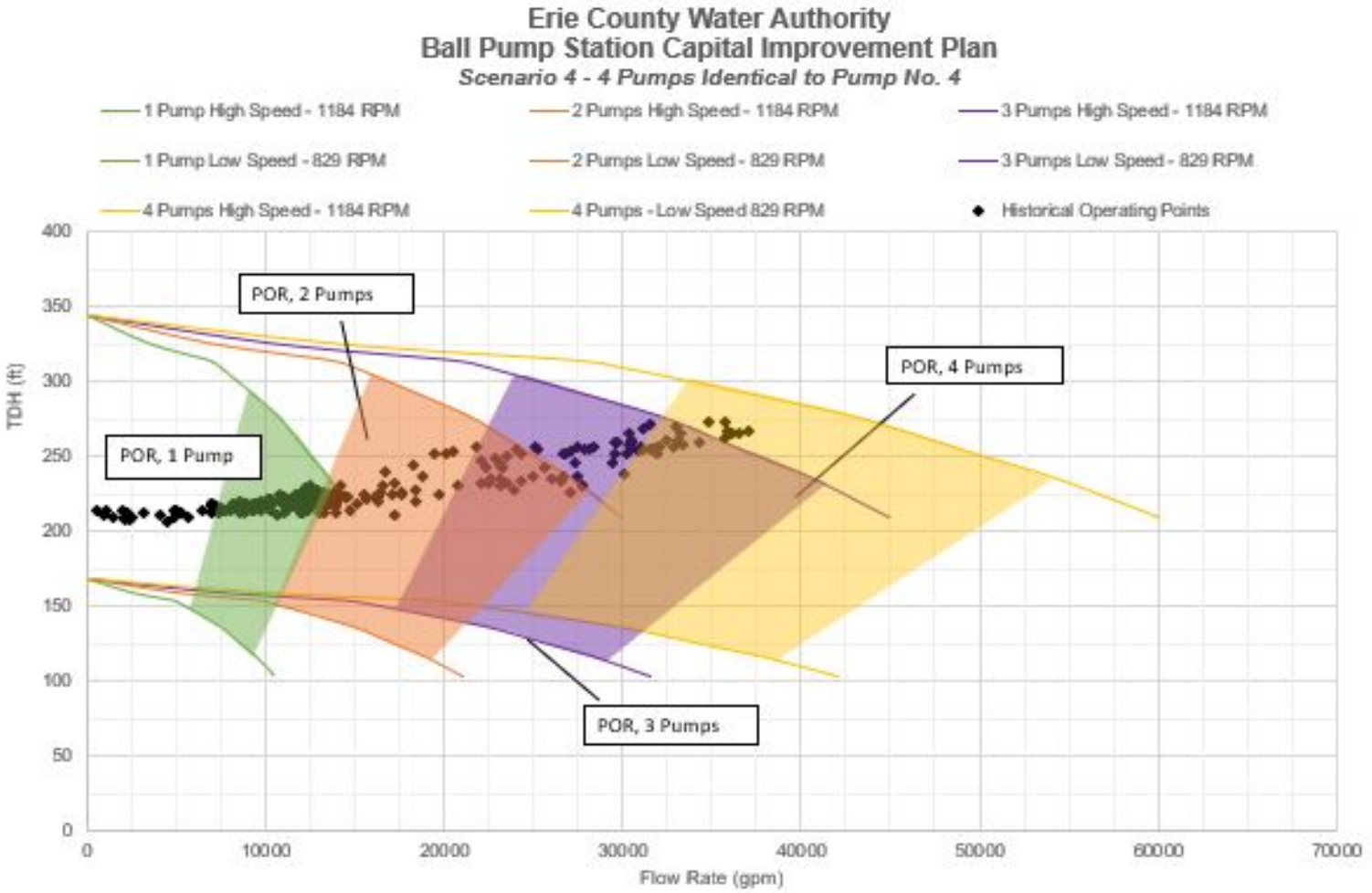


Figure 3.6: Operating Scenario 4 – Four Pumps Identical to Pump 4

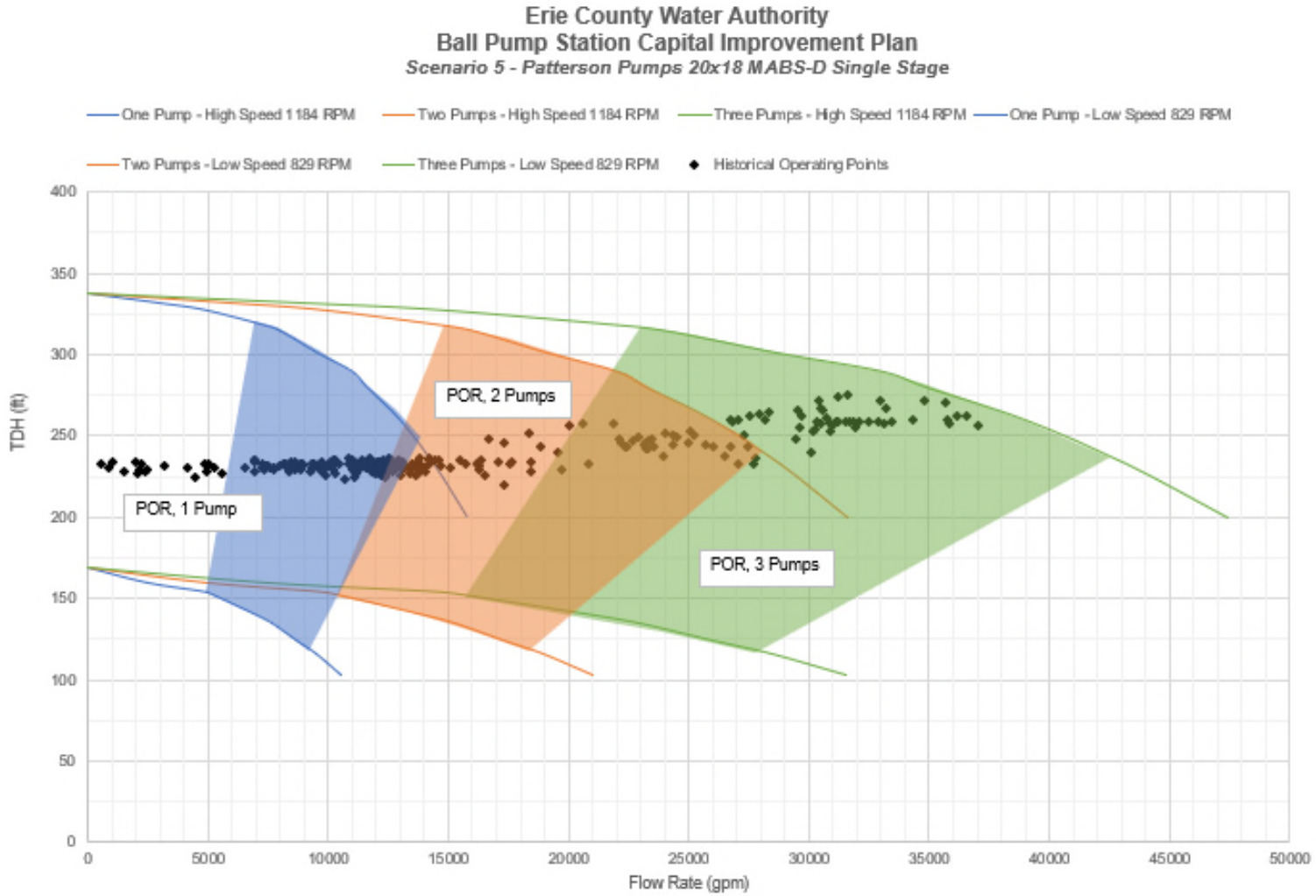


Figure 3.7: Operating Scenario 5 – Patterson Pumps 20x18 MABS-D Single Stage

3.5 Future Growth Considerations

Overall water demands within the ECWA system have remained relatively stable since 1994 as shown in Figure 3.8:

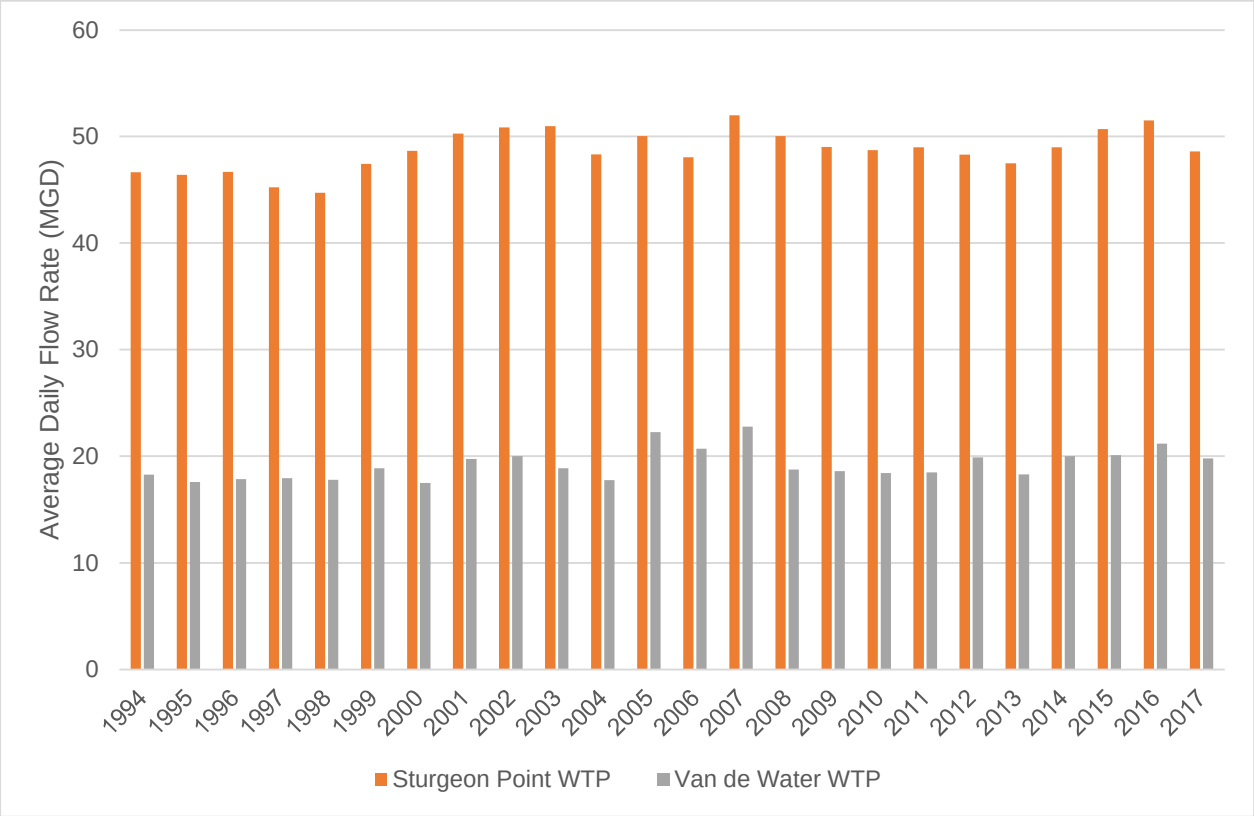


Figure 3.8: WTP Historic Average Daily Flow Rates

Also, from a peak pumping perspective the highest peak hour discharge flows from Ball Pump Station occurred in 2007 and 2012, over 8 to 13 years ago. Therefore, for the purposes of the CIP, the 2012-2017 operating data was used for selecting alternative pumping improvement alternatives. At the June 28, 2019 workshop, ECWA stated that there may be opportunities to provide additional water service to adjacent municipalities. This aligns with the ECWA's Comprehensive Strategic Plan, approved September 2019. Specifically, Strategic Initiative 3 – Expand ECWA's Regional Presence includes efforts to "coordinate with representatives of potential bulk water customers, including Genesee County, the Village of Alden, and the City of North Tonawanda to determine their water supply needs, whether on a daily or emergency supply basis. Analyze our treatment and distribution systems and identify required capital improvements and associated financial responsibility". An expanded ECWA system would result in increased flows from Van de Water and Sturgeon Point Treatment Plants which would also increase the required pumping capacity at Ball Pump Station.

The potential flow increase from Ball Pump Station will be impacted by the location of the watermain interconnections at the Erie/Genesee County line. Some water to Genesee County could be provided by Sturgeon Point Treatment Plant while other interconnections could have water provided by Van de Water Treatment Plant through Ball Pump Station. In January 2020, the ECWA released an RFP titled *Van de Water Treatment Plant Capacity Expansion Project* with the goal of developing a Basis of Design for the expansion of Van de Water Treatment Plant (VdW) from the current rated capacity of 49.5 MGD to 82.5 MGD. Results of the Van de Water Treatment Plan Capacity Expansion Project should align with future capital projects at Ball Pump Station and Sturgeon Point Water Treatment Plant.

If ECWA decides to move forward with a pump improvement project for Ball Pump Station, a more detailed hydraulic analysis should be performed utilizing a computerized hydraulic modeling software program as part of that project's Basis of Design Report. Future demand scenarios should be developed and analyzed through ECWA's hydraulic model to confirm the recommended capacity of Ball Pump Station, identify the necessary transmission main improvements, and create a future system curve for Ball PS that can inform final pump sizing.

To provide a high-level overview of the improvements necessary to expand the Ball PS service area, the flow versus total dynamic head curves of five 1,250 hp Patterson Pumps were plotted with approximate preferred operating regions. The existing system curve was estimated using historic operating points and a best-fit trend line. This analysis shows that a firm capacity of approximately 66 MGD can be achieved with five 1,250 hp pumps. To achieve a facility flow rate of 82.5 MGD, transmission main improvements will be necessary to maintain system pressures within their current ranges. Without any transmission main improvements, Ball Pump Station discharge pressures would most likely exceed 150 psi at a flow of 82.5 MGD. A summary of this scenario is provided in Figure 3.9.

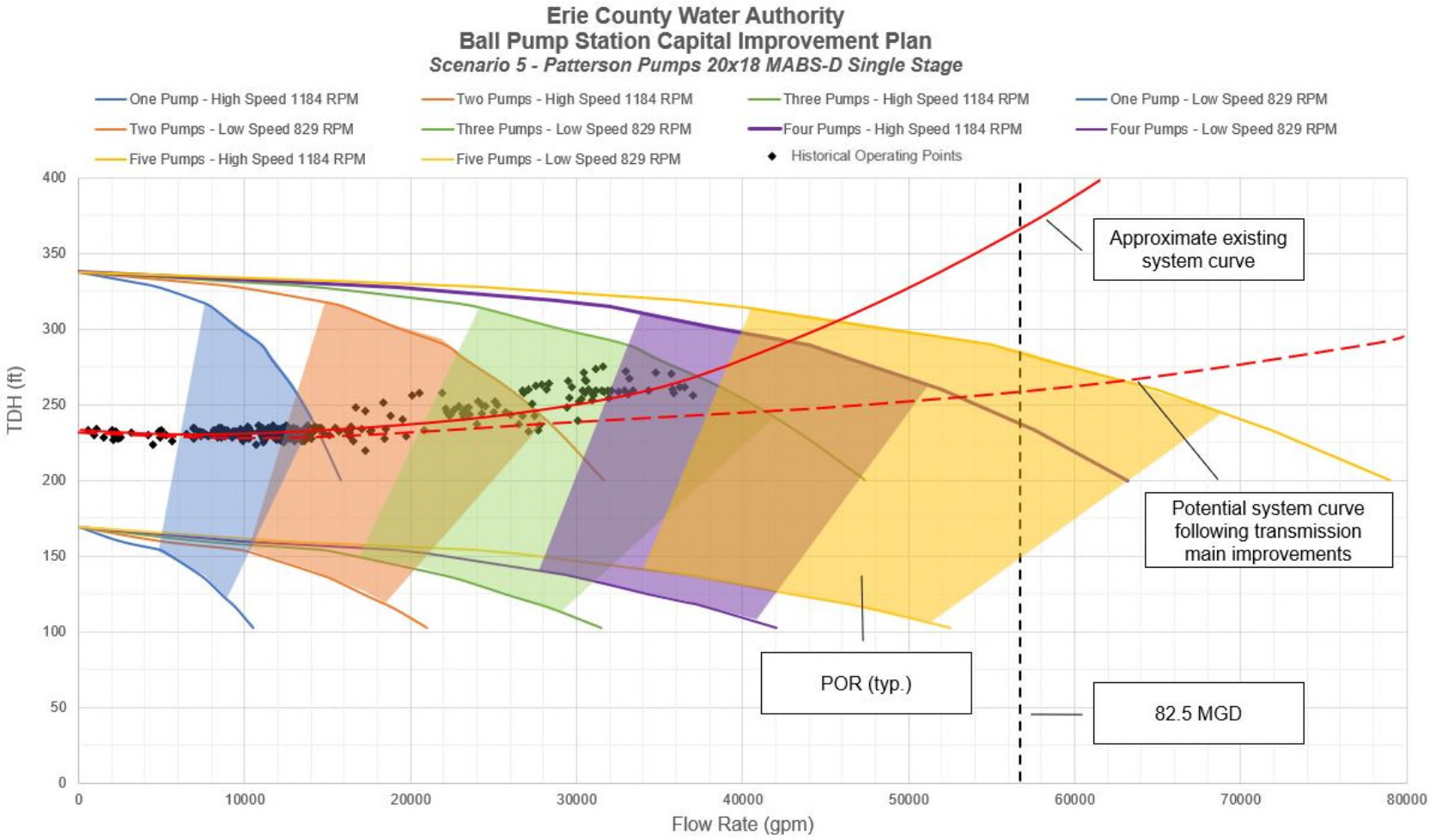


Figure 3.9: Future Growth – Patterson Pumps 20x18 MABS-D Single Stage

4 CAPITAL PROJECT SUMMARY TABLE

Table 4.1 and 4.2 present a summary of the projects included in the CIP, and the probable project cost associated with each (within the parameters discussed in Section 3.1 of this report).

Table 4.1 presents the opinion of probable cost (in 2019 dollars) by project.

Table 4.2 presents a projected cash flow for the first five years with long-term improvements for years 5-10 and 11-15.

Table 4.1 Opinion of Probable Project Cost Summary (2019 USD)

Project	Time Period	Point Estimate	Low Range (-30%)	High Range (+50%)
Project 1A – Pumping System Improvements (Five 1000-HP pumps)	Near Term 2020-2025	$ 11,440,000	$ 8,010,000	$ 17,160,000
Project 1B – Pumping System Improvements (Four 1250-HP pumps)	Near Term 2020-2025	$ 12,840,000	$ 8,990,000	$ 19,260,000
Project 2 – HVAC and Miscellaneous Improvements	Near Term 2025-2030	$ 1,500,000	$ 770,000	$ 2,250,000
Project 3 – Exterior Piping Improvements	Mid-Term 2025-2030	$ 4,260,000	$ 2,990,000	$ 6,390,000
Project 4 – Interior Piping Improvements	Mid-Term 2025-2030	$ 5,800,000	$ 4,060,000	$ 8,700,000
Project 5 – Land Acquisition and Maintenance Facility	Long-Term 2030-2035	$ 510,000	$ 360,000	$ 770,000
Project 6 – Building Exterior Improvements	Long-Term 2030-2035	$ 1,390,000	$ 980,000	$ 2,090,000
Project 7 – Paving Improvements	Mid-Term 2025-2030	$ 880,000	$ 620,000	$ 1,320,000
Total		$25,780,000	$ 17,790,000	$ 38,680,000

Note: Total estimate assumes Project 1A (four pumps) selected.

Table 4.2 Projected Cash Flow Summary

Year	Years 0-5 (2025)		Years 5-10 (2030)			Years 10-15 (2035)	
	Project No. 1: Pumping System Improvements	Project No. 2: HVAC and Misc. Improvements	Project No. 3 Exterior Piping Improvements	Project No. 5: Land Acquisition and Maintenance Facility	Project No. 7 Paving Improvements	Project No. 4: Interior Piping Improvements	Project No. 6: Building Exterior Improvements
2020	$ 600,000						
2021	$ 6,120,000						
2022	$ 3,120,000						
2023	$ 1,460,000						
2024	$ 1,300,000						
2025	$ 860,000						
2026	$ 640,000		$ 610,000				
2027			$ 1,920,000				
2028			$ 2,170,000				
2029			$ 1,080,000				
2030			$ 840,000				
2031						$ 870,000	
2032						$ 2,800,000	
2033						$ 2,940,000	
2034						$ 1,320,000	
2035						$ 910,000	
Escalated Total	$ 14,100,000		$ 6,620,000			$ 8,840,000	

Note: Total estimate assumes Project 1A selected. Annual Inflation Rate = 2%

APPENDIX A

Asset ID and Hierarchy Standard Memo

Technical Memorandum

ARCADIS Design & Consultancy for natural and built assets

To:
Leonard Kowalski, PE
Director of Engineering
Erie County Water Authority

Copies:

Arcadis of New York, Inc.
50 Fountain Plaza
Suite 600
Buffalo
New York 14202
Tel 716 667 0900
Fax 716 842 2612

From:

Arcadis of New York, Inc.

Date:

January 4, 2019

Revised January 20, 2020

Arcadis Project No.:

00041053.MP-80

Subject:

Asset Identification and Hierarchy Standard

1. PURPOSE

This Standard Operating Procedure outlines the standard identification and naming convention for “facilities” (level 5), “processes” (level 6), “asset groups” (level 7), and “assets” (level 8) for the Erie County Water Authority (ECWA) Ball Pump Station Capital Improvement Plan project. This document intends to create a consistent approach to the identification of assets across the pump stations and storage tanks “asset type” (level 4). Identification must be understandable by operations personnel, while also providing information needed for effective planning, management, and maintenance of assets. Refer to the “Erie County Water Authority Ball Pump Station Asset Hierarchy” attachment.

2. ASSET DEFINITION

The following factors will determine if an item is considered an asset for ECWA:

1. A work order will be written for this specific item;
2. A separate condition assessment will be performed on this item; and/or
3. Depreciation or costs need to be tracked separately on this item.

ECWA assets (level 8) will be identified on three sub-levels: “individual asset”, “component”, and “collection”, defined as follows:

2.1 Individual Asset Identification

An individual asset is identified based upon the following criteria:

- Structural: Buildings, tanks, process structures.
- Mechanical: Valves (14-inch diameter and larger), pumps, process equipment.
- Plumbing: Backflow preventers, drains, emergency eyewash/shower.
- Heating, Ventilating, and Air Conditioning (HVAC): Exhaust fans, supply fans, heaters, air conditioning units, and boilers.
- Instrumentation and Controls (I&C): Remote instrumentation (e.g., transmitters, analyzers, controllers, etc.), remote control panels, and SCADA equipment.
- Electrical: Motors/drives (over 50 horsepower (Hp)), motor control centers (MCC), electrical panels, transformers, and generators.

2.2 Component Asset Identification

Common examples of components and their associated assets include:

- Structural components: doors, windows, overhead doors, and loading bays.
- Mechanical components: Valves less than 14 inches in diameter, actuators, and oil filters/hydraulic units.
- I&C: Local instrumentation and control panels, programmable logic controllers (PLC), and remote terminal units (RTU).
- Electrical components: MCC cubicles, 50-Hp and smaller motors/drives.

2.3 Collection Asset Identification

Large groups of similar items are identified together. These groups would be bounded by the limits of the process. This would be used for piping, electrical, HVAC, and other components of a process that can’t be isolated to an individual piece of equipment but are integral to the function of the asset.

2.4 Identification Example

Consider the two-tank, three-pump system shown below, with typical piping, valves, local control panels, and instrumentation. Each tank would be considered an individual asset (level 8) in the tank asset group (level 7). If the pump motors are under 50-Hp each, each pump is considered an individual asset (level 8) under the pump asset group (level 7). The associated motor, valves, instrumentation, and local control panel are considered components to the pump. The piping is considered a collection of items and will be identified as an asset. All of the assets (level 8) and asset groups (level 7) would be identified within the process (level 6).

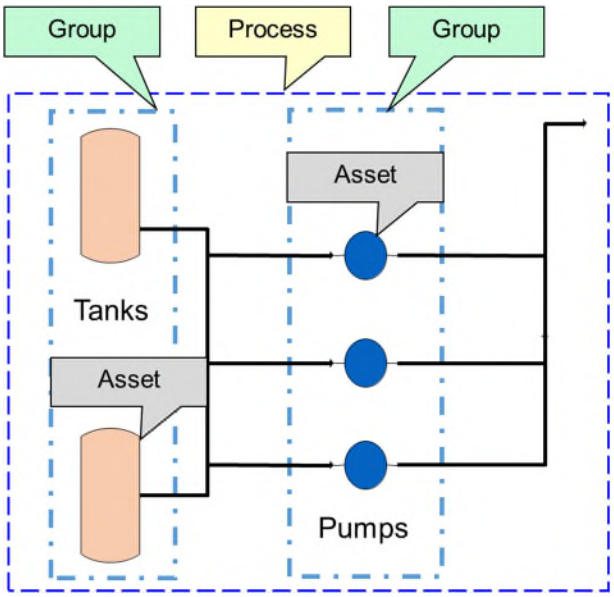


Figure 1: Sample System

3. NAMING STANDARD

Items will be named using a prefix that assigns the item to the asset level. The purpose of the name is to allow staff searching for the asset to have a clear system to perform a search that will provide a short list to easily select the correct asset based on the description. The name is not intended to be searchable without an understanding of the standard and facilities. Asset names will be based on the following subsections, below.

Example: BAL-PMPG-PMP-01

3.1 Facility Prefix

The first three characters identify the facility that the asset is located at as identified in the following table:

Table 1: Facility Prefix

Code	Description
BAL	Ball Pump Station and Tanks

Example: **BAL-**PMPG-PMP-01

3.2 Process Prefix

The subsequent four characters identify the process within the facility as identified in the following table. Where processes are similar, the naming should be similar, such that it is understandable by staff familiar with the processes.

Table 2: Process Prefix

Code	Description
PMPG	Pumping
STOR	Distribution System Water Storage
FACS	Facility-Wide Support Systems

CHEM	Chemical Feed

Example: BAL-**PMPG**-PMP-01

3.3 Asset Group/Asset Prefix

The subsequent three characters identify the asset/equipment within the process as identified in the following table. Where processes are similar, the naming should be similar, such that it is understandable by staff familiar with the processes (such as pumps and motors).

Table 3: Asset Group/Asset Prefix

Code	Description
Process Equipment	
CLI	Chlorine Injector
CMP	Compressor
MTR	Motor
PMP	Pump
Process Structures	
BCR	Bridge Crane
CLW	Clear Well
MHT	Monorail, Hoist, and Trolley
SET	Settling Tank
STR	Structure
SWL	Suction Well
TKB	Bulk Storage Tank (Chemical)
TKD	Day Tank (Chemical)
TNK	Tank (Process)
TRO	Trough
Flow Control Devices	
SLG	Slide or Sluice Gate
STP	Stop Logs
VAL	Altitude Valve
VAR	Air Release Valve
VAV	Air/Vacuum Release Valve
VBA	Ball Valve
VBF	Butterfly Valve
VCK	Check Valve
VCO	Cone Valve

VGA	Gate Valve
VMU	Mud Valve
PPG	Piping
VPL	Plug Valve
VPR	Pressure Relief Valve
VRG	Pressure Regulator Valve
VSO	Solenoid Valve
VSR	Surge Relief Valve
Electrical	
BAT	Battery
BTC	Battery Charger
BUS	Bus (Electrical)
CBP	Circuit Breaker Panel
DIS	Disconnect
GEN	Generator
LIN	Lighting, Interior
LEX	Lighting, Exterior
MCC	Motor Control Center
TSW	Transfer Switch
UPS	Uninterruptible Power Supply
VFD	Variable Frequency Drive
XFR	Transformer
Instrumentation and Controls	
ANZ	Analyzer
DPS	Differential Pressure Switch
FLM	Flow Meter
IOC	I/O Cabinet
LVI	Level Indicator
MST	Motor Starter
OIT	Operator Interface Terminal
PIN	Pressure Indicator
PLC	Programmable Logic Controller
RCP	Remote Control Panel

RTU	Remote Terminal Unit
SCD	SCADA Cabinet
SPL	Sampler
VFT	Venturi Flow Tube
WTS	Weight Scale
Buildings and Grounds	
FNC	Fencing
FTK	Fuel Tank
GBG	Generator Building
MPS	Main Pumping Station
PRK	Parking Lot
PYD	Power Yard
SEC	Security
Heating, Ventilating, and Air Conditioning	
AHU	Air Handling Unit
BOL	Boiler
FAN	Fan
FMT	Fan Motor
UHT	Unit Heater
Plumbing	
BFP	Backflow Preventer
EES	Emergency Eyewash and Shower
HWH	Hot Water Heater
SPM	Sump Pump

Example: BAL-PMPG-**PMP**-01

3.4 Sequential Number Prefix

The final character identifies the sequential number relative to the asset group. The character should be a two-digit number and is assigned left to right or top to bottom. The location prefix would be updated if the physical asset is relocated to a different location.

Example: BAL-PMPG-PMP-**01**

4. ASSET ATTRIBUTE DATA CATEGORIES

The asset attribute data category information should provide sufficient information to describe the asset and its location. For example, the description must include the following:

- Process and Physical Attributes:

  - Asset identification (name and number)
  - Asset type
  - Capacity/Size
- Financial Attributes:
  - Installation date and cost
  - Replacement cost
  - Estimated useful life
- Location:
  - Facility/Building/Room
- Asset Management Attributes:
  - Physical condition
  - Performance condition
  - Consequence of failure
  - Risk

APPENDIX B

Condition Assessment Results

Project	Asset Name	New CMMS ID	Inspection Type	Physical Condition	Process Condition	Redundancy	Most Likely Failure Mode	Total Risk Score (COF x POF)
Pumping System Improvements	Check Valve 3 (Pump 3, 24")	BAL-PMPG-VCK-03	Mechanical	4	2	2	P	4.8
	Pump 4	BAL-PMPG-PMP-04	Mechanical	3	2	2	L	7.25
	Pump 5	BAL-PMPG-PMP-05	Mechanical	3	2	2	L	7.25
	Check Valve 2 (Pump 2, 24")	BAL-PMPG-VCK-02	Mechanical	3	2	2	P	4.75
	Pump 4 Motor	BAL-PMPG-MTR-04	Mechanical	2	2	2	L	5.8
	Pump 5 Motor	BAL-PMPG-MTR-05	Mechanical	1	2	2	L	4.35
	Pump 3	BAL-PMPG-PMP-03	Mechanical	3	2	2	L	2.5
	Pump 1 Motor Starter	BAL-PMPG-MST-01	Electrical	2	2	2	L	3.8
	Pump 2 Motor Starter	BAL-PMPG-MST-02	Electrical	2	2	2	L	3.8
	Pump 1	BAL-PMPG-PMP-01	Mechanical	2	2	2	L	3.8
	Pump 2	BAL-PMPG-PMP-02	Mechanical	2	2	2	L	3.8
	Pump 2 Motor	BAL-PMPG-MTR-02	Mechanical	2	2	2	L	3.8
	Check Valve 1 (Pump 1, 16")	BAL-PMPG-VCK-01	Mechanical	2	2	2	P	3.8
	Check Valve 4 (Pump 4, 20")	BAL-PMPG-VCK-04	Mechanical	2	2	2	P	4.4
	Check Valve 5 (Pump 5, 20")	BAL-PMPG-VCK-05	Mechanical	2	2	2	P	4.4
	Pump 1 Motor	BAL-PMPG-MTR-01	Mechanical	1	2	2	L	2.85
	VFD 1 - Pump No.4	BAL-PMPG-VFD-01	Electrical	2	2	2	L	5.8
	VFD 2 - Pump No.5	BAL-PMPG-VFD-02	Electrical	2	2	2	L	5.8
	Pump 3 Motor Starter	BAL-PMPG-MST-03	Electrical	2	2	2	L	2
	Pump 3 Motor	BAL-PMPG-MTR-03	Mechanical	2	2	2	L	2
Building and Site Improvements	Pump Station Structure 1st Floor	BAL-FACS-MPS-02	Structural	3	1	0	P	5.8
	Pump Station Structure basement	BAL-FACS-MPS-01	Structural	3	1	0	P	5.8
	Sump Pump (Venturi Pits 1)	BAL-PMPG-SPM-03	Mechanical	4	5	0	L	7.65
	Sump Pump (Venturi Pits 2)	BAL-PMPG-SPM-04	Mechanical	4	5	0	L	7.65
	Sump Pump (Venturi Pits 3)	BAL-PMPG-SPM-05	Mechanical	3	2	0	L	4.25
	Venturi Flow Tube 1 (Pit 1)	BAL-PMPG-VFT-01	Mechanical	3	2	2	P	3.25
	Venturi Flow Tube 2 (Pit 2)	BAL-PMPG-VFT-02	Mechanical	3	2	2	P	3.25
	Venturi Flow Tube 3 (Pit 3)	BAL-PMPG-VFT-03	Mechanical	3	2	2	P	3.25
	Motor Starter Control Disconnect 1 - Exhaust Fan 1	BAL-FACS-DIS-01	Electrical	1	1	2	L	1
	Motor Starter Control Disconnect 2 - Exhaust Fan 2	BAL-FACS-DIS-02	Electrical	1	1	2	L	1
	Motor Starter Control Disconnect 3 - Exhaust Fan 3	BAL-FACS-DIS-03	Electrical	2	2	2	L	2
	Motor Starter Control Disconnect 4 - Exhaust Fan 4	BAL-FACS-DIS-04	Electrical	1	1	2	L	1
	Unit Heater - Southwest Basement Corner (2 heaters)	BAL-FACS-UHT-04	HVAC	3	2	2	P	2.5
	Unit Heater - Southeast Basement Corner	BAL-FACS-UHT-05	HVAC	1	2	2	P	1.5
	Unit Heater West Wall Basement	BAL-FACS-UHT-06	HVAC	2	2	2	P	2
	Unit Heater East Wall Basement	BAL-FACS-UHT-07	HVAC	1	2	2	P	1.5
	Unit Heater - Northwest Basement Corner	BAL-FACS-UHT-08	HVAC	1	2	2	P	1.5
	Unit Heater - Northeast Basement Corner (2 heaters)	BAL-FACS-UHT-09	HVAC	1	2	2	P	1.5
	Unit Heater - Boiler Room	BAL-FACS-UHT-10	HVAC	1	1	1	P	1
	Unit Heater - South Wall Operating Floor (2)	BAL-FACS-UHT-11	HVAC	1	1	2	P	1
	Ball Vent Fan 1	BAL-FACS-FAN-01	HVAC	1	1	2	P	1
	Ball Vent Fan 2	BAL-FACS-FAN-02	HVAC	1	1	2	P	1
	Ball Vent Fan 3	BAL-FACS-FAN-03	HVAC	1	1	2	P	1
	Ball Vent Fan 4	BAL-FACS-FAN-04	HVAC	1	1	2	P	1
	Stirring Fans (2) - Operating Floor	BAL-FACS-FAN-05	HVAC	1	1	2	P	1.3
Exterior Piping Improvements	54" Piping	BAL-PMPG-PPG-01	Mechanical	2	3	1	P	6.5
	48" Piping	BAL-PMPG-PPG-02	Mechanical	2	3	1	P	6.5
Interior Process Improvements	Surge Relief Valve 1	BAL-PMPG-VSR-01	Mechanical	4	3	1	P	10.15
	Surge Relief Valve 2	BAL-PMPG-VSR-02	Mechanical	3	4	1	P	10.15
	Surge Relief Valve 3	BAL-PMPG-VSR-03	Mechanical	3	4	1	P	10.15
	Surge Relief Valve 4	BAL-PMPG-VSR-04	Mechanical	3	4	1	P	10.15
	Surge Relief Valve 5	BAL-PMPG-VSR-05	Mechanical	4	3	1	P	10.15
	Rising Stem Gate Valve 1 (SR1)	BAL-PMPG-VGA-01	Mechanical	3	4	1	P	8.05
	Rising Stem Gate Valve 2 (SR1)	BAL-PMPG-VGA-02	Mechanical	3	4	1	P	8.05
	Rising Stem Gate Valve 3 (SR2)	BAL-PMPG-VGA-03	Mechanical	3	4	1	P	8.05
	Rising Stem Gate Valve 4 (SR2)	BAL-PMPG-VGA-04	Mechanical	3	4	1	P	8.05
	Rising Stem Gate Valve 5 (SR3)	BAL-PMPG-VGA-05	Mechanical	2	2	1	P	4.6
	Rising Stem Gate Valve 6 (SR3)	BAL-PMPG-VGA-06	Mechanical	2	2	1	P	4.6
	Rising Stem Gate Valve 7 (SR4)	BAL-PMPG-VGA-07	Mechanical	3	4	1	P	8.05
	Rising Stem Gate Valve 8 (SR4)	BAL-PMPG-VGA-08	Mechanical	3	4	1	P	8.05
	Rising Stem Gate Valve 9 (SR5)	BAL-PMPG-VGA-09	Mechanical	3	4	1	P	8.05
	Rising Stem Gate Valve 10 (SR5)	BAL-PMPG-VGA-10	Mechanical	2	2	1	P	4.6
	Altitude Valve 1	BAL-PMPG-VAL-01	Mechanical	2	5	1	P	4.55
	Altitude Valve 2	BAL-PMPG-VAL-02	Mechanical	3	5	1	P	5.2
	Altitude Valve 3	BAL-PMPG-VAL-03	Mechanical	3	5	1	P	5.2

Interior Process Improvements	Altitude Valve 4	BAL-PMPG-VAL-04	Mechanical	2	5	1	P	4.55
	36" Piping	BAL-PMPG-PPG-03	Mechanical	4	3	1	P	9.1
	30" Piping	BAL-PMPG-PPG-04	Mechanical	3	3	1	P	7.8
	48" Butterfly Valve 1 (North Tank)	BAL-PMPG-VBF-21	Mechanical	1	2	1	P	3
	48" Butterfly Valve 2 (South Tank)	BAL-PMPG-VBF-10	Mechanical	1	2	1	P	3
	54" Butterfly Valve 1 (North Tank)	BAL-PMPG-VBF-09	Mechanical	1	2	1	P	3
	54" Butterfly Valve 2 (South Tank)	BAL-PMPG-VBF-02	Mechanical	1	2	1	P	3
	24" Butterfly Valve 6A (AV-1)	BAL-PMPG-VBF-32	Mechanical	1	2	2	P	1.95
	24" Butterfly Valve 6E (AV-1)	BAL-PMPG-VBF-33	Mechanical	1	2	2	P	1.95
	24" Butterfly Valve 6B (AV-2)	BAL-PMPG-VBF-34	Mechanical	1	2	2	P	1.95
	24" Butterfly Valve 6F (AV-2)	BAL-PMPG-VBF-35	Mechanical	1	2	2	P	1.95
	24" Butterfly Valve 6C (AV-3)	BAL-PMPG-VBF-36	Mechanical	2	2	2	P	2.6
	24" Butterfly Valve 6G (AV-3)	BAL-PMPG-VBF-37	Mechanical	1	2	2	P	1.95
	24" Butterfly Valve 6D (AV-4)	BAL-PMPG-VBF-38	Mechanical	2	2	2	P	2.6
	24" Butterfly Valve 6H (AV-4)	BAL-PMPG-VBF-39	Mechanical	2	2	2	P	2.6
Additional Assets	Power Yard	BAL-FACS-PYD-01	Electrical	1	2	2	P	6
	Switch 201 on Line 181	BAL-FACS-TSW-03	Electrical	1	2	2	L	3
	Switch 101 on Line 182	BAL-FACS-TSW-02	Electrical	1	2	2	L	3
	Switch 100 on Cross	BAL-FACS-TWS-02	Electrical	1	2	2	L	3
	North Tank 4.2MG	BAL-STOR-TNK-01	Structural	1	2	2	P	6
	Fencing	BAL-FACS-FNC-01	Structural	3	3	0	P	4.8
	Flow Monitor North	BAL-PMPG-FLM-01	Mechanical	2	1	1	L	2.4
	Flow Monitor South	BAL-PMPG-FLM-03	Mechanical	2	1	1	L	2.4
	Remote Terminal Unit	BAL-PMPG-RTU-01	Electrical	2	2	1	L	3.2
	48" Butterfly Valve 3F	BAL-PMPG-VBF-19	Mechanical	3	2	2	P	3.25
	Pressure Release Valve	BAL-PMPG-VPR-01	Mechanical	3	2	2	P	3.25
	Bus 1-A-1 (MCC-1)	BAL-FACS-BUS-01	Electrical	2	2	1	L	3.2
	Transformer - T3-A - 300 KVA	BAL-FACS-XFR-02	Electrical	2	2	1	L	6
	Main Breaker Panels	BAL-FACS-CBP-01	Electrical	2	2	1	L	5.2
	Sump Pump (west wall)	BAL-FACS-SPM-01	Mechanical	3	2	1	L	3.25
	30" Butterfly Valve 12C (Pump 5S)	BAL-PMPG-VBF-31	Mechanical	3	2	2	P	4
	Transformer T3-B - 500 KVA	BAL-FACS-XFR-01	Electrical	2	2	1	L	6
	54" Butterfly Valve 9A	BAL-PMPG-VBF-03	Mechanical	3	2	2	P	3.25
	Auto Transfer Switch	BAL-FACS-TSW-01	Electrical	1	2	1	L	1.95
	Flow Monitor Center	BAL-PMPG-FLM-02	Mechanical	3	1	1	L	3.2
	Tank Level Indicator	BAL-STOR-LVI-01	Mechanical	3	1	1	L	2.6
	Discharge Pressure Indicator	BAL-PMPG-PIN-02	Mechanical	3	1	1	L	2.6
	Pump 1 Diff Pressure Switch	BAL-PMPG-DPS-01	Mechanical	2	2	2	L	2.6
	Pump 2 Diff Pressure Switch	BAL-PMPG-DPS-02	Mechanical	2	2	2	L	2.6
	Pump 3 Diff Pressure Switch	BAL-PMPG-DPS-03	Mechanical	2	2	2	L	2
	Pump 4 Diff Pressure Switch	BAL-PMPG-DPS-04	Mechanical	2	2	2	L	3.2
	Pump 5 Diff Pressure Switch	BAL-PMPG-DPS-05	Mechanical	2	2	2	L	3.2
	Lead Batteries (4)	BAL-FACS-BAT-01	Electrical	2	2	1	P	3.4
	24" Butterfly Valve 4E (Pump 5D)	BAL-PMPG-VBF-41	Mechanical	3	2	2	P	4.75
	Check Valve 6 (Disc/Suct Hdr, 30")	BAL-PMPG-VCK-06	Mechanical	2	2	2	P	3.8
	30" Butterfly Valve 4B (Pump 2D)	BAL-PMPG-VBF-28	Mechanical	2	2	2	P	3.8
	30" Butterfly Valve 12A (Pump 2S)	BAL-PMPG-VBF-27	Mechanical	2	2	2	P	3.8
	36" Butterfly Valve 5B (Pump 3S)	BAL-PMPG-VBF-23	Mechanical	2	2	2	P	2.6
	24" Butterfly Valve 4D (Pump 4D)	BAL-PMPG-VBF-40	Mechanical	2	2	2	P	4.4
	30" Butterfly Valve 12B (Pump 4S)	BAL-PMPG-VBF-30	Mechanical	2	2	2	P	4.4
	54" Butterfly Valve 13A (Suct Hdr)	BAL-PMPG-VBF-05	Mechanical	2	2	2	P	2.6
	54" Butterfly Valve 8A (Suct Hdr South)	BAL-PMPG-VBF-04	Mechanical	2	2	2	P	2.6
	54" Butterfly Valve 13B (Suct Hdr)	BAL-PMPG-VBF-06	Mechanical	2	2	2	P	2.6
	48" Butterfly Valve 2C	BAL-PMPG-VBF-18	Mechanical	2	2	2	P	2.6
	60" Butterfly Valve 7A	BAL-PMPG-VBF-01	Mechanical	2	2	2	P	2.6
	54" Butterfly Valve 9C	BAL-PMPG-VBF-08	Mechanical	2	2	2	P	2.6
	48" Butterfly Valve 3A	BAL-PMPG-VBF-11	Mechanical	2	2	2	P	2.6
	48" Butterfly Valve 3E	BAL-PMPG-VBF-17	Mechanical	2	2	2	P	2.6
	48" Butterfly Valve 3G	BAL-PMPG-VBF-20	Mechanical	2	2	2	P	2.6
	48" Butterfly Valve 3D	BAL-PMPG-VBF-16	Mechanical	2	2	2	P	2.6
	48" Butterfly Valve 3C	BAL-PMPG-VBF-14	Mechanical	2	2	2	P	2.6
	48" Butterfly Valve 2B	BAL-PMPG-VBF-15	Mechanical	2	2	2	P	2.6

Additional Assets	48" Butterfly Valve 3B	BAL-PMPG-VBF-13	Mechanical	2	2	2	P	2.6
	48" Butterfly Valve 2A	BAL-PMPG-VBF-12	Mechanical	2	2	2	P	2.6
	30" Butterfly Valve 1A	BAL-PMPG-VBF-24	Mechanical	2	2	2	P	2.6
	30" Butterfly Valve 1B	BAL-PMPG-VBF-25	Mechanical	2	2	2	P	2.6
	Butterfly Valve 5E	BAL-PMPG-VBF-42	Mechanical	2	2	2	P	2.6
	Butterfly Valve 5D	BAL-PMPG-VBF-43	Mechanical	2	2	2	P	2.6
	Butterfly Valve 5C	BAL-PMPG-VBF-44	Mechanical	2	2	2	P	2.6
	54" Butterfly Valve 9B	BAL-PMPG-VBF-07	Mechanical	2	2	2	P	2.6
	Generator Building	BAL-FACS-GBG-01	Structural	2	1	1	P	3.45
	Hot Water Boiler No.1	BAL-FACS-BOL-01	HVAC	1	2	2	P	2.55
	Batteries for Best Access Controller	BAL-FACS-BAT-03	Electrical	1	2	2	P	2.1
	Drive Motor for Fan 1	BAL-FACS-FMT-01	HVAC	1	2	2	L	1.95
	Drive Motor for Fan 2	BAL-FACS-FMT-02	HVAC	1	2	2	L	1.95
	Drive Motor for Fan 3	BAL-FACS-FMT-03	HVAC	1	2	2	L	1.95
	Drive Motor for Fan 4	BAL-FACS-FMT-04	HVAC	1	2	2	L	1.95
	16" Gate Valve	BAL-PMPG-VGA-11	Mechanical	1	2	1	P	1.95
	Lead Batteries (2) - ATS	BAL-FACS-BAT-02	Electrical	1	2	2	P	2.1
	South Tank 4.2MG	BAL-STOR-TNK-02	Structural	1	1	2	P	4
	30" Butterfly Valve 4A (Pump 1D)	BAL-PMPG-VBF-26	Mechanical	1	2	2	P	2.85
	36" Butterfly Valve 5A (Pump 1S)	BAL-PMPG-VBF-22	Mechanical	1	2	2	P	2.85
	30" Butterfly Valve 4C (Pump 3D)	BAL-PMPG-VBF-29	Mechanical	1	2	2	P	1.95
	12" Butterfly Valve 1 (North Tank)	BAL-PMPG-VBF-46	Mechanical	1	2	1	P	2.4
	12" Butterfly Valve 2 (South Tank)	BAL-PMPG-VBF-45	Mechanical	1	2	1	P	2.4
	Battery Charger	BAL-FACS-BTC-01	Electrical	1	2	1	P	1.5
	Generator 2000KW	BAL-FACS-GEN-01	Electrical	1	1	1	P	2.3
	Pump Station Structure Roof	BAL-FACS-MPS-03	Structural	1	1	0	P	3.3
	Ball Tank 1 (400 Gal Diesel)	BAL-FACS-FTK-01	Mechanical	1	1	1	P	2.8
	Ball Tank 2 (4000 Gal Diesel)	BAL-FACS-FTK-02	Structural	1	1	1	P	3.1
	Suction Pressure Indicator	BAL-PMPG-PIN-01	Mechanical	1	1	1	L	1.6
	Sump Pump (East Wall)	BAL-FACS-SPM-02	Mechanical	1	1	2	L	1.3
	Bridge Crane - West Bay - 15 Ton	BAL-FACS-BCR-01	Structural	1	1	1	P	2
	Bridge Crane - East Bay -15 Ton	BAL-FACS-BCR-02	Structural	1	1	1	P	2
	Hot Water Circulation Pump - Boiler	BAL-FACS-PMP-06	Mechanical	1	1	1	P	1.3
	Hot Water Heater (40 Gal)	BAL-FACS-HWH-01	Mechanical	1	1	0	P	1.3
	Fluoride Analyzer	BAL-FACS-ANZ-01	Mechanical	1	1	1	L	1.3
	Expansion Tank-Hot Water Tank	BAL-FACS-HWH-02	Mechanical	1	1	1	P	1.3
	Hot Water Boiler No.2	BAL-FACS-BOL-02	HVAC	1	1	2	P	1.3

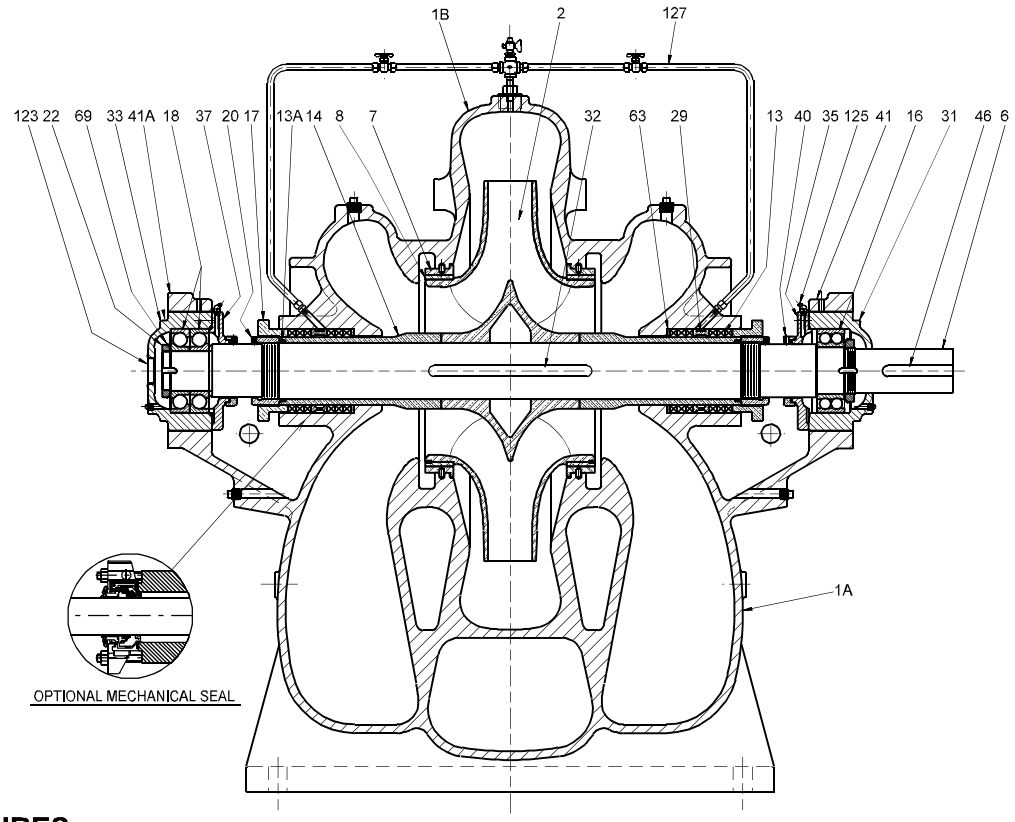
APPENDIX C

Manufacturer Information

Toccoa, Georgia
U.S.A.

20 x 18 MABS
SPLIT CASE PUMP

SECTION	A18
PAGE	14
DATE:	JAN. 2,2000



FEATURES:

- REPLACEABLE PACKING BOX BUSHING PROVIDED TO PROTECT CASING FROM PACKING WEAR
- MACHINED MOUNTING SURFACES
- DEFLECTORS PROVIDED TO PREVENT PRODUCT FROM ENTERING BEARING HOUSINGS
- CASING RINGS PROVIDED TO PROTECT CASING FROM WEAR
- DYNAMICALLY BALANCED IMPELLER
- HYDROSTATICALLY TESTED TO 1 1/2 TIMES SHUT-OFF
- INTEGRALLY CAST PACKING BOXES
- PREDRILLED AND TAPPED PACKING BOX DRIP POCKETS FOR REMOVAL OF PACKING BOX LEAKAGE
- SHAFT SLEEVES LOCKED AGAINST ROTATION BY IMPELLER KEY

ITEM	DESCRIPTION	MATERIAL
1A	LOWER CASING	Cast Iron - ASTM A48-CL40
1B	UPPER CASING	Cast Iron - ASTM A48-CL40
2	IMPELLER	ASTM B148 C95400 Bronze
6	SHAFT	AISI 4340
7	CASING RING	ASTM B505 C95200 Bronze
8	IMPELLER WR RING	ASTM B505 C95400 Bronze
13	PACKING	TFE Graphite Impregnated
13A	SHAFT SLEEVE O-RING	Nitrile (Buna N)
14	SHAFT SLEEVE	ASTM B505 C95400 Bronze
16	INBOARD BEARING	Mfg Standard
17	PACKING GLAND	ASTM B584 C83600 Bronze
18	OUTBOARD BEARING	Mfg Standard
20	SHAFT SLEEVE NUT	ASTM B505 C95400 Bronze
22	LOCK NUT	Steel - Mfg Standard
29	LANTERN RING	ASTM B505 C95400 Bronze

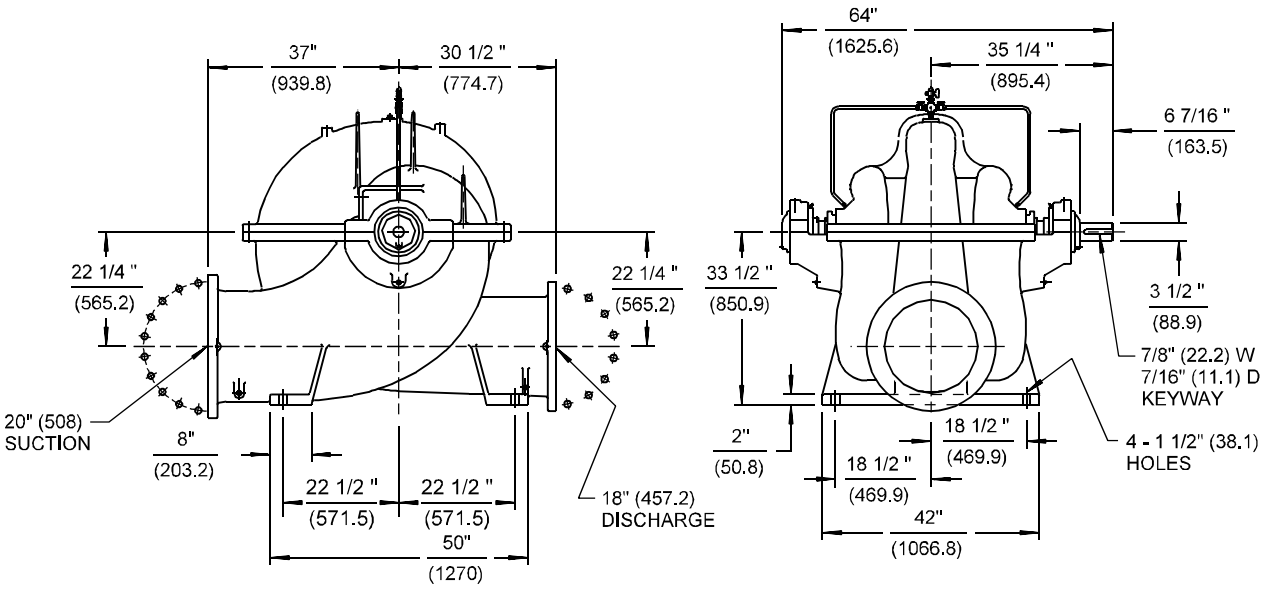
ITEM	DESCRIPTION	MATERIAL
31	INBOARD BRG HOUSING	Cast Iron - ASTM A48-CL30
32	IMPELLER KEY	Stainless - AISI 304
33	OUTBOARD BRG HSG	Cast Iron - ASTM A48-CL30
35	INBOARD BRG COVER	Cast Iron - ASTM A48-CL30
37	OUTBOARD BRG COVER	Cast Iron - ASTM A48-CL30
40	DEFLECTOR	Aluminum
46	COUPLING KEY	AISI 1018 Cold Drawn Steel
63	STUFFING BOX BUSHING	ASTM B505 C95400 Bronze
69	BEARING LOCKWASHER	Steel - Mfg Standard
123	BEARING END COVER	Steel - Mfg Standard
125	GREASE FITTING	Mfg Standard
127	SEAL WATER PIPING	Copper Tubing

Toccoa, Georgia
U.S.A.

20 x 18 MABS
SPLIT CASE PUMP

SECTION	A18
PAGE	15
DATE:	JAN. 2,2000

	SUCTION					DISCHARGE				
FLANGE	O.D.	THK	HOLES	SIZE	D.B.C.	O.D.	THK	HOLES	SIZE	D.B.C.
125#	27 3/4" (708.9)	1 13/16" (46.0)	20	1 1/4" (31.8)	25" (635)	25" (635)	1 11/16" (42.9)	16	1 1/4" (31.8)	22 3/4" (577.9)
250#	30 1/2" (774.7)	2 1/2" (63.5)	24	1 3/8" (34.9)	27" (685.8)	28" (711.2)	2 3/8" (60.3)	24	1 3/8" (34.9)	24 3/4" (628.7)



ENGINEERING DATA:

GENERAL	
BARE PUMP WEIGHT	10,000#
MAXIMUM OPERATING TEMPERATURE - F °	200
MAXIMUM WORKING PRESSURE	175
HYDROSTATIC TEST PRESSURE	275

CASING	
CASING MATERIAL	CAST IRON
STANDARD DISCHARGE FLANGE RATING	125# - FF
STANDARD SUCTION FLANGE RATING	125# - FF
CASING WALL THICKNESS	11/16"
VENT/PRIMING NPT	3/4"
GAUGE NPT	1/4"
DRAIN NPT	1/2"

IMPELLER	C-4884	C-7173
MAXIMUM DIAMETER	29"	28"
MINIMUM DIAMETER	24 1/2"	22"
MAXIMUM SHPERE	2 3/4"	2 1/2"
NUMBER OF VANES	8	7
EYE AREA SQ. IN.	224	176
WEIGHT	503#	435#
WR ^2 for MAXIMUM DIAMETER (LBS-FT^2)	424	382
NOMINAL DIAMETRICAL WEAR RING CLEARANCE	.017	.017

SHAFT AND BEARING		
SHAFT DIAMETER	AT COUPLING	3 1/2"
	AT IMPELLER	4 1/2"
	AT SHAFT SLEEVE	4 1/2"
CENTER TO CENTER OF BEARINGS		51"
KEYWAYS	AT COUPLING	7/8" X 7/16"
	AT IMPELLER	7/8" X 7/16"
INBOARD BEARING		5219
OUTBOARD BEARING		7316 BECB

PACKING BOX		
SLEEVE O.D.		5 3/8"
PACKING BOX BORE		6 5/8"
PACKING BOX DEPTH		5 15/16"
BOX INLET NPT		1/4"
PACKING	SIZE	5/8"
	NUMBER OF RINGS	7
	WATER SEAL RING WIDTH	1 1/4"

Pump Data Sheet - Patterson 60 Hz Pumps

Company: Erie County Water Authority
Name: Ball Pump #4
Date: 5/16/2019

Pumping Technology For Tomorrow's World
Patterson™
A Gorman-Rupp Company

Pump:

Size: 20x18 MABS-D

Type: HSC
Synch speed: 1200 rpm

Speed: 1180 rpm
Dia: 26.5625 in

Curve: 18MABS-D

Impeller: C-7173

Specific Speeds:

Ns: 1771
Nss: ---

Dimensions:

Suction: 20 in
Discharge: 18 in

Pump Limits:

Temperature: 200 °F
Pressure: 175 psi g
Sphere size: 2.5 in

Power: ---
Eye area: ---

Search Criteria:

Flow: 12000 US gpm

Head: 275 ft

Fluid:

Water
Density: 62.32 lb/ft³
Viscosity: 0.9946 cP

Temperature: 68 °F
Vapor pressure: 0.3391 psi a
Atm pressure: 14.7 psi a

NPSHa: ---

Motor:

Standard: ---
Enclosure: ---

Speed: ---
Frame: ---

Sizing criteria: Max Power on Design Curve

---- Data Point ----

Flow:	12000 US gpm
Head:	275 ft
Eff:	88.1%
Power:	947 hp
NPSHr:	28.6 ft

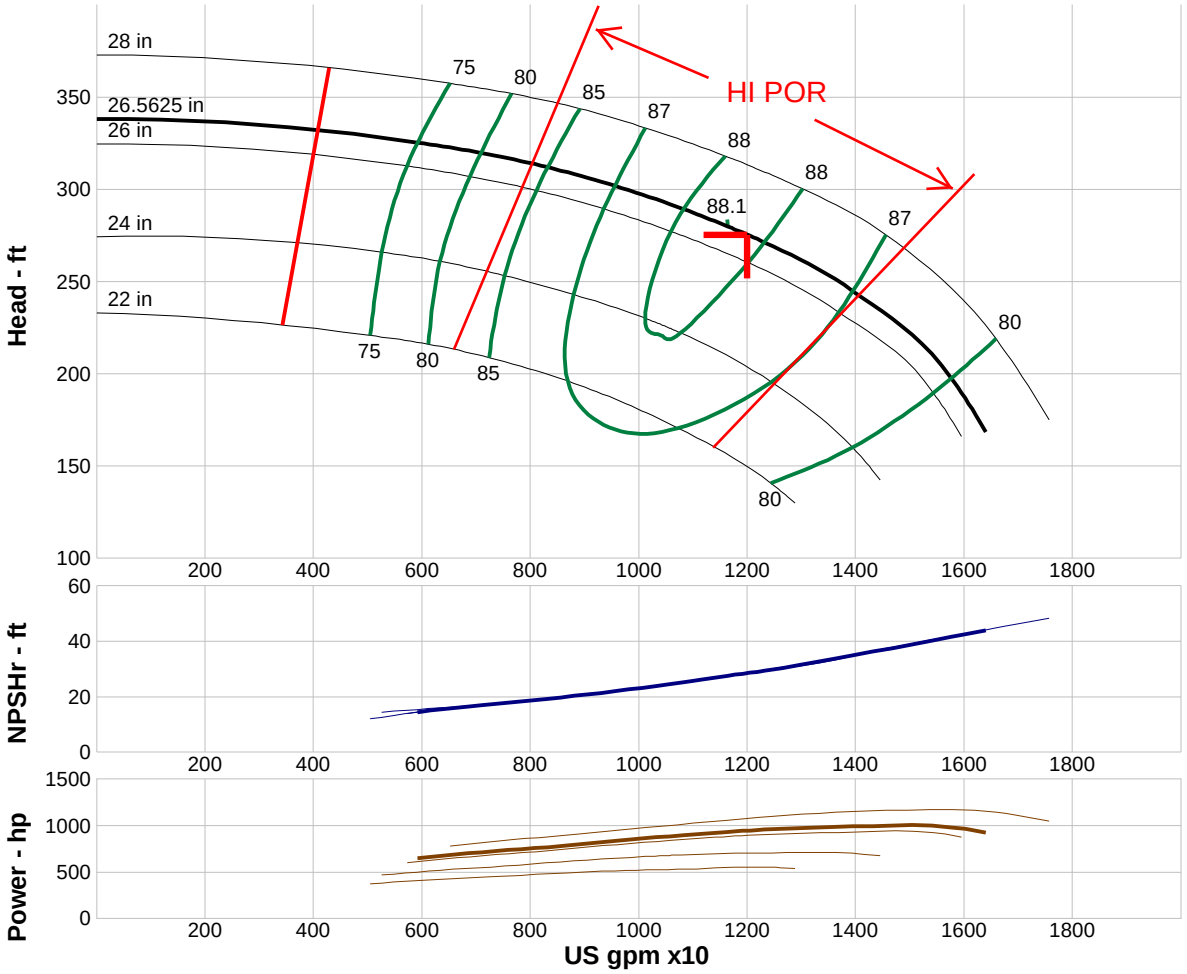
---- Design Curve ----

Shutoff head:	338 ft
Shutoff dP:	146 psi
Min flow:	4072 US gpm
BEP:	88.1% @ 11635 US gpm

NOL power:
991 hp @ 13943 US gpm

-- Max Curve --

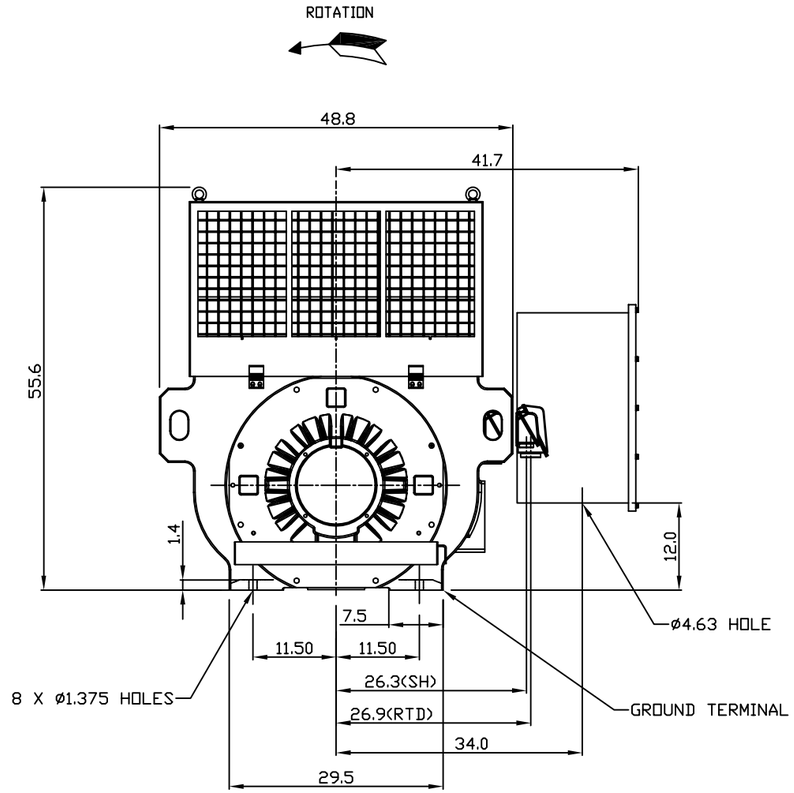
Max power:
1163 hp @ 14549 US gpm

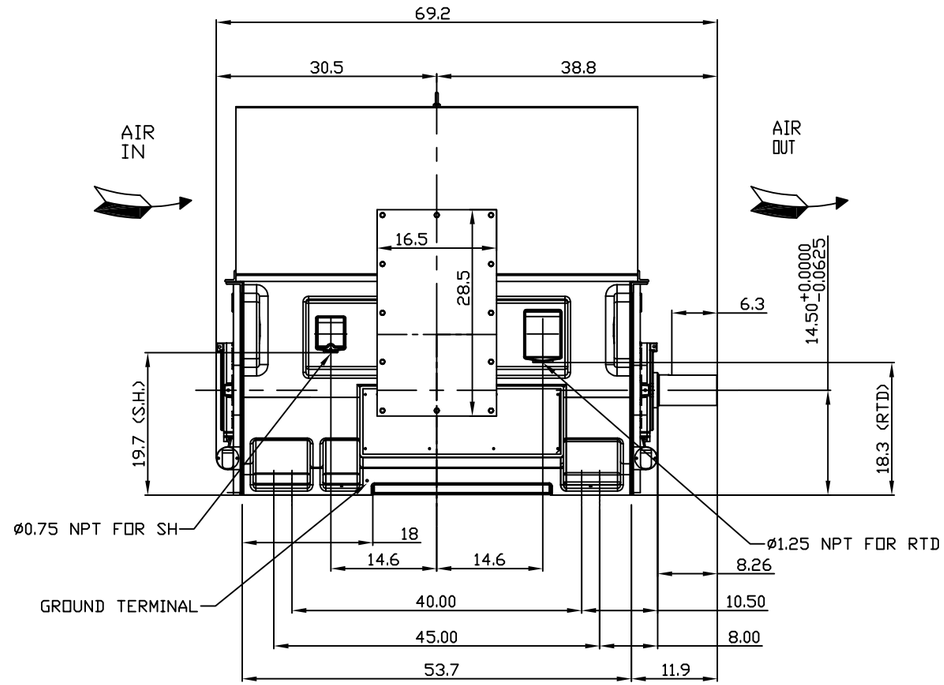


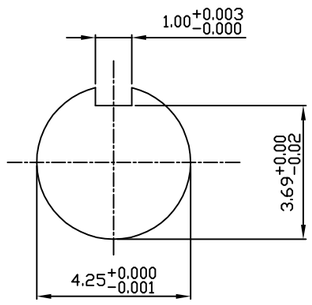
In accordance with the Hydraulic Institute Standards, pump is guaranteed for one set of conditions. Performance guarantees are based on shop test and when handling clear, cold, fresh water at sea level and at a temperature no greater than 85 degrees F. Suction lift must not exceed that shown on curve.

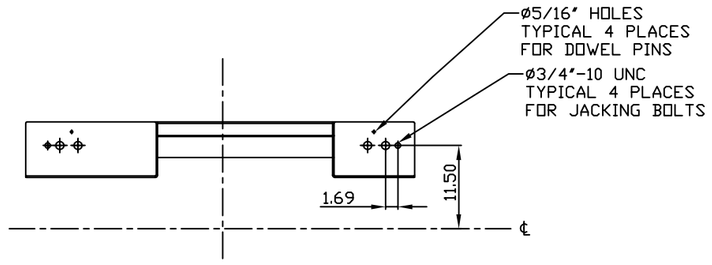
Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
14400	1180	233	85.2	989	36.7
12000	1180	275	88.1	947	28.6
9600	1180	301	87	839	22.1
7200	1180	319	80.5	720	17.2
4800	1180	328	70.2	584	12.2









TECHNICAL INFORMATION

1. BEARING LUBRICATION — DE: Mobil Polyrex EM; ODE: Mobil Polyrex EM
2. BEARING TYPE — DE: 6326C3; ODE: 6326C3 INSULATED
3. WINDING TEMP. DETECTORS
   NUMBER AND TYPE: 6xRTD(Pt0°C-100ohm)
   LOCATION: IN STATOR SLOT
4. BEARING TEMP. DETECTORS
   NUMBER AND TYPE: _____
5. SPACE HEATER 1 PHASE
   VOLTS: 120 WATTS: 400
6. ROTATION: CCW VIEWED FROM NON DRIVE END
   THIS MOTOR IS BI DIRECTIONAL
7. MOTOR PAINT COLOR: _____
8. APPROX. WEIGHT: 7300 Lbs
9. ACCESORIES:

DRAWING LIST

MAIN TERMINAL BOX
130-7532-02

AUX TERMINAL BOX FOR	
SPACE HEATER	130-7520-50
R.T.D.	130-7522-51
THERMISTOR	N/A
PRODUCTION #	N/A

NO.	REVISION	BY	DATE
3	UPDATE	RWS	1/2/14
2	UPDATE	MH	8/15/05
1	UPDATE	RW	4/16/03
0	FIRST ISSUE	RW	3/25/03

MOTOR OUTLINE FOR THREE PHASE INDUCTION MOTOR

CUSTOMER NAME				P.O. NO.	MOTOR TAG NO.	
OUTPUT HP	POLE 6	VOLTAGE V	FREQUENCY Hz	FULL LOAD SPEED (min^{-1})	TOSHIBA MODEL NO.	
TYPE	FORM	INS. CLASS F	RATING CONT.	FRAME 5811/12	S.F.	ENCLOSURE WP-I

TOSHIBA INTERNATIONAL CORPORATION
HOUSTON, TEXAS U.S.A.

3rd ANGLE PROJ.	PREPARED BY:	DATE:	CHECKED BY:	DATE:	DRAWING NO.:	REV.
	R. WILKINS	03/25/03	M. HO	04/01/03	MDSL 0086-03	3

Issued Date	1/23/2018	Transmit #	
Issued By	dschoeck	Issued Rev	

TOSHIBA
Leading Innovation >>>

TYPICAL MOTOR PERFORMANCE DATA

Model: M206WPAL11E-A

HP	kW	Pole	FL RPM	Frame	Voltage	Hz	Phase	FL Amps
1000	746	6	1185	5812US	4000	60	3	142.96
Enclosure	**IP**	**Ins. Class**	**S.F.**	**Duty**	**NEMA Nom. Eff.**	**NEMA Design**	**kVA Code**	**Ambient (°C)**
WP-I	23	F	1.15	CONT	96.2	-	F	40 C

Load	HP	kW	Amperes	Efficiency (%)	Power Factor (%)
Full Load	1000	745.7	142.9	96.2	78.2
¾ Load	750.00	559.3	115.1	96.2	72.8
½ Load	500.00	372.9	91.3	95.6	61.6
¼ Load	250.00	186.4	74.2	92.9	39.0
No Load			64.0		2.8
Locked Rotor			798.330800028853		25.5

Torque				Rotor wk² Inertia
Full Load (lb-ft)	**Locked Rotor (% FLT)**	**Pull Up (% FLT)**	**Break Down (% FLT)**	**(lb-ft²)**
4432	145	125	210	467.14

Safe Stall Time(s)		Sound Pressure dB(A) @ 1M	Bearings*		Approx. Motor Weight
Cold	**Hot**		**DE**	**NDE**	**(lbs)**
6.2	2.4	-	6326C3	6326C3 INS	0

*Bearings are the only recommended spare part(s).

Motor Options:
Product Family:ODP & WP-I
Mounting:Footed,Shaft:US Shaft

Customer	
Customer PO	
Sales Order	
Project #	

Tag:

All characteristics are average expected values.

Issued Date	1/23/2018	Transmit #	
Issued By	dschoeck	Issued Rev	

TOSHIBA
Leading Innovation >>>

SPEED TORQUE/CURRENT CURVE

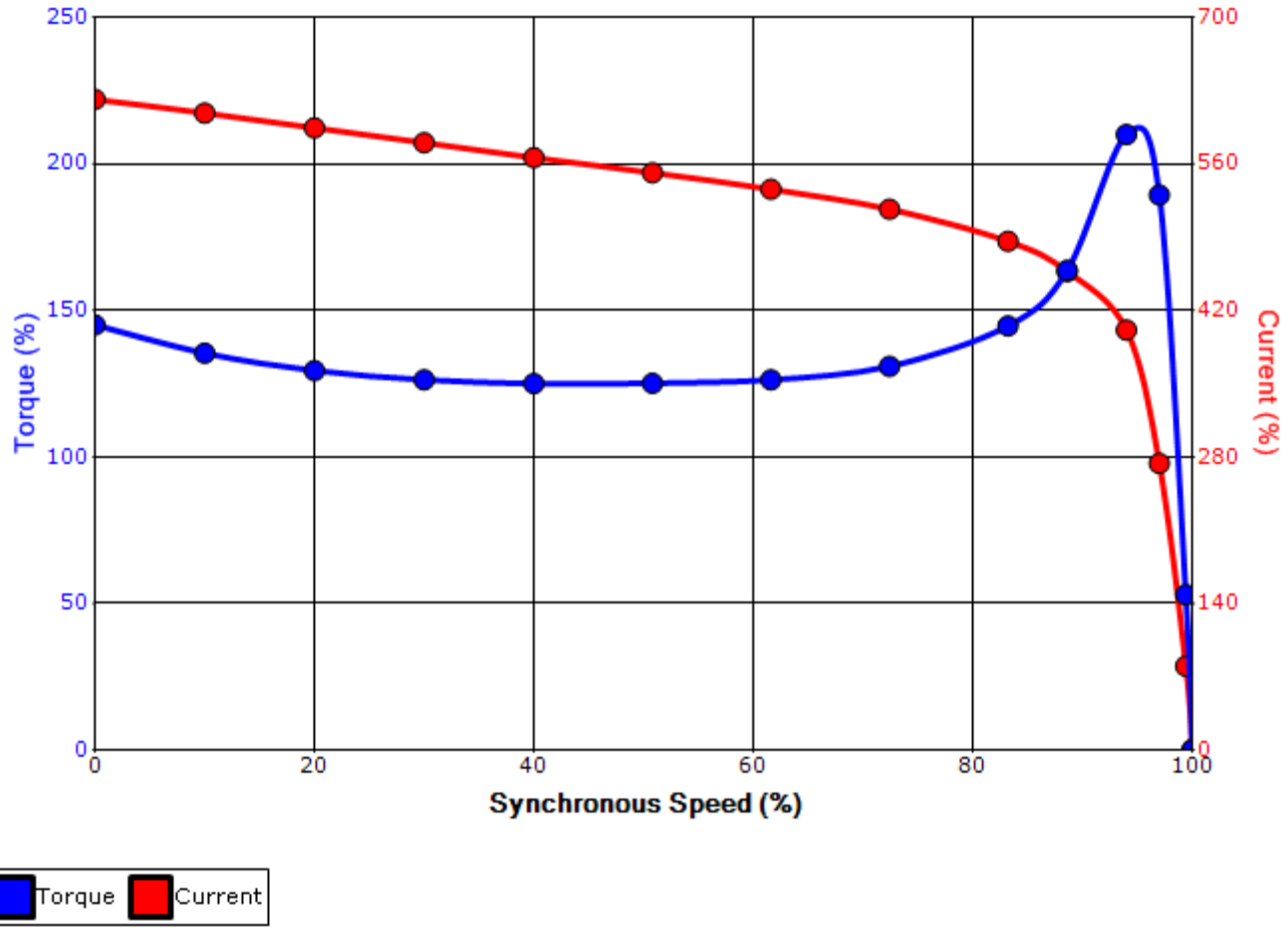
Model: M206WPAL11E-A

HP	kW	Pole	FL RPM	Frame	Voltage	Hz	Phase	FL Amps
1000	746	6	1185	5812US	4000	60	3	142.96

Enclosure	IP	Ins. Class	S.F.	Duty	NEMA Nom. Eff.	NEMA Design	kVA Code	Ambient (°C)
WP-I	23	F	1.15	CONT	96.2	-	F	40 C

Locked Rotor Amps	Rotor wk² Inertia (lb-ft²)	Torque			
		Full Load (lb-ft)	Locked Rotor (%)	Pull Up (%)	Break Down (%)
798.330800028853	467.14	4432	145	125	210

Design Values



Customer				wk² Load Inertia (lb-ft²)	-
Customer PO				Load Type	-
Sales Order				Voltage (%)	100
Project #				Accel. Time	-

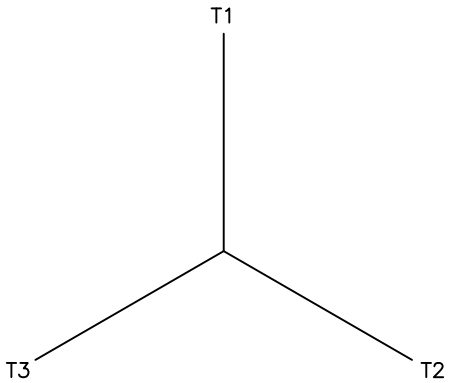
Tag:

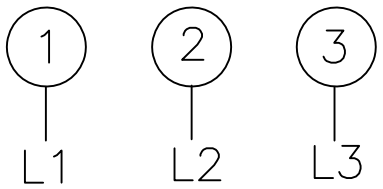
All characteristics are average expected values.

TOSHIBA INTERNATIONAL CORPORATION · HOUSTON, TEXAS U.S.A.

Engineering	bmammen	Doc. Written By	D. Suarez	Doc.# / Rev	MPCF-1121 / 0
Engr. Date	7/24/2014	Doc. Approved By	M. Campbell	Doc. Issued	6/8/2011

Motor Connection Diagram
3 Leads - Wye Connection





Switch L1 and L2 to reverse rotation

Each lead may consist of more than one cable.
If multiple cables represent a single lead, each one of them will be labeled with the appropriate lead number.

APPENDIX D

Opinion of Probable Project Cost

ECWA Ball PS Capital Improvement Plan — **Opinion of Probable Project Cost Summary**

Project No. 1A: Pumping System Improvements — **Prepared By:** JDS

Date: **June-19** — **Checked By:** TS

Division	Description	Design Parameters	Engineer's Opinion of Probable Construction Cost	% of Total
0	Insurance and Bonds, 5% total bid		$363,308	4.3%
1	Mob/Demob/Div 01 Gen Requirements, 10% bid items		$542,493	6.5%
	Four new 1250 HP pumps with VFDs		$4,030,000	48.0%
	Demo pumps 1-5, suction and discharge piping		$25,000	0.3%
	New enclosed room to house VFDs with separate HVAC system		$200,000	2.4%
	Cushioned swing check valves on each new pump		$62,100	0.7%
	New suction and discharge piping from isolation butterfly valves		$184,432	2.2%
	Improvements to the surge relief system		$233,400	2.8%
	Electrical (10%)		$460,000	5.5%
	I/C (5%)		$230,000	2.7%
	25% contingency for conceptual estimate		$1,298,733	15.5%
	GC O&P, 10% preceding items		$762,947	9.1%
	Total Construction		$ 8,393,000	99.9%
Opinion of Probable Current Construction Cost (Point Estimate)			**$ 8,400,000**	**100.0%**
Opinion of Probable Current ConstructionCost (Low Estimate (-30%))			**$ 5,880,000**	**70.0%**
Opinion of Probable Current Construction Cost (High Estimate (+50%))			**$ 12,600,000**	**150.0%**

Engineering, Legal, and Administrative Costs	**25.0%**
Contingency Factor (to cover typical change orders)	**5.0%**
Escalation Factor to midpoint of construction	**6.1%**

		Point Estimate
Opinion of Probable Project Cost		**$11,440,000**
Low Range Estimate (-30%)		**$8,010,000**
High Range Estimate (+50%)		**$17,160,000**

Escalation

Annual Rate of Inflation		2%
Mid-Point of Construction		June 1, 2022
Escalation from Date of Estimate to Mid-Point of Construction		6.1%

The following assumptions and references were used to develop the opinion of probable cost

1. This opinion of probable cost is based on Association for the Advancement of Cost Engineering (AACE) Class 5 estimate guidelines, which are typically accurate on the low range of -30% and on the high range of 50%. Level of detail and cost range will be refined as the project scope is further developed.
2. All unit costs are rounded to the nearest $1,000
3. All final opinions are rounded up to the nearest $10,000
4. This opinion of probable construction cost includes a suggested 5% Owner's construction contingency, intended to cover typical construction-phase change orders, due to unanticipated field conditions and Owner revisions in project scope.
5. Opinion of probable cost based on 2019 dollars.

ECWA Ball PS Capital Improvement Plan — **Opinion of Probable Project Cost Summary**

Project No. 1B: Pumping System Improvements — **Prepared By:** JDS

Date: **June-19** — **Checked By:** TS

Division	Description	Design Parameters	Engineer's Opinion of Probable Construction Cost	% of Total
0	Insurance and Bonds, 5% total bid		$408,099	4.3%
1	Mob/Demob/Div 01 Gen Requirements, 10% bid items		$609,407	6.5%
	Four new 1250 HP pumps		$4,562,500	48.4%
	Demo pumps 1-5, suction and discharge piping		$25,000	0.3%
	New enclosed room to house VFDs with separate HVAC system		$200,000	2.1%
	Cushioned swing check valves on each new pump		$77,625	0.8%
	New suction and discharge piping from isolation butterfly valves		$225,540	2.4%
	Improvements to the surge relief system		$233,400	2.5%
	Electrical (10%)		$510,000	5.4%
	I/C (5%)		$260,000	2.8%
	25% contingency for conceptual estimate		$1,458,516	15.5%
	GC O&P, 10% preceding items		$857,009	9.1%
	Total Construction		$ 9,428,000	100.0%
Opinion of Probable Current Construction Cost (Point Estimate)			**$ 9,430,000**	**100.0%**
Opinion of Probable Current Construction Cost (Low Estimate (-30%))			**$ 6,610,000**	**70.1%**
Opinion of Probable Current Construction Cost (High Estimate (+50%))			**$ 14,150,000**	**150.1%**

Engineering, Legal, and Administrative Costs	**25.0%**
Contingency Factor (to cover typical change orders)	**5.0%**
Escalation Factor to midpoint of construction	**6.1%**

		Point Estimate
Opinion of Probable Project Cost		**$12,840,000**
Low Range Estimate (-30%)		**$8,990,000**
High Range Estimate (+50%)		**$19,260,000**

Escalation

Annual Rate of Inflation		2%
Mid-Point of Construction		June 1, 2022
Escalation from Date of Estimate to Mid-Point of Construction		6.1%

The following assumptions and references were used to develop the opinion of probable cost

1. This opinion of probable cost is based on Association for the Advancement of Cost Engineering (AACE) Class 5 estimate guidelines, which are typically accurate on the low range of -30% and on the high range of 50%. Level of detail and cost range will be refined as the project scope is further developed.
2. All unit costs are rounded to the nearest $1,000
3. All final opinions are rounded up to the nearest $10,000
4. This opinion of probable construction cost includes a suggested 5% Owner's construction contingency, intended to cover typical construction-phase change orders, due to unanticipated field conditions and Owner revisions in project scope.
5. Opinion of probable cost based on 2019 dollars.

ECWA Ball PS Capital Improvement Plan — **Opinion of Probable Project Cost Summary**

Project No. 2: HVAC and Miscellaneous Improvements — **Prepared By:** JDS

Date: **June-19** — **Checked By:** TS

Division	Description	Design Parameters	Engineer's Opinion of Probable Construction Cost	% of Total
0	Insurance and Bonds, 5% total bid		$47,382	4.3%
1	Mob/Demob/Div 01 Gen Requirements, 10% bid items		$69,270	6.3%
2	New man door on east side of structure near Pump 1		$3,000	0.3%
	Replacement of the exhaust fan components, unit heaters, and other outdated or inefficient components of the HVAC system		$214,700	19.5%
3	New sump pumps in the venturi pits, new instrumentation conduit between PS and venturi pits, new 2-inch water supply line with connections throughout the PS, replacement of the existing sanitary sewer drain		$45,000	4.1%
4	New 480V Motor Control Centers		$330,000	
	Electrical (10%)		$100,000	2.7%
	I&C (5%)		$20,000	
	25% contingency for conceptual estimate		$165,675	15.1%
	GC O&P, 10% preceding items		$99,503	9.0%
	Total Construction		$ 1,095,000	99.5%
Opinion of Probable Current ConstructionCost (Point Estimate)			**$ 1,100,000**	**100.0%**
Opinion of Probable Current Construction Cost (Low Estimate (-30%))			**$ 770,000**	**70.0%**
Opinion of Probable Current Construction Cost (High Estimate (+50%))			**$ 1,650,000**	**150.0%**

Engineering, Legal, and Administrative Costs	**25.0%**
Contingency Factor (to cover typical change orders)	**5.0%**
Escalation Factor to midpoint of construction	**6.1%**

		Point Estimate
Opinion of Probable Construction Cost		**$1,500,000**
Low Range Estimate (-30%)		**$1,050,000**
High Range Estimate (+50%)		**$2,250,000**

Escalation

Annual Rate of Inflation		2%
Mid-Point of Construction		June 1, 2022
Escalation from Date of Estimate to Mid-Point of Construction		6.1%

The following assumptions and references were used to develop the opinion of probable cost

1. This opinion of probable cost is based on Association for the Advancement of Cost Engineering (AACE) Class 5 estimate guidelines, which are typically accurate on the low range of -30% and on the high range of 50%. Level of detail and cost range will be refined as the project scope is further developed.
2. All unit costs are rounded to the nearest $1,000
3. All final opinions are rounded up to the nearest $10,000
4. This opinion of probable construction cost includes a suggested 5% Owner's construction contingency, intended to cover typical construction-phase change orders, due to unanticipated field conditions and Owner revisions in project scope.
5. Opinion of probable cost based on 2019 dollars.

ECWA Ball PS Capital Improvement Plan — **Opinion of Probable Project Cost Summary**

Project No. 3: Exterior Piping Improvements — **Prepared By:** JDS

Date: **June-19** — **Checked By:** TS

Division	Description	Design Parameters	Engineer's Opinion of Probable Construction Cost	% of Total
0	Insurance and Bonds, 5% total bid		$124,821	4.3%
1	Mob/Demob/Div 01 Gen Requirements, 10% bid items		$162,790	5.6%
	Replacement of the buried 48 inch piping that runs between the two tanks, west of the pump station		$200,488	6.9%
	Replacement of the buried 54 inch piping that runs between the two tanks, west of the pump station		$228,995	7.9%
	Replacement of sections of the buried 60 inch piping that runs from the west into the south side of the pump station with a 48 inch line and addition of a parallel 48 inch pipe to create redundancy		$576,835	20.0%
	Discharge piping replacements		$524,585	18.2%
	Remove Altitude Valves		$12,000	0.4%
	Two check valve chambers		$85,000	2.9%
	Replacement section of overflow piping		$320,000	11.1%
	25% contingency for conceptual estimate		$385,726	13.3%
	GC O&P, 10% preceding items		$262,124	9.1%
Item 1	Total Construction		$ 2,884,000	99.8%
Opinion of Probable Current Construction Cost (Point Estimate)			**$ 2,890,000**	**100.0%**
Opinion of Probable Current Construction Cost (Low Estimate (-30%))			**$ 2,030,000**	**70.2%**
Opinion of Probable Current Construction Cost (High Estimate (+50%))			**$ 4,340,000**	**150.2%**

Engineering, Legal, and Administrative Costs	**25.0%**
Contingency Factor (to cover typical change orders)	**5.0%**
Escalation Factor to midpoint of construction	**17.2%**

		Point Estimate
Opinion of Probable Project Cost		**$4,260,000**
Low Range Estimate (-30%)		**$2,990,000**
High Range Estimate (+50%)		**$6,390,000**

Escalation

Annual Rate of Inflation		2%
Mid-Point of Construction		June 1, 2027
Escalation from Date of Estimate to Mid-Point of Construction		17.2%

The following assumptions and references were used to develop the opinion of probable cost

1. This opinion of probable cost is based on Association for the Advancement of Cost Engineering (AACE) Class 5 estimate guidelines, which are typically accurate on the low range of -30% and on the high range of 50%. Level of detail and cost range will be refined as the project scope is further developed.
2. All unit costs are rounded to the nearest $1,000
3. All final opinions are rounded up to the nearest $10,000
4. This opinion of probable construction cost includes a suggested 5% Owner's construction contingency, intended to cover typical construction-phase change orders, due to unanticipated field conditions and Owner revisions in project scope.
5. Opinion of probable cost based on 2019 dollars.

ECWA Ball PS Capital Improvement Plan — **Opinion of Probable Project Cost Summary**

Project No. 4: Interior Process Improvements — **Prepared By:** JDS

Date: **June-19** — **Checked By:** TS

Division	Description	Design Parameters	Engineer's Opinion of Probable Construction Cost	% of Total
0	Insurance and Bonds, 5% total bid		$156,795	4.3%
1	Mob/Demob/Div 01 Gen Requirements, 10% bid items		$232,809	6.4%
2	Replacement of basement piping		$2,288,094	63.0%
3	Demolition of existing piping and appurtenances		$40,000	1.1%
	25% contingency for conceptual estimate		$575,000	15.8%
	GC O&P, 10% preceding items		$330,000	9.1%
	Total Construction		$ 3,623,000	99.8%
Opinion of Probable Current Construction Cost (Point Estimate)			**$ 3,630,000**	**100.0%**
Opinion of Probable Current Construction Cost (Low Estimate (-30%))			**$ 2,550,000**	**70.2%**
Opinion of Probable Current Construction Cost (High Estimate (+50%))			**$ 5,450,000**	**150.1%**

Engineering, Legal, and Administrative Costs	**25.0%**
Contingency Factor (to cover typical change orders)	**5.0%**
Escalation Factor to midpoint of construction	**29.4%**

		Point Estimate
Opinion of Probable Project Cost		**$5,800,000**
Low Range Estimate (-30%)		**$4,060,000**
High Range Estimate (+50%)		**$8,700,000**

Escalation

Annual Rate of Inflation		2%
Mid-Point of Construction		June 1, 2032
Escalation from Date of Estimate to Mid-Point of Construction		29.4%

The following assumptions and references were used to develop the opinion of probable cost

1. This opinion of probable cost is based on Association for the Advancement of Cost Engineering (AACE) Class 5 estimate guidelines, which are typically accurate on the low range of -30% and on the high range of 50%. Level of detail and cost range will be refined as the project scope is further developed.
2. All unit costs are rounded to the nearest $1,000
3. All final opinions are rounded up to the nearest $10,000
4. This opinion of probable construction cost includes a suggested 5% Owner's construction contingency, intended to cover typical construction-phase change orders, due to unanticipated field conditions and Owner revisions in project scope.
5. Opinion of probable cost based on 2019 dollars.

ECWA Ball PS Capital Improvement Plan — **Opinion of Probable Project Cost Summary**

Project No. 5: Land Acquisition and Development — **Prepared By:** JDS

Date: **June-19** — **Checked By:** TS

Division	Description	Design Parameters	Engineer's Opinion of Probable Construction Cost	% of Total
0	Insurance and Bonds, 5% total bid		$14,460	4.3%
1	Mob/Demob/Div 01 Gen Requirements, 10% bid items		$21,200	6.2%
2	Purchasing land north of North Tank, bordering Sweet Home Road and the site road		$80,000	23.5%
3	Site Improvements and construction of pole barn		$120,000	35.3%
	Electrical (10%)		$12,000	3.5%
	I&C/Scada (5%)		$6,000	1.8%
	25% contingency for conceptual estimate		$50,000	14.7%
	GC O&P, 10% preceding items		$30,366	8.9%
	Total Construction		$ 335,000	98.5%
Opinion of Probable Current Construction Cost (Point Estimate)			**$ 340,000**	**100.0%**
Opinion of Probable Current Construction Cost (Low Estimate (-30%))			**$ 240,000**	**70.6%**
Opinion of Probable Current Construction Cost (High Estimate (+50%))			**$ 510,000**	**150.0%**

Engineering, Legal, and Administrative Costs	**25.0%**
Contingency Factor (to cover typical change orders)	**5.0%**
Escalation Factor to midpoint of construction	**17.2%**

		Point Estimate
Opinion of Probable Project Cost		**$510,000**
Low Range Estimate (-30%)		**$360,000**
High Range Estimate (+50%)		**$770,000**

Escalation

Annual Rate of Inflation		2%
Mid-Point of Construction		June 1, 2027
Escalation from Date of Estimate to Mid-Point of Construction		17.2%

The following assumptions and references were used to develop the opinion of probable cost

1. This opinion of probable cost is based on Association for the Advancement of Cost Engineering (AACE) Class 5 estimate guidelines, which are typically accurate on the low range of -30% and on the high range of 50%. Level of detail and cost range will be refined as the project scope is further developed.
2. All unit costs are rounded to the nearest $1,000
3. All final opinions are rounded up to the nearest $10,000
4. This opinion of probable construction cost includes a suggested 5% Owner's construction contingency, intended to cover typical construction-phase change orders, due to unanticipated field conditions and Owner revisions in project scope.
5. Opinion of probable cost based on 2019 dollars.

ECWA Ball PS Capital Improvement Plan — **Opinion of Probable Project Cost Summary**

Project No. 6: Exterior Building Improvements — **Prepared By:** JDS

Date: **June-19** — **Checked By:** TS

Division	Description	Design Parameters	Engineer's Opinion of Probable Construction Cost	% of Total
0	Insurance and Bonds, 5% total bid		$37,358	4.3%
1	Mob/Demob/Div 01 Gen Requirements, 10% bid items		$55,900	6.4%
2	Replacement of the sheet metal/foam panel exterior of the building		$479,000	55.1%
	Electrical (10%)		$50,000	5.7%
	I&C (5%)		$30,000	3.4%
	25% contingency for conceptual estimate		$132,250	15.2%
	GC O&P, 10% preceding items		$78,451	9.0%
	Total Construction		$ 863,000	99.2%
Opinion of Probable Current Construction Cost (Point Estimate)			**$ 870,000**	**100.0%**
Opinion of Probable Current Construction Cost (Low Estimate (-30%))			**$ 610,000**	**70.1%**
Opinion of Probable Current Construction Cost (High Estimate (+50%))			**$ 1,310,000**	**150.6%**

Engineering, Legal, and Administrative Costs	**25.0%**
Contingency Factor (to cover typical change orders)	**5.0%**
Escalation Factor to midpoint of construction	**29.4%**

		Point Estimate
Opinion of Probable Project Cost		**$1,390,000**
Low Range Estimate (-30%)		**$980,000**
High Range Estimate (+50%)		**$2,090,000**

Escalation

Annual Rate of Inflation		2%
Mid-Point of Construction		June 1, 2032
Escalation from Date of Estimate to Mid-Point of Construction		29.4%

The following assumptions and references were used to develop the opinion of probable cost

1. This opinion of probable cost is based on Association for the Advancement of Cost Engineering (AACE) Class 5 estimate guidelines, which are typically accurate on the low range of -30% and on the high range of 50%. Level of detail and cost range will be refined as the project scope is further developed.
2. All unit costs are rounded to the nearest $1,000
3. All final opinions are rounded up to the nearest $10,000
4. This opinion of probable construction cost includes a suggested 5% Owner's construction contingency, intended to cover typical construction-phase change orders, due to unanticipated field conditions and Owner revisions in project scope.
5. Opinion of probable cost based on 2019 dollars.

ECWA Ball PS Capital Improvement Plan — **Opinion of Probable Project Cost Summary**

Project No. 7: Paving Improvements — **Prepared By:** JDS

Date: **June-19** — **Checked By:** TS

Division	Description	Design Parameters	Engineer's Opinion of Probable Construction Cost	% of Total
0	Insurance and Bonds, 5% total bid		$23,693	4.3%
1	Mob/Demob/Div 01 Gen Requirements, 10% bid items		$35,100	6.4%
2	Remove and replace the parking lot and driving surfaces, up to intersection with Sweet Home Road at two egress points		$351,000	63.8%
	25% contingency for conceptual estimate		$87,750	16.0%
	GC O&P, 10% preceding items		$49,754	9.0%
	Total Construction		$ 548,000	99.6%
Opinion of Probable Current Construction Cost (Point Estimate)			**$ 550,000**	**100.0%**
Opinion of Probable Current Construction Cost (Low Estimate (-30%))			**$ 390,000**	**70.9%**
Opinion of Probable Current Construction Cost (High Estimate (+50%))			**$ 830,000**	**150.9%**

Engineering, Legal, and Administrative Costs	**25.0%**
Contingency Factor (to cover typical change orders)	**5.0%**
Escalation Factor to midpoint of construction	**29.4%**

		Point Estimate
Opinion of Probable Project Cost		**$880,000**
Low Range Estimate (-30%)		**$620,000**
High Range Estimate (+50%)		**$1,320,000**

Escalation

Annual Rate of Inflation		2%
Mid-Point of Construction		June 1, 2032
Escalation from Date of Estimate to Mid-Point of Construction		29.4%

The following assumptions and references were used to develop the opinion of probable cost

1. This opinion of probable cost is based on Association for the Advancement of Cost Engineering (AACE) Class 5 estimate guidelines, which are typically accurate on the low range of -30% and on the high range of 50%. Level of detail and cost range will be refined as the project scope is further developed.
2. All unit costs are rounded to the nearest $1,000
3. All final opinions are rounded up to the nearest $10,000
4. This opinion of probable construction cost includes a suggested 5% Owner's construction contingency, intended to cover typical construction-phase change orders, due to unanticipated field conditions and Owner revisions in project scope.
5. Opinion of probable cost based on 2019 dollars.

APPENDIX E

Project Workshop Slides

ECWA – BALL PUMP STATION

Capital Improvement Plan – Progress Workshop

May 22, 2019

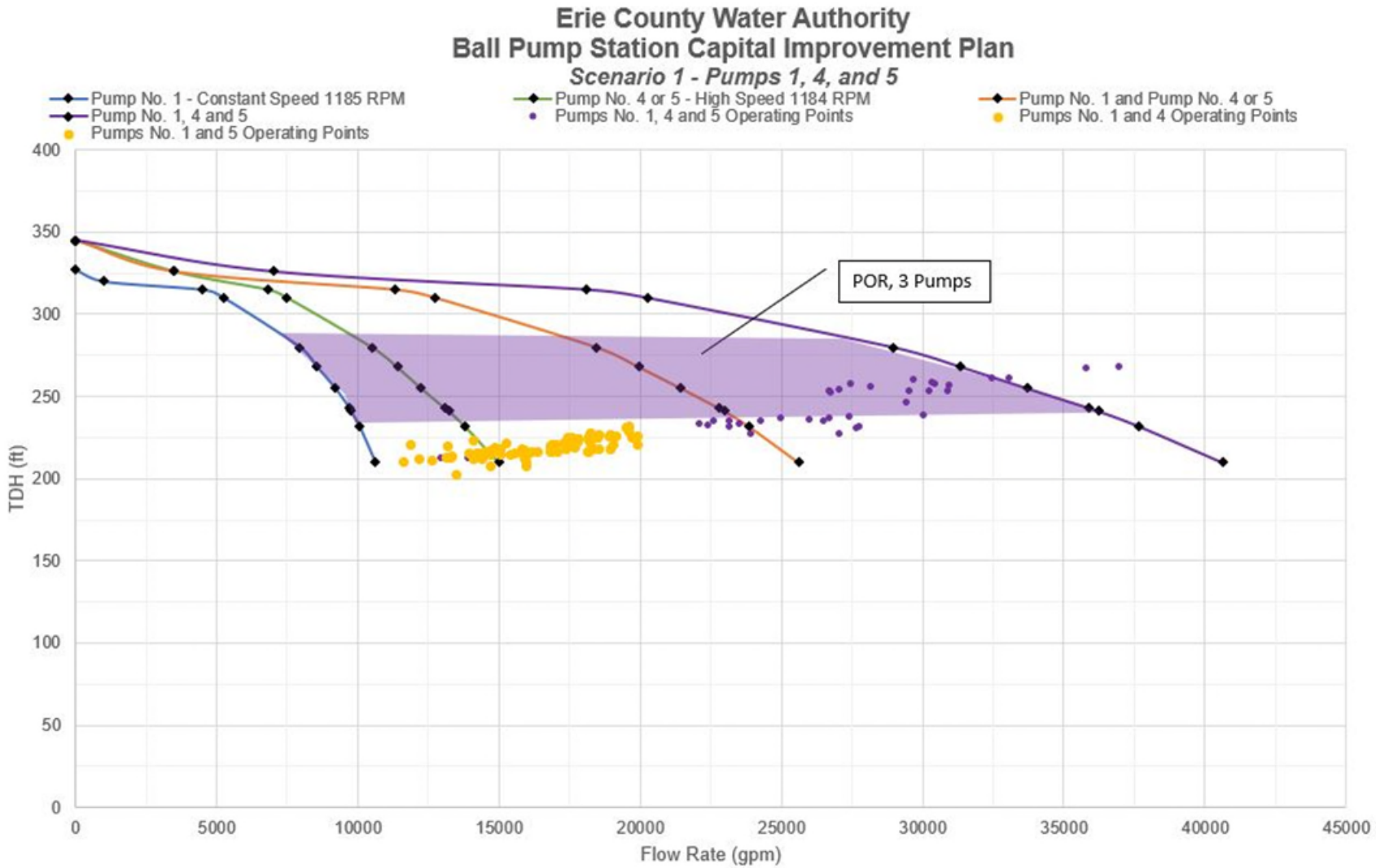
Agenda

- Hydraulic Evaluation
- Asset Scoring and Analysis
- CIP Discussion
- Next Steps

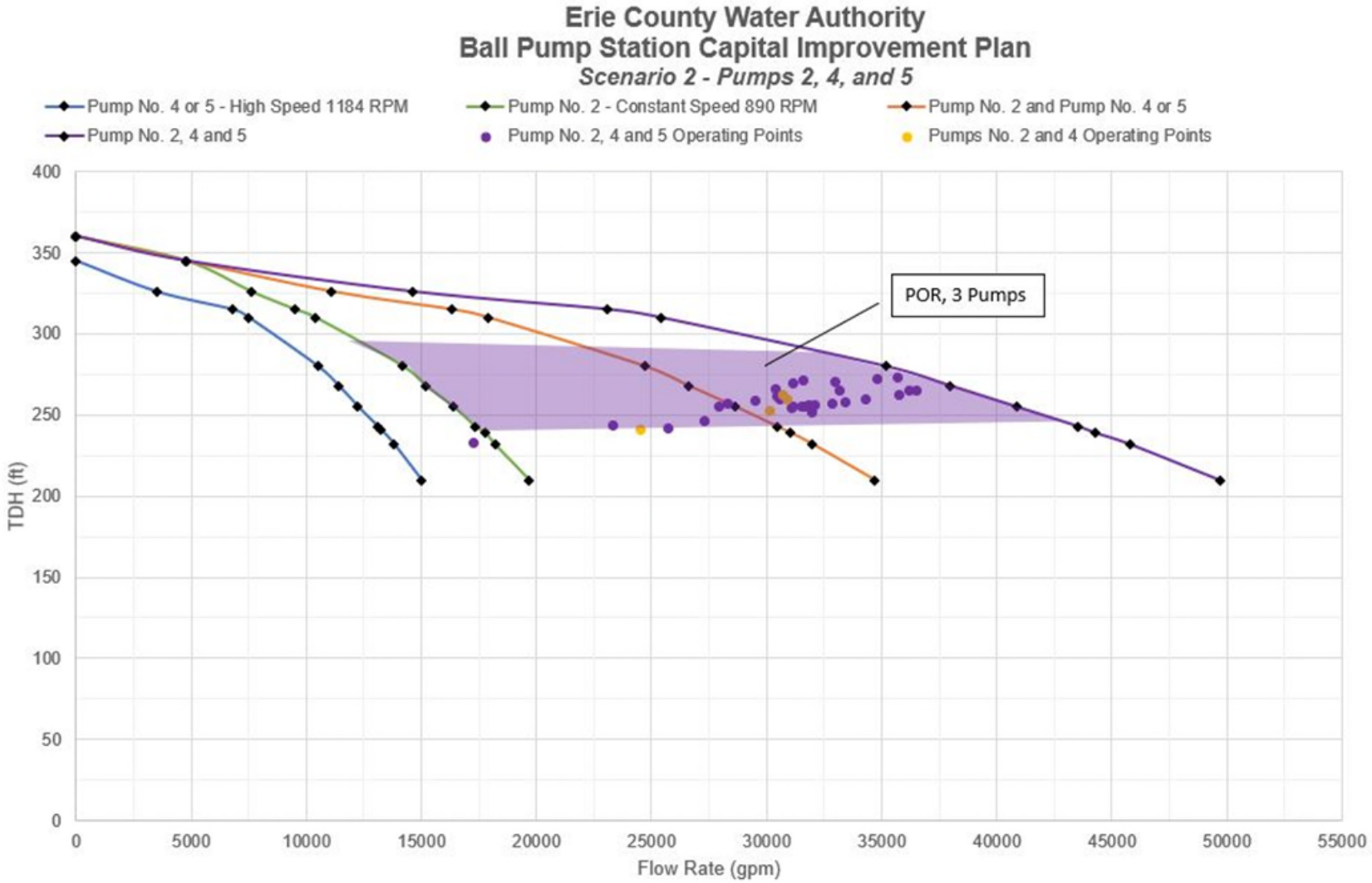
Hydraulic Evaluation

Hydraulic Evaluation

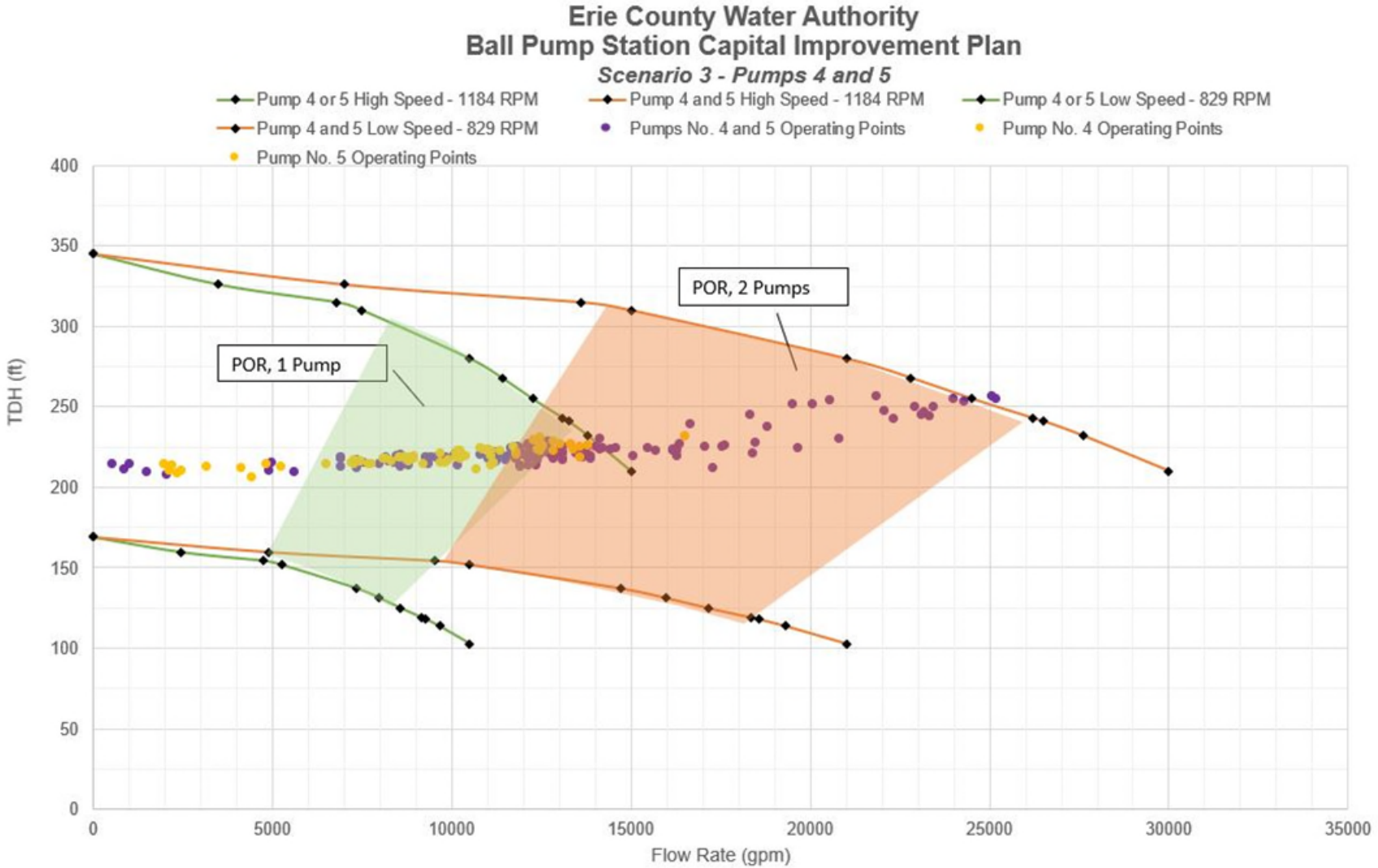
- Desktop evaluation of pumping system operations
- Pump curves and operating points were developed using the information provided by ECWA
- Flow and pressure data during low, average day, and peak demands were converted to TDH and plotted on the pump curves
- Elevation difference and minor losses between the suction/discharge pressure gauges and centerline of the pumps were included
- 5 scenarios were developed to compare operating points to the preferred operating range (POR)



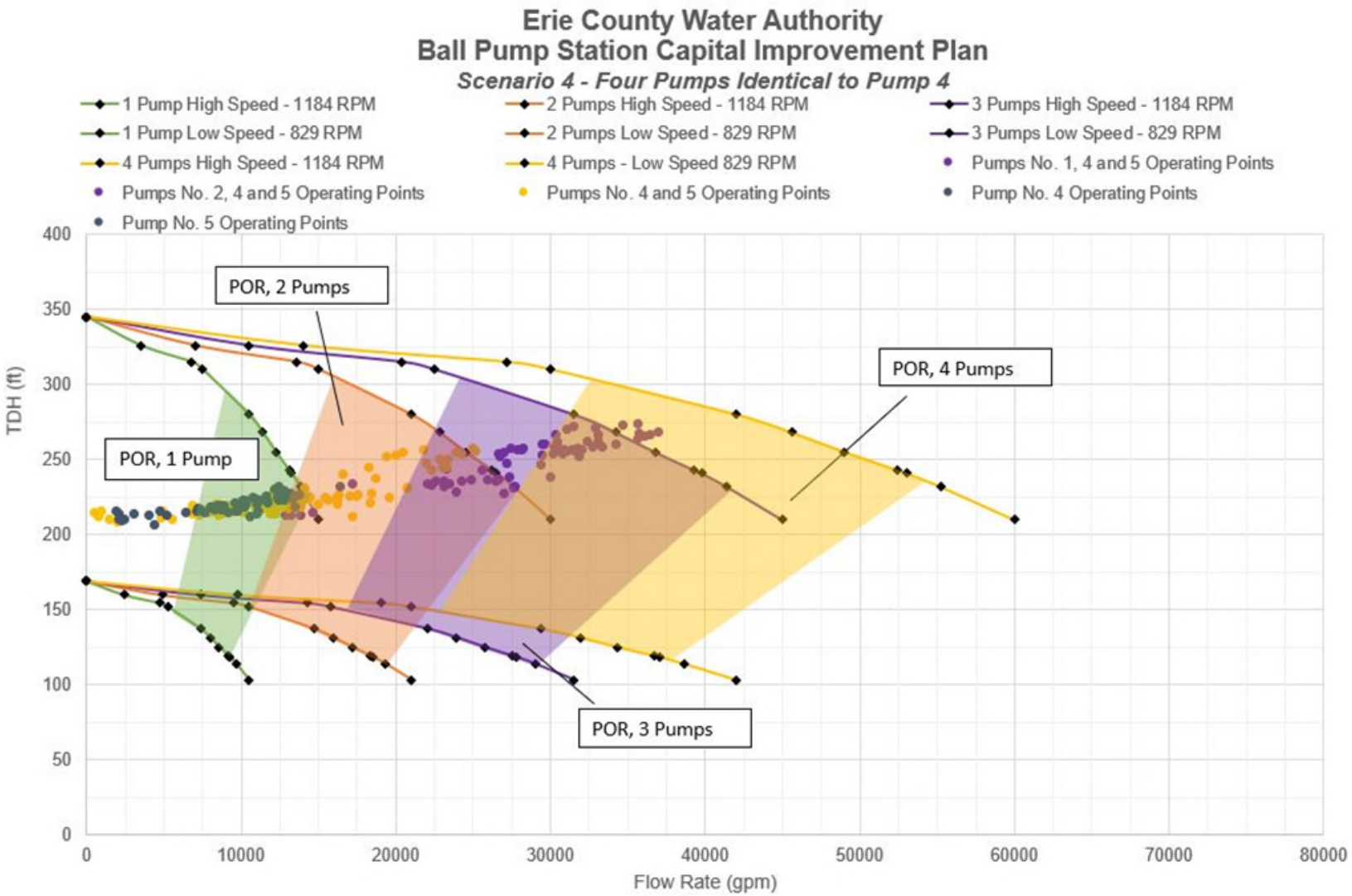
Scenario 1 – Pumps 1, 4 and 5



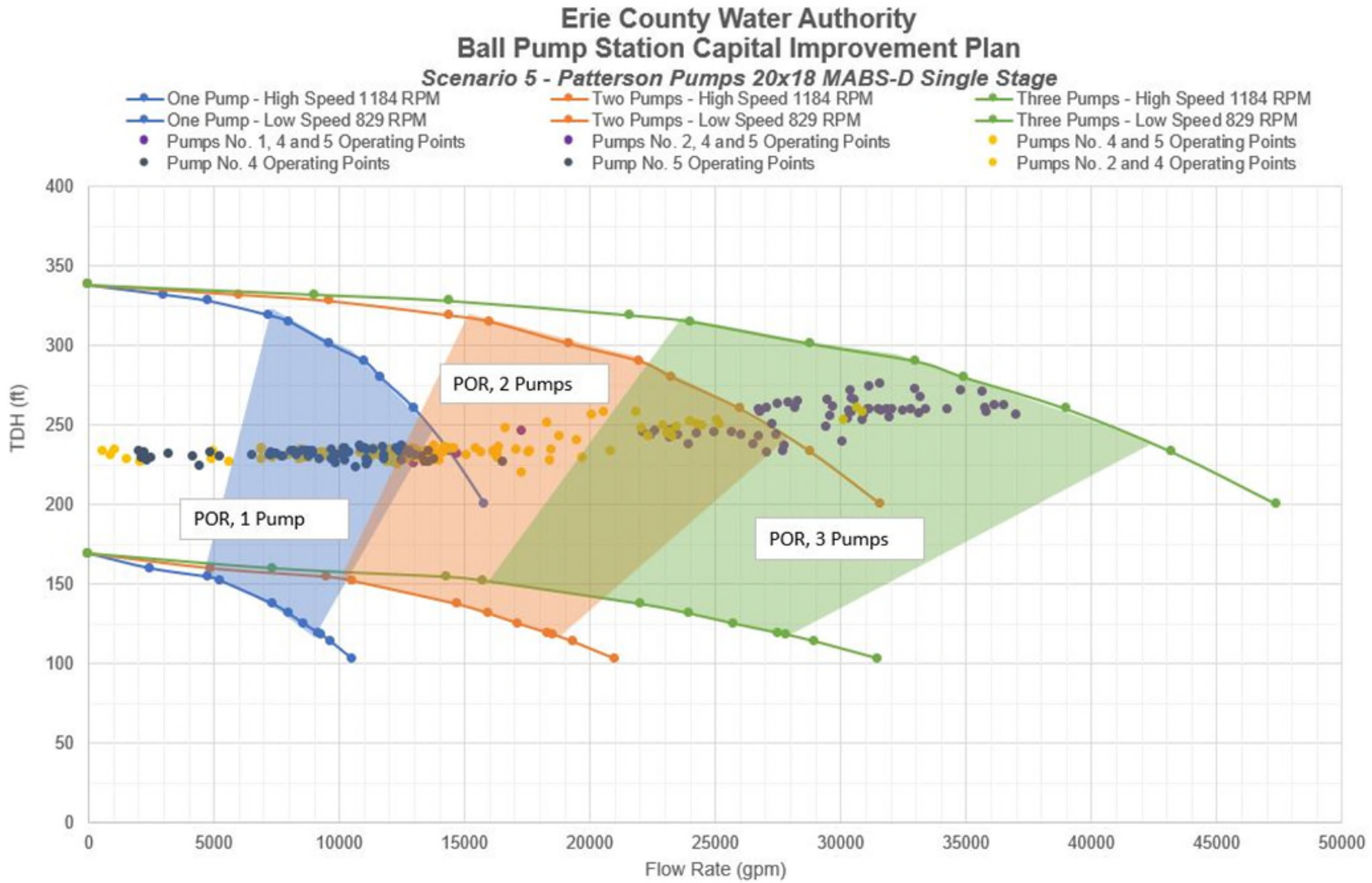
Scenario 2 – Pumps 2, 4 and 5



Scenario 3 – Pumps 4 and 5



Scenario 4 – Four Pumps Identical to Pump 4



Scenario 5 – Three Patterson Pumps

Patterson Pump Information	
Speed, (RPM)	1,200
Shutoff Head, (ft.)	338
Suction Diameter, (in.)	20
Discharge Diameter, (in.)	18
Motor Rating, (hp)	1,250
Impeller Size, (in.)	26.5625
Max Impeller Size, (in.)	28
Non-Overloading Power, (hp)	1,163

Connected Load Comparison	
Existing Connected Load	5,450 hp
Scenario 4: Connected Load (5 Pumps, N+1 Redundancy)	5,000 hp
Scenario 5: Connected Load (4 Pumps, N+1 Redundancy)	5,000 hp

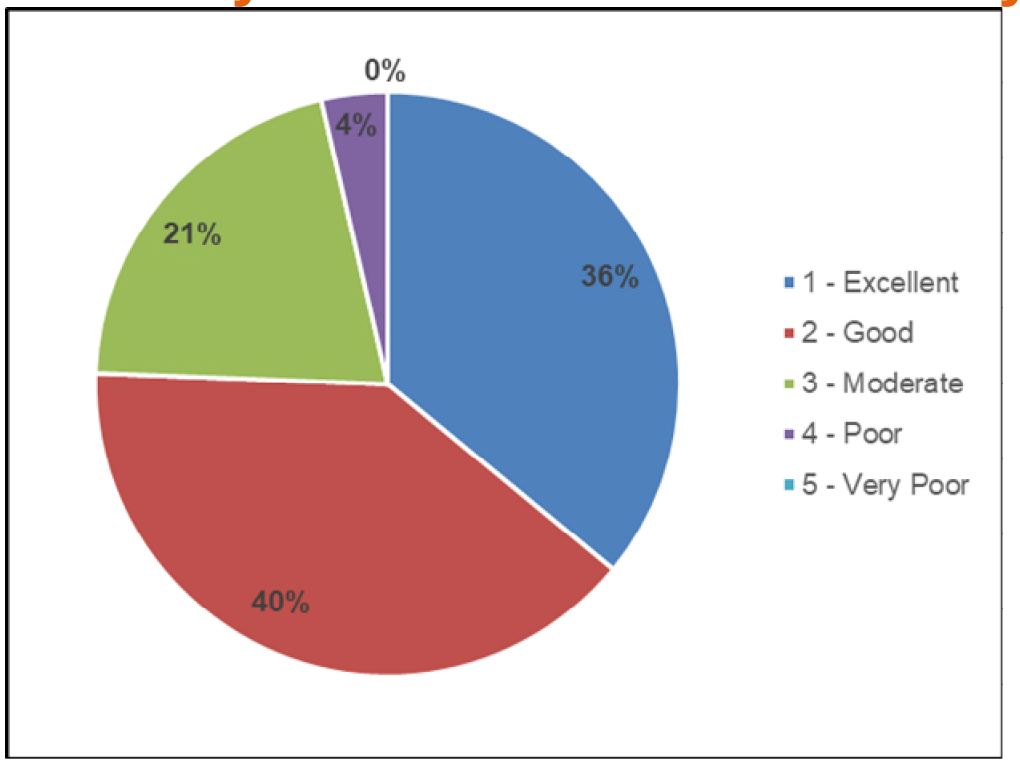
Asset Scoring and Analysis

Summary of Asset Scoring and Analysis

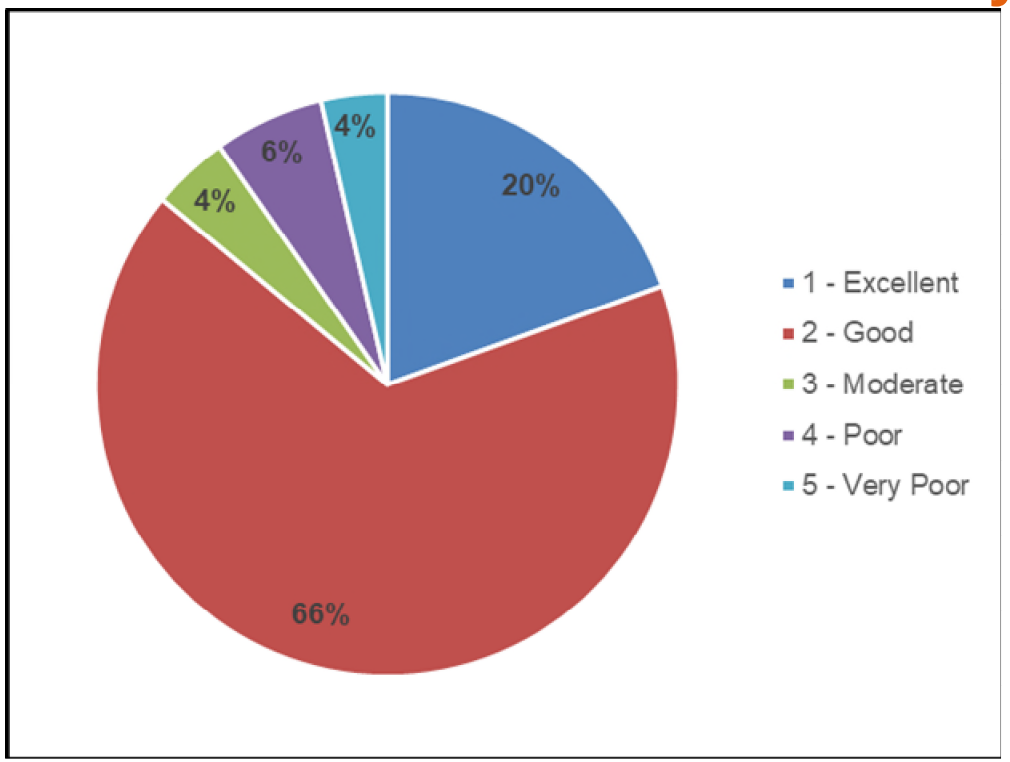
- 164 assets inventoried and assessed
- Asset condition assessment scoring considered physical condition, process condition, redundancy, most likely failure mode, consequence of failure, and probability of failure
- Assets that were scored as “poor” or “very poor” in physical or process condition categories, or assets that have no redundancy and a “level of service” most likely failure mode were further evaluated to be incorporated into improvement projects

Physical and Process Condition Scoring

Asset Physical Condition Summary



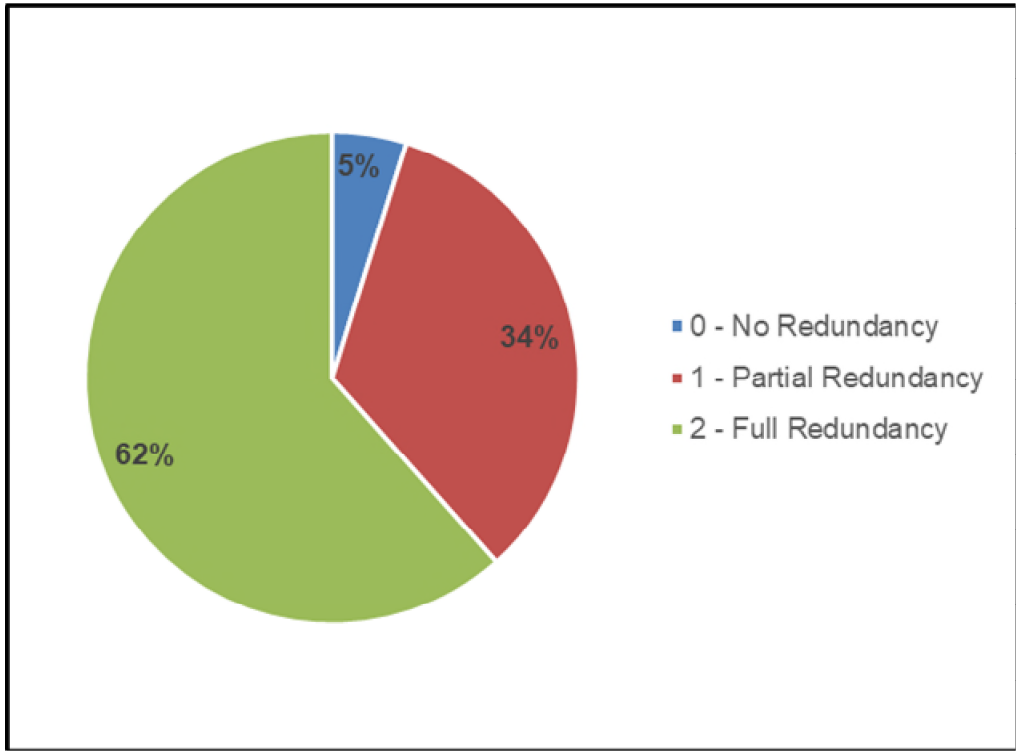
Asset Process Condition Summary



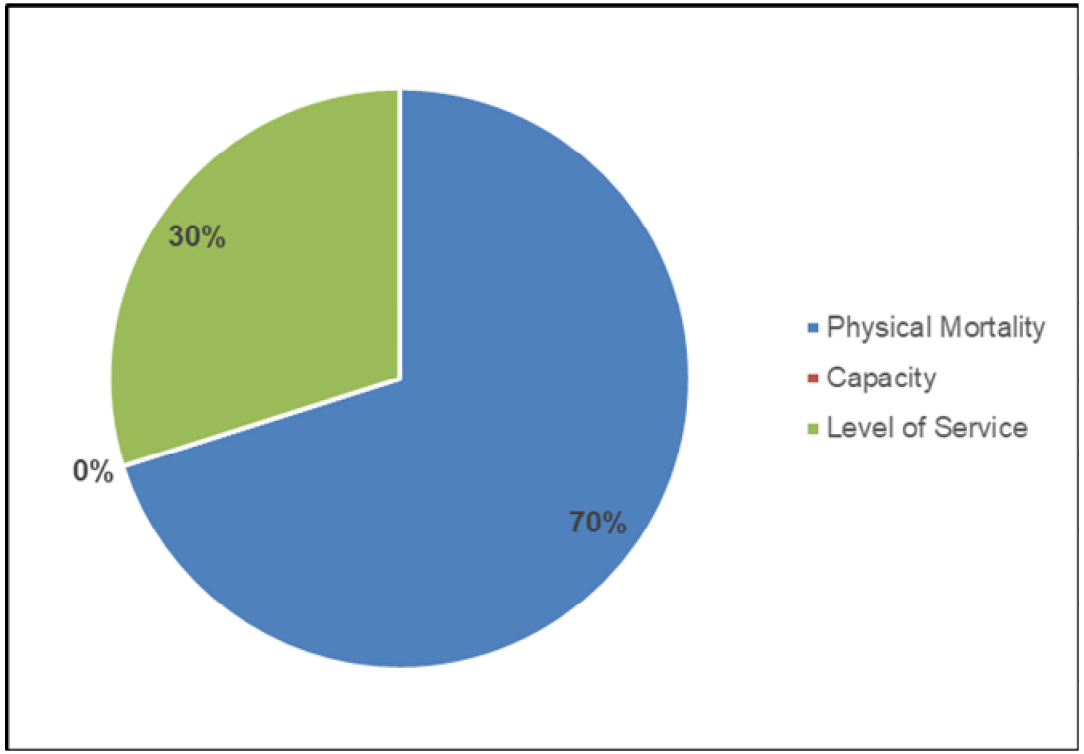
76% (physical) and 86% (process) of assets in good or excellent condition

Redundancy and Most Likely Failure Mode

Asset Redundancy Summary



Asset Most Likely Failure Summary



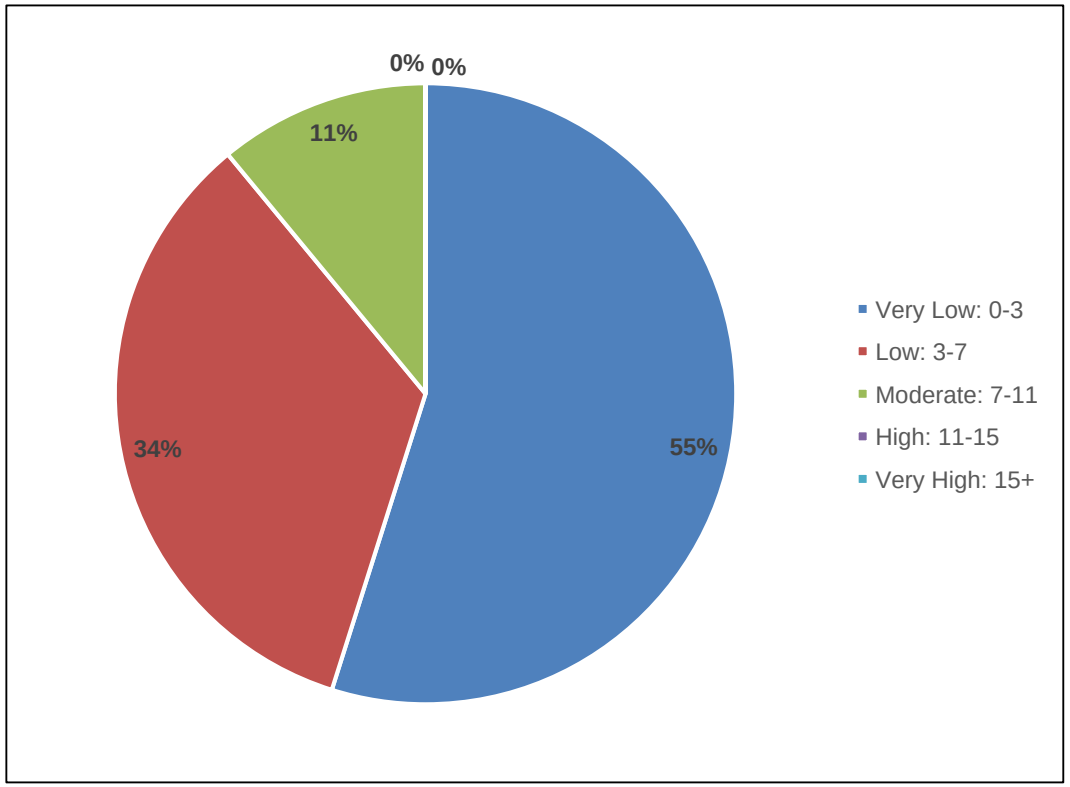
62% of assets have full redundancy

70% will most likely fail physically

Total Risk Score

- Each asset was given a score for total risk
- Total risk score is comprised of the following:
  - A triple bottom line consequence of failure (economic, environmental, social consequences)
  - Probability of failure (physical and process condition)
  - The consequence of failure score is multiplied by the probability of failure score to get the total risk score

Total Risk Score Summary



89% of assets have low or very low total risk scores, 0% have high or very high

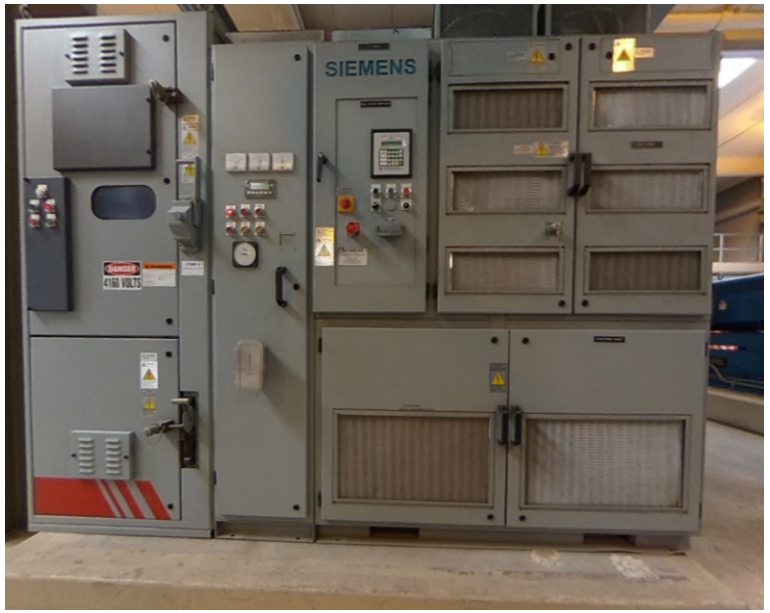
CIP Discussion

Capital Improvement Projects Discussion

- 4 projects were developed:
  - Pumping System Improvements
  - Building and Site Improvements
  - Exterior Piping Improvements
  - Interior Process Improvements
- Generally Ball Pump Station is in good condition but the identified projects will help sustain the success of this facility well into the future.

Pumping System Improvements

- Four new HSC pumps with new high efficiency motors
- New enclosed room to house VFDs in a conditioned environment through independent HVAC system
- New pump control valves or cushioned swing check valves
- New suction/discharge piping to each pump and butterfly isolation valves?

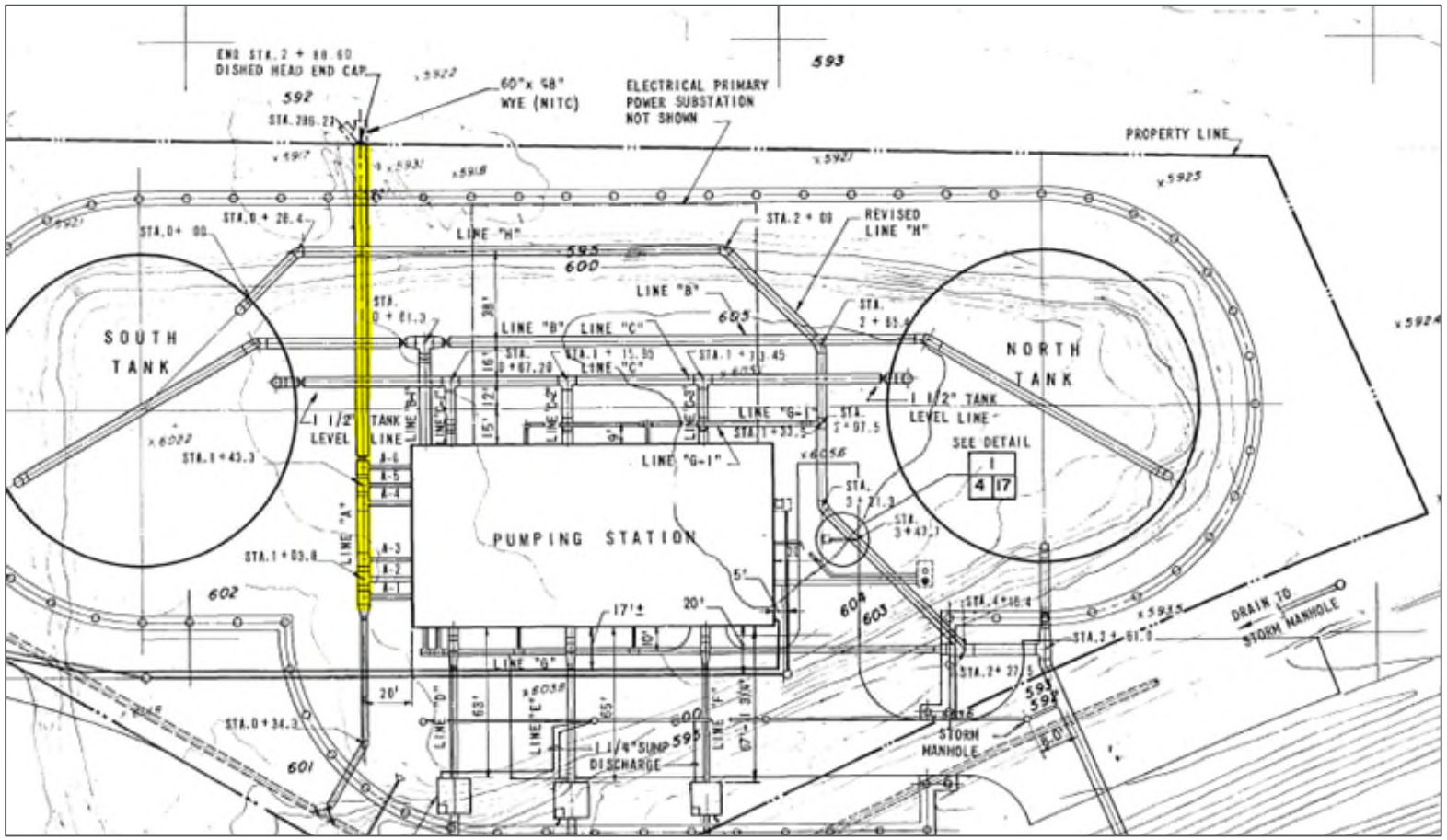


Building and Site Improvements

- New door on east side of structure near Pump 1, replacement of existing doors
- Replacement of the exhaust fan components, unit heaters, and other outdated or inefficient components of the HVAC system
- Improvements to site security including new security cameras and an updated alarm system
- New 2-inch water supply line with connections throughout the PS
- Replacement of the sheet metal/foam panel exterior of the building
- New sump pumps in the venturi pits
- New instrumentation conduit between PS and venturi pits
- Interior/exterior lighting improvements
- Replacement of the existing sanitary sewer drain
- Repave the parking lot and driving surfaces

Exterior Piping Improvements

- Replacement of the buried 48” and 54” piping between the two tanks, west of the pump station.
- Parallel main between twin 48” mains and PS to address ‘single point of failure’. Consider direct supply to tanks and eliminate altitude valves.
- Discharge piping replacement?
- Overflow piping replacement?



Interior Process Improvements

- Replacement of corroded sections of basement piping
- Replacement of domed hatches on suction and discharge piping
- Replacement of drain valves on the header piping in the basement
- Improvements to the surge relief system
- Remove altitude valves. Consider electric actuated isolation valve(s)

Next Steps

Next Steps

- Preparation of cost estimate for each project identified
- Prioritization of projects
- Draft initial CIP report for review

Questions and Answers

THANK YOU!

ECWA Ball Pump Station Capital Improvement Plan | May 22, 2019

Asset Inventory

Project	Asset Name	New CMMS ID	Inspection Type	Physical Condition	Process Condition	Redundancy	Most Likely Failure Mode	Consequence of Failure	Probability of Failure	Total Risk Score (COF x POF)
Project 1: Pump Replacement	Check Valve 3 (Pump 3, 24")	BPS-PMPG-VCK-03	Mechanical	4	2	2	P	1.6	3	4.8
	Pump 4	BPS-PMPG-PMP-04	Mechanical	3	2	2	L	2.9	2.5	7.25
	Pump 5	BPS-PMPG-PMP-05	Mechanical	3	2	2	L	2.9	2.5	7.25
	Check Valve 2 (Pump 2, 24")	BPS-PMPG-VCK-02	Mechanical	3	2	2	P	1.9	2.5	4.75
	Pump 4 Motor	BPS-PMPG-MTR-04	Mechanical	2	2	2	L	2.9	2	5.8
	Pump 5 Motor	BPS-PMPG-MTR-05	Mechanical	1	2	2	L	2.9	1.5	4.35
	Pump 3	BPS-PMPG-PMP-03	Mechanical	3	2	2	L	1	2.5	2.5
	Pump 1 Motor Starter	BPS-PMPG-MST-01	Electrical	2	2	1	L	1.9	2	3.8
	Pump 2 Motor Starter	BPS-PMPG-MST-02	Electrical	2	2	1	L	1.9	2	3.8
	Pump 1	BPS-PMPG-PMP-01	Mechanical	2	2	2	L	1.9	2	3.8
	Pump 2	BPS-PMPG-PMP-02	Mechanical	2	2	2	L	1.9	2	3.8
	Pump 2 Motor	BPS-PMPG-MTR-02	Mechanical	2	2	2	L	1.9	2	3.8
	Check Valve 1 (Pump 1, 16")	BPS-PMPG-VCK-01	Mechanical	2	2	2	P	1.9	2	3.8
	Check Valve 4 (Pump 4, 20")	BPS-PMPG-VCK-04	Mechanical	2	2	2	P	2.2	2	4.4
	Check Valve 5 (Pump 5, 20")	BPS-PMPG-VCK-05	Mechanical	2	2	2	P	2.2	2	4.4
	Pump 1 Motor	BPS-PMPG-MTR-01	Mechanical	1	2	2	L	1.9	1.5	2.85
	VFD 1 - Pump No.4	BPS-PMPG-VFD-01	Electrical	2	2	2	L	2.9	2	5.8
	VFD 2 - Pump No.5	BPS-PMPG-VFD-02	Electrical	2	2	2	L	2.9	2	5.8
	Pump 3 Motor Starter	BPS-PMPG-MST-03	Electrical	2	2	2	L	1	2	2
	Pump 3 Motor	BPS-PMPG-MTR-03	Mechanical	2	2	2	L	1	2	2
ding and Site Improvements	Pump Station Structure 1st Floor	BPS-FACS-MPS-02	Structural	3	1	2	P	2.9	2	5.8
	Pump Station Structure basement	BPS-FACS-MPS-01	Structural	3	1	2	P	2.9	2	5.8
	Sump Pump (Venturi Pits 1)	BPS-PMPG-SPM-03	Mechanical	4	5	0	L	1.7	4.5	7.65
	Sump Pump (Venturi Pits 2)	BPS-PMPG-SPM-04	Mechanical	4	5	0	L	1.7	4.5	7.65
	Sump Pump (Venturi Pits 3)	BPS-PMPG-SPM-05	Mechanical	3	2	0	L	1.7	2.5	4.25
	Venturi Flow Tube 1 (Pit 1)	BPS-PMPG-VFT-01	Mechanical	3	2	1	P	1.3	2.5	3.25
	Venturi Flow Tube 2 (Pit 2)	BPS-PMPG-VFT-02	Mechanical	3	2	1	P	1.3	2.5	3.25
	Venturi Flow Tube 3 (Pit 3)	BPS-PMPG-VFT-03	Mechanical	3	2	1	P	1.3	2.5	3.25
	Motor Starter Control Disconnect 1 - Exhaust Fan 1	BPS-FACS-DIS-01	Electrical	1	1	2	L	1	1	1
	Motor Starter Control Disconnect 2 - Exhaust Fan 2	BPS-FACS-DIS-02	Electrical	1	1	2	L	1	1	1
	Motor Starter Control Disconnect 3 - Exhaust Fan 3	BPS-FACS-DIS-03	Electrical	2	2	1	L	1	2	2

Asset Inventory

Project 2: Buil	Motor Starter Control Disconnect 4 - Exhaust Fan 4	BPS-FACS-DIS-04	Electrical	1	1	2	L	1	1	1
	Unit Heater - Southwest Basement Corner (2 heaters)	BPS-FACS-UHT-04	HVAC	3	2	2	P	1	2.5	2.5
	Unit Heater - Southeast Basement Corner	BPS-FACS-UHT-05	HVAC	1	2	2	P	1	1.5	1.5
	Unit Heater West Wall Basement	BPS-FACS-UHT-06	HVAC	2	2	2	P	1	2	2
	Unit Heater East Wall Basement	BPS-FACS-UHT-07	HVAC	1	2	2	P	1	1.5	1.5
	Unit Heater - Northwest Basement Corner	BPS-FACS-UHT-08	HVAC	1	2	2	P	1	1.5	1.5
	Unit Heater - Northeast Basement Corner (2 heaters)	BPS-FACS-UHT-09	HVAC	1	2	2	P	1	1.5	1.5
	Unit Heater - Boiler Room	BPS-FACS-UHT-10	HVAC	1	1	1	P	1	1	1
	Unit Heater - South Wall Operating Floor (2)	BPS-FACS-UHT-11	HVAC	1	1	2	P	1	1	1
	Ball Vent Fan 1	BPS-FACS-FAN-01	HVAC	1	1	2	P	1	1	1
	Ball Vent Fan 2	BPS-FACS-FAN-02	HVAC	1	1	2	P	1	1	1
	Ball Vent Fan 3	BPS-FACS-FAN-03	HVAC	1	1	2	P	1	1	1
	Ball Vent Fan 4	BPS-FACS-FAN-04	HVAC	1	1	2	P	1	1	1
	Stirring Fans (2) - Operating Floor	BPS-FACS-FAN-05	HVAC	1	1	2	P	1.3	1	1.3
Project 3: Exterior Piping Improvements	54" Piping	BPS-PMPG-PIP-01	Mechanical	2	3	1	P	2.6	2.5	6.5
	48" Piping	BPS-PMPG-PIP-02	Mechanical	2	3	1	P	2.6	2.5	6.5
rior Process Improvements	Surge Relief Valve 1	BPS-PMPG-VSR-01	Mechanical	4	3	1	P	2.9	3.5	10.15
	Surge Relief Valve 2	BPS-PMPG-VSR-02	Mechanical	3	4	1	P	2.9	3.5	10.15
	Surge Relief Valve 3	BPS-PMPG-VSR-03	Mechanical	3	4	1	P	2.9	3.5	10.15
	Surge Relief Valve 4	BPS-PMPG-VSR-04	Mechanical	3	4	1	P	2.9	3.5	10.15
	Surge Relief Valve 5	BPS-PMPG-VSR-05	Mechanical	4	3	1	P	2.9	3.5	10.15
	Rising Stem Gate Valve 1 (SR1)	BPS-PMPG-VGA-01	Mechanical	3	4	1	P	2.3	3.5	8.05
	Rising Stem Gate Valve 2 (SR1)	BPS-PMPG-VGA-02	Mechanical	3	4	1	P	2.3	3.5	8.05
	Rising Stem Gate Valve 3 (SR2)	BPS-PMPG-VGA-03	Mechanical	3	4	1	P	2.3	3.5	8.05
	Rising Stem Gate Valve 4 (SR2)	BPS-PMPG-VGA-04	Mechanical	3	4	1	P	2.3	3.5	8.05
	Rising Stem Gate Valve 5 (SR3)	BPS-PMPG-VGA-05	Mechanical	2	2	1	P	2.3	2	4.6
	Rising Stem Gate Valve 6 (SR3)	BPS-PMPG-VGA-06	Mechanical	2	2	1	P	2.3	2	4.6
	Rising Stem Gate Valve 7 (SR4)	BPS-PMPG-VGA-07	Mechanical	3	4	1	P	2.3	3.5	8.05
	Rising Stem Gate Valve 8 (SR4)	BPS-PMPG-VGA-08	Mechanical	3	4	1	P	2.3	3.5	8.05
	Rising Stem Gate Valve 9 (SR5)	BPS-PMPG-VGA-09	Mechanical	3	4	1	P	2.3	3.5	8.05
	Rising Stem Gate Valve 10 (SR5)	BPS-PMPG-VGA-10	Mechanical	2	2	1	P	2.3	2	4.6
	Altitude Valve 1	BPS-PMPG-VAL-01	Mechanical	2	5	0	P	1.3	3.5	4.55

Asset Inventory

Project 4: Inte	Altitude Valve 2	BPS-PMPG-VAL-02	Mechanical	3	5	0	P	1.3	4	5.2
	Altitude Valve 3	BPS-PMPG-VAL-03	Mechanical	3	5	0	P	1.3	4	5.2
	Altitude Valve 4	BPS-PMPG-VAL-04	Mechanical	2	5	0	P	1.3	3.5	4.55
	36" Piping	BPS-PMPG-PIP-03	Mechanical	4	3	1	P	2.6	3.5	9.1
	30" Piping	BPS-PMPG-PIP-04	Mechanical	3	3	1	P	2.6	3	7.8
	48" Butterfly Valve 1 (North Tank)	BPS-PMPG-VBF-21	Mechanical	1	2	1	P	2	1.5	3
	48" Butterfly Valve 2 (South Tank)	BPS-PMPG-VBF-10	Mechanical	1	2	1	P	2	1.5	3
	54" Butterfly Valve 1 (North Tank)	BPS-PMPG-VBF-09	Mechanical	1	2	1	P	2	1.5	3
	54" Butterfly Valve 2 (South Tank)	BPS-PMPG-VBF-02	Mechanical	1	2	1	P	2	1.5	3
	24" Butterfly Valve 6A (AV-1)	BPS-PMPG-VBF-32	Mechanical	1	2	2	P	1.3	1.5	1.95
	24" Butterfly Valve 6E (AV-1)	BPS-PMPG-VBF-33	Mechanical	1	2	2	P	1.3	1.5	1.95
	24" Butterfly Valve 6B (AV-2)	BPS-PMPG-VBF-34	Mechanical	1	2	2	P	1.3	1.5	1.95
	24" Butterfly Valve 6F (AV-2)	BPS-PMPG-VBF-35	Mechanical	1	2	2	P	1.3	1.5	1.95
	24" Butterfly Valve 6C (AV-3)	BPS-PMPG-VBF-36	Mechanical	2	2	2	P	1.3	2	2.6
	24" Butterfly Valve 6G (AV-3)	BPS-PMPG-VBF-37	Mechanical	1	2	2	P	1.3	1.5	1.95
	24" Butterfly Valve 6D (AV-4)	BPS-PMPG-VBF-38	Mechanical	2	2	2	P	1.3	2	2.6
	24" Butterfly Valve 6H (AV-4)	BPS-PMPG-VBF-39	Mechanical	2	2	2	P	1.3	2	2.6
	Power Yard	BPS-FACS-PYD-01	Electrical	1	2	0	P	4	1.5	6
	Switch 201 on Line 181	BPS-FACS-TSW-03	Electrical	1	2	2	L	2	1.5	3
	Switch 101 on Line 182	BPS-FACS-TSW-02	Electrical	1	2	2	L	2	1.5	3
	Switch 100 on Cross	BPS-FACS-TWS-02	Electrical	1	2	2	L	2	1.5	3
	North Tank 4.2MG	BPS-STOR-TNK-01	Structural	1	2	2	P	4	1.5	6
	Fencing	BPS-FACS-FNC-01	Structural	3	3	2	P	1.6	3	4.8
	Flow Monitor North	BPS-PMPG-FLM-01	Mechanical	2	1	1	L	1.6	1.5	2.4
	Flow Monitor South	BPS-PMPG-FLM-03	Mechanical	2	1	1	L	1.6	1.5	2.4
	Remote Terminal Unit	BPS-PMPG-RTU-01	Electrical	2	2	1	L	1.6	2	3.2
	48" Butterfly Valve 3F	BPS-PMPG-VBF-19	Mechanical	3	2	2	P	1.3	2.5	3.25
	Pressure Release Valve	BPS-PMPG-VPR-01	Mechanical	3	2	2	P	1.3	2.5	3.25
	Bus 1-A-1 (MCC-1)	BPS-FACS-BUS-01	Electrical	2	2	1	L	1.6	2	3.2
	Transformer - T3-A - 300 KVA	BPS-FACS-XFR-02	Electrical	2	2	1	L	3	2	6
	Main Breaker Panels	BPS-FACS-CBP-01	Electrical	2	2	1	L	2.6	2	5.2
	Sump Pump (west wall)	BPS-FACS-SPM-01	Mechanical	3	2	1	L	1.3	2.5	3.25
	30" Butterfly Valve 12C (Pump 5S)	BPS-PMPG-VBF-31	Mechanical	3	2	2	P	1.6	2.5	4
	Transformer T3-B - 500 KVA	BPS-FACS-XFR-01	Electrical	2	2	1	L	3	2	6
	54" Butterfly Valve 9A	BPS-PMPG-VBF-03	Mechanical	3	2	2	P	1.3	2.5	3.25
	Auto Transfer Switch	BPS-FACS-TSW-01	Electrical	1	2	1	L	1.3	1.5	1.95
	Flow Monitor Center	BPS-PMPG-FLM-02	Mechanical	3	1	1	L	1.6	2	3.2
	Tank Level Indicator	BPS-STOR-LVI-01	Mechanical	3	1	1	L	1.3	2	2.6
	Discharge Pressure Indicator	BPS-PMPG-PIN-02	Mechanical	3	1	1	L	1.3	2	2.6

Asset Inventory

	Pump 1 Diff Pressure Switch	BPS-PMPG-DPS-01	Mechanical	2	2	2	L	1.3	2	2.6
	Pump 2 Diff Pressure Switch	BPS-PMPG-DPS-02	Mechanical	2	2	2	L	1.3	2	2.6
	Pump 3 Diff Pressure Switch	BPS-PMPG-DPS-03	Mechanical	2	2	2	L	1	2	2
	Pump 4 Diff Pressure Switch	BPS-PMPG-DPS-04	Mechanical	2	2	2	L	1.6	2	3.2
	Pump 5 Diff Pressure Switch	BPS-PMPG-DPS-05	Mechanical	2	2	2	L	1.6	2	3.2
	Lead Batteries (4)	BPS-FACS-BAT-01	Electrical	2	2	1	P	1.7	2	3.4
	24" Butterfly Valve 4E (Pump 5D)	BPS-PMPG-VBF-41	Mechanical	3	2	2	P	1.9	2.5	4.75
	Check Valve 6 (Disc/Suct Hdr, 30")	BPS-PMPG-VCK-06	Mechanical	2	2	2	P	1.9	2	3.8
	30" Butterfly Valve 4B (Pump 2D)	BPS-PMPG-VBF-28	Mechanical	2	2	2	P	1.9	2	3.8
	30" Butterfly Valve 12A (Pump 2S)	BPS-PMPG-VBF-27	Mechanical	2	2	2	P	1.9	2	3.8
	36" Butterfly Valve 5B (Pump 3S)	BPS-PMPG-VBF-23	Mechanical	2	2	2	P	1.3	2	2.6
	24" Butterfly Valve 4D (Pump 4D)	BPS-PMPG-VBF-40	Mechanical	2	2	2	P	2.2	2	4.4
	30" Butterfly Valve 12B (Pump 4S)	BPS-PMPG-VBF-30	Mechanical	2	2	2	P	2.2	2	4.4
	54" Butterfly Valve 13A (Suct Hdr)	BPS-PMPG-VBF-05	Mechanical	2	2	2	P	1.3	2	2.6
	54" Butterfly Valve 8A (Suct Hdr South)	BPS-PMPG-VBF-04	Mechanical	2	2	2	P	1.3	2	2.6
	54" Butterfly Valve 13B (Suct Hdr)	BPS-PMPG-VBF-06	Mechanical	2	2	2	P	1.3	2	2.6
	48" Butterfly Valve 2C	BPS-PMPG-VBF-18	Mechanical	2	2	2	P	1.3	2	2.6
	60" Butterfly Valve 7A	BPS-PMPG-VBF-01	Mechanical	2	2	2	P	1.3	2	2.6
	54" Butterfly Valve 9C	BPS-PMPG-VBF-08	Mechanical	2	2	2	P	1.3	2	2.6
	48" Butterfly Valve 3A	BPS-PMPG-VBF-11	Mechanical	2	2	2	P	1.3	2	2.6
	48" Butterfly Valve 3E	BPS-PMPG-VBF-17	Mechanical	2	2	2	P	1.3	2	2.6
	48" Butterfly Valve 3G	BPS-PMPG-VBF-20	Mechanical	2	2	2	P	1.3	2	2.6
	48" Butterfly Valve 3D	BPS-PMPG-VBF-16	Mechanical	2	2	2	P	1.3	2	2.6
	48" Butterfly Valve 3C	BPS-PMPG-VBF-14	Mechanical	2	2	2	P	1.3	2	2.6
	48" Butterfly Valve 2B	BPS-PMPG-VBF-15	Mechanical	2	2	2	P	1.3	2	2.6
	48" Butterfly Valve 3B	BPS-PMPG-VBF-13	Mechanical	2	2	2	P	1.3	2	2.6
	48" Butterfly Valve 2A	BPS-PMPG-VBF-12	Mechanical	2	2	2	P	1.3	2	2.6
	30" Butterfly Valve 1A	BPS-PMPG-VBF-24	Mechanical	2	2	2	P	1.3	2	2.6
	30" Butterfly Valve 1B	BPS-PMPG-VBF-25	Mechanical	2	2	2	P	1.3	2	2.6
	Butterfly Valve 5E	BPS-PMPG-VBF-42	Mechanical	2	2	2	P	1.3	2	2.6
	Butterfly Valve 5D	BPS-PMPG-VBF-43	Mechanical	2	2	2	P	1.3	2	2.6
	Butterfly Valve 5C	BPS-PMPG-VBF-44	Mechanical	2	2	2	P	1.3	2	2.6
	54" Butterfly Valve 9B	BPS-PMPG-VBF-07	Mechanical	2	2	2	P	1.3	2	2.6
	Generator Building	BPS-FACS-GBG-01	Structural	2	1	2	P	2.3	1.5	3.45
	Hot Water Boiler No.1	BPS-FACS-BOL-01	HVAC	1	2	2	P	1.7	1.5	2.55
	Batteries for Best Access Controller	BPS-FACS-BAT-03	Electrical	1	2	2	P	1.4	1.5	2.1
	Drive Motor for Fan 1	BPS-FACS-FMT-01	HVAC	1	2	2	L	1.3	1.5	1.95
	Drive Motor for Fan 2	BPS-FACS-FMT-02	HVAC	1	2	2	L	1.3	1.5	1.95
	Drive Motor for Fan 3	BPS-FACS-FMT-03	HVAC	1	2	2	L	1.3	1.5	1.95
	Drive Motor for Fan 4	BPS-FACS-FMT-04	HVAC	1	2	2	L	1.3	1.5	1.95
	16" Gate Valve	BPS-PMPG-VGA-11	Mechanical	1	2	1	P	1.3	1.5	1.95
	Lead Batteries (2) - ATS	BPS-FACS-BAT-02	Electrical	1	2	2	P	1.4	1.5	2.1

Asset Inventory

	South Tank 4.2MG	BPS-STOR-TNK-02	Structural	1	1	2	P	4	1	4
	30" Butterfly Valve 4A (Pump 1D)	BPS-PMPG-VBF-26	Mechanical	1	2	2	P	1.9	1.5	2.85
	36" Butterfly Valve 5A (Pump 1S)	BPS-PMPG-VBF-22	Mechanical	1	2	2	P	1.9	1.5	2.85
	30" Butterfly Valve 4C (Pump 3D)	BPS-PMPG-VBF-29	Mechanical	1	2	2	P	1.3	1.5	1.95
	12" Butterfly Valve 1 (North Tank)	BPS-PMPG-VBF-46	Mechanical	1	2	1	P	1.6	1.5	2.4
	12" Butterfly Valve 2 (South Tank)	BPS-PMPG-VBF-45	Mechanical	1	2	1	P	1.6	1.5	2.4
	Battery Charger	BPS-FACS-BAC-01	Electrical	1	2	2	P	1	1.5	1.5
	Generator 2000KW	BPS-FACS-GEN-01	Electrical	1	1	1	P	2.3	1	2.3
	Pump Station Structure Roof	BPS-FACS-MPS-03	Structural	1	1	0	P	3.3	1	3.3
	Ball Tank 1 (400 Gal Diesel)	BPS-FACS-FTK-01	Mechanical	1	1	2	P	2.8	1	2.8
	Ball Tank 2 (4000 Gal Diesel)	BPS-FACS-FTK-02	Structural	1	1	2	P	3.1	1	3.1
	Suction Pressure Indicator	BPS-PMPG-PIN-01	Mechanical	1	1	1	L	1.6	1	1.6
	Sump Pump (East Wall)	BPS-FACS-SPM-02	Mechanical	1	1	2	L	1.3	1	1.3
	Bridge Crane - West Bay - 15 Ton	BPS-FACS-BCR-01	Structural	1	1	1	P	2	1	2
	Bridge Crane - East Bay -15 Ton	BPS-FACS-BCR-02	Structural	1	1	1	P	2	1	2
	Hot Water Circulation Pump - Boiler	BPS-FACS-PMP-06	Mechanical	1	1	1	P	1.3	1	1.3
	Hot Water Heater (40 Gal)	BPS-FACS-HWH-01	Mechanical	1	1	2	P	1.3	1	1.3
	Fluoride Analyzer	BPS-FACS-ANZ-01	Mechanical	1	1	1	L	1.3	1	1.3
	Expansion Tank-Hot Water Tank	BPS-FACS-HWH-02	Mechanical	1	1	1	P	1.3	1	1.3
	Hot Water Boiler No.2	BPS-FACS-BOL-02	HVAC	1	1	2	P	1.3	1	1.3

ECWA BALL PUMP STATION

Capital Improvement Plan – Project Prioritization Workshop

August 1, 2019

Agenda

CIP Project Summaries

- Overview of seven projects – list of improvements identified

Project Cost Estimates

- Included Point, High (+50%) and Low (-30%) for each project

CIP Prioritization

- Evaluated based on 0-5 yr, 5-10 yr, and 10-15 yr timeframes

Next Steps

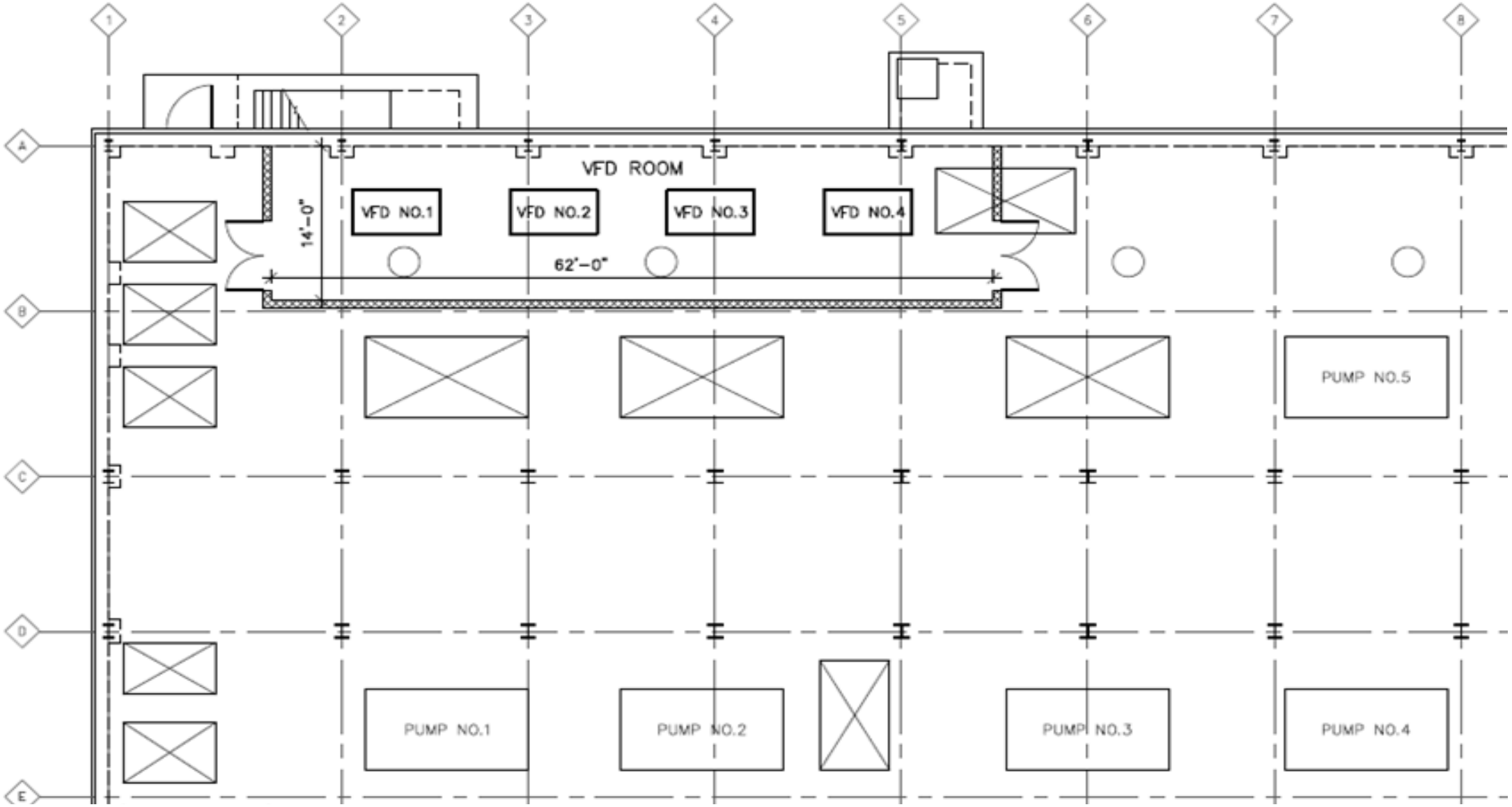
- Draft Report for ECWA review

CIP Project Summaries

Project 1 – Pumping System Improvements

- 4 or 5 new pumps with VFDs
  - 4 pumps: 1250 HP
  - 5 pumps: 1000 HP
- Conditioned VFD room
- Suction and discharge piping between isolation butterfly valves and new pump control valves
- Surge relief system improvements

Budgetary cost estimates have been developed for 4 and 5 new pumps



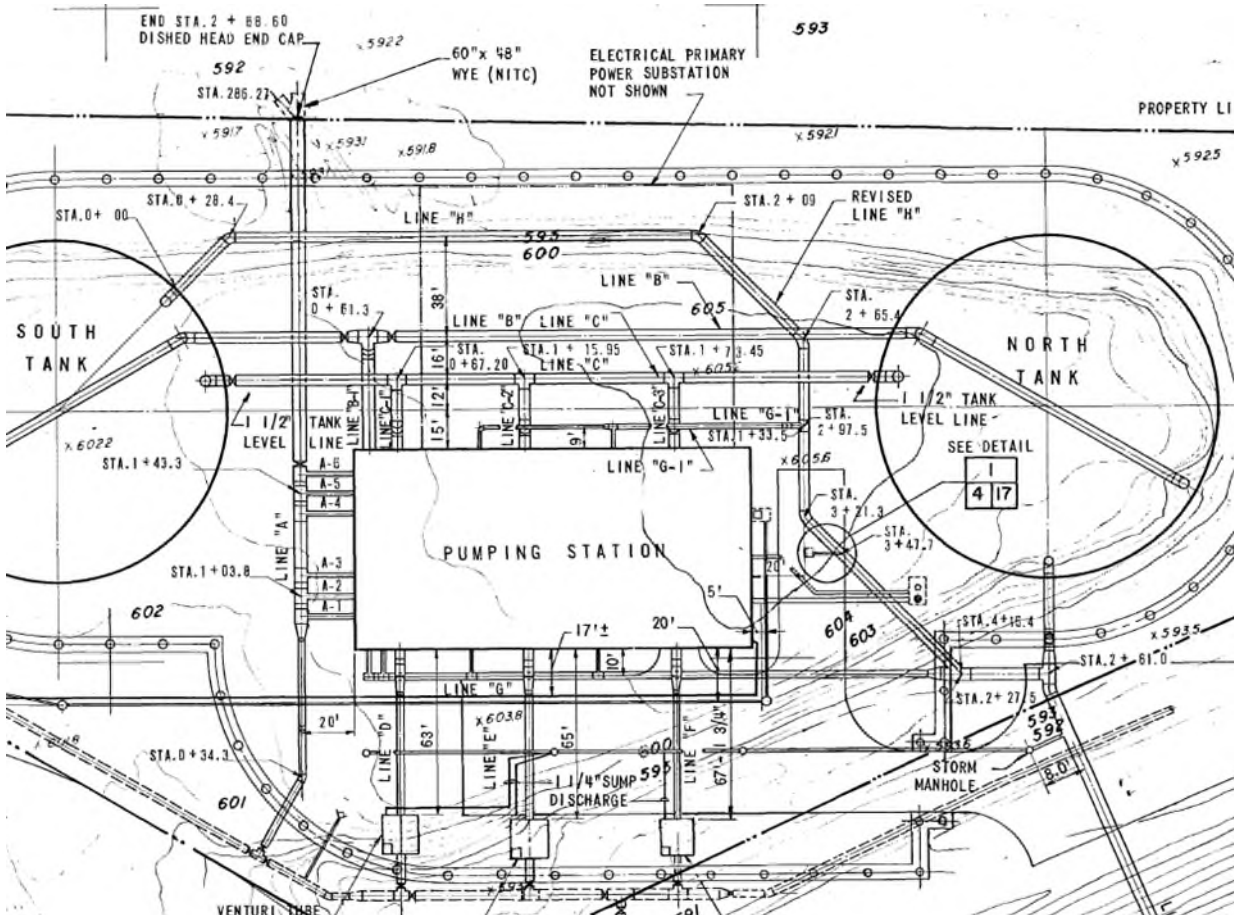
Project No. 1: Conditioned VFD room

Project 2 – HVAC and Miscellaneous Improvements

- New man door on the east side of the structure near Pump 1
- Unit heaters, exhaust fan components, other outdated HVAC assets
- New sump pumps and instrumentation conduit to venturi pits
- 2 in. water supply line
- Replacement of sanitary sewer service lateral

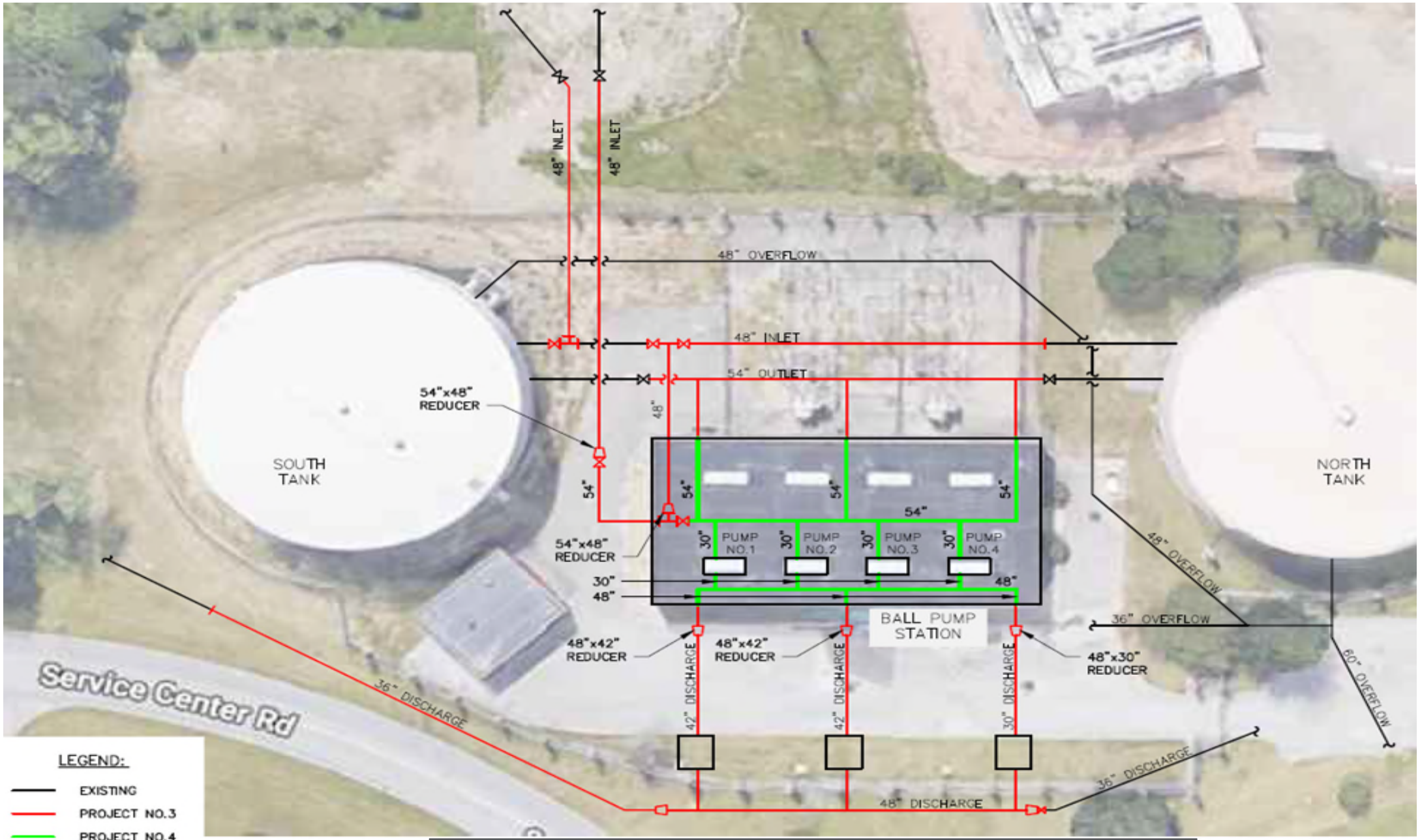
Project 3 – Exterior Piping Improvements

- Replacement of buried piping:
  - Tank inlet/outlet piping
  - PS suction/discharge piping
  - 60 in. inlet piping
- Improvements to 48 in. transmission main to remove single point of failure
- Removal of altitude valves



Project 4 – Interior Piping Improvements

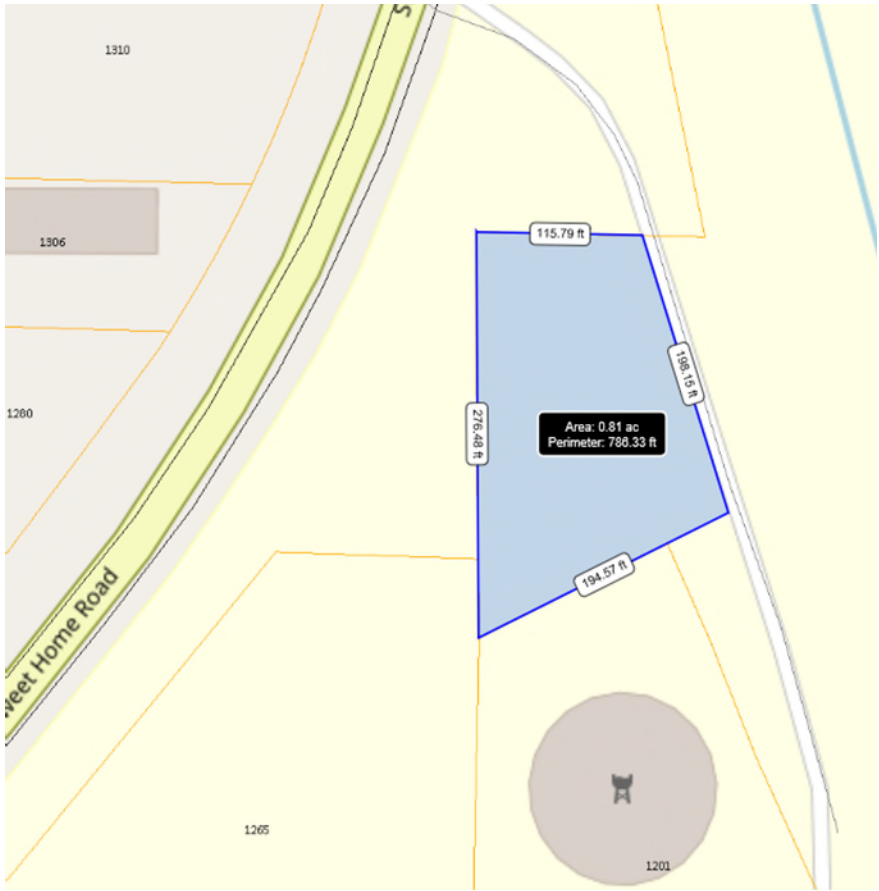
- Replacement of basement piping and valves for sections not replaced during:
  - Project 1: Pumping System Improvements or,
  - Project 3: Exterior Piping Improvements



Projects No. 3 & 4: Ball PS Piping Plan

Project 5 – Property Acquisition and Storage Facility

- Purchase land north of the north storage tank, bordering Sweet Home Road and the site road leading to Ball PS
- Site Improvements and construction of a pole barn for line maintenance storage



Project 6 – Exterior Building Improvements

- Replacement of the sheet metal and foam panel exterior of the building with a CMU and brick exterior
- New doors, windows, louvers, and minor revisions to in-place plumbing

Project 7 – Paving Improvements

- Remove and replace the parking lot and driving surfaces up to the intersection with Sweet Home Road

Project Cost Estimates

Project Cost Summary

Project	Point Estimate	Low Range (-30%)	High Range (+50%)
Project 1A – Pumping System	$11,440,000	$8,010,000	$17,160,000
Project 1B – Pumping System	$12,840,000	$8,990,000	$19,260,000
Project 2 – HVAC and Misc.	$660,000	$470,000	$990,000
Project 3 – Exterior Piping	$3,550,000	$2,490,000	$5,330,000
Project 4 – Interior Piping	$3,180,000	$2,230,000	$4,770,000
Project 5 – Land Acquisition and Storage Facility	$510,000	$360,000	$770,000
Project 6 – Building Exterior	$1,390,000	$980,000	$2,090,000
Project 7 – Paving	$580,000	$410,000	$870,000
Total	**$21,310,000**	**$14,950,000**	**$31,980,000**

Note: Total estimate assumes Project 1A (four pumps) selected.

CIP Prioritization

Draft Prioritization Plan

Near Term (0-5 years)

- ***Project 1***: Pumping System Improvements
- ***Project 2***: HVAC and Miscellaneous Improvements

Mid-Term (5-10 years)

- ***Project 3***: Exterior Piping Improvements
- ***Project 5:*** Property Acquisition and Storage Facility

Long-Term (10-15 years)

- ***Project 4***: Interior Piping Improvements
- ***Project 6***: Exterior Building Improvements
- ***Project 7***: Paving Improvements

		0 - 5 Years (2025)			5 - 10 Years (2030)			10 - 15 Years (2035)		
	Capital Project	**Point Estimate**	**Low Estimate**	**High Estimate**	**Point Estimate**	**Low Estimate**	**High Estimate**	**Point Estimate**	**Low Estimate**	**High Estimate**
Project No. 1	**Pumping System Improvements**	$11,440,000	$8,010,000	$17,160,000						
Project No. 2	**HVAC and Miscellaneous Improvements**	$660,000	$470,000	$990,000						
Project No. 3	**Exterior Piping Improvements**				$3,550,000	$2,490,000	$5,330,000			
Project No. 5	**Property Acquisition and Storage Facility**				$510,000	$360,000	$770,000			
Project No. 4	**Interior Piping Improvements**							$3,180,000	$2,230,000	$4,770,000
Project No. 6	**Exterior Building Improvements**							$1,390,000	$980,000	$2,090,000
Project No. 7	**Paving Improvements**							$580,000	$410,000	$870,000
	TOTAL	$12,100,000	$8,480,000	$18,150,000	$4,060,000	$2,850,000	$6,100,000	$5,150,000	$3,620,000	$7,730,000

Note: Total estimate assumes Project 1A selected.

Questions?

Next Steps

THANK YOU!

ECWA Ball Pump Station Capital Improvement Plan | August 1, 2019

APPENDIX F

Historic Flow Rate Data

Erie County Water Authority
Ball Pump Station Capital Improvement Plan
Appendix F: Historic Flow Rate Data

Monthly Data

2012	Average Daily Flow Rate (MGD)		
Month	Sturgeon Point WTP	Van de Water WTP	Ball PS
January	46.8	16.2	13.7
February	46.1	16.6	14.0
March	45.9	16.7	14.0
April	44.6	15.9	13.7
May	49.5	21.1	18.9
June	52.1	24.9	22.4
July	60.2	35.2	32.1
August	53.1	28.3	25.6
September	47.6	19.8	17.4
October	44.0	14.8	12.1
November	44.0	14.2	11.6
December	45.0	14.5	12.6

2013	Average Daily Flow Rate (MGD)		
Month	Sturgeon Point WTP	Van de Water WTP	Ball PS
January	46.9	16.9	14.6
February	47.7	18.9	16.5
March	47.4	18.5	16.1
April	46.4	17.5	15.2
May	49.1	20.5	18.2
June	48.6	19.8	17.6
July	50.2	21.9	19.8
August	49.4	20.5	18.4
September	46.2	17.3	15.2
October	44.7	15.4	13.5
November	45.1	15.1	12.9
December	47.8	17.7	15.3

2014	Average Daily Flow Rate (MGD)		
Month	Sturgeon Point WTP	Van de Water PS	Ball PS
January	50.0	20.2	17.1
February	50.4	22.9	19.2
March	50.1	22.6	19.1
April	49.0	20.7	17.6
May	49.1	21.0	17.9
June	51.0	23.0	20.2
July	49.4	22.1	19.3
August	49.7	20.9	18.0
September	47.6	18.1	15.2
October	45.9	15.4	12.3
November	46.7	16.1	13.4
December	48.8	17.1	14.3

Erie County Water Authority
Ball Pump Station Capital Improvement Plan
Appendix F: Historic Flow Rate Data

2015	Average Daily Flow Rate (MGD)		
Month	Sturgeon Point WTP	Van de Water WTP	Ball PS
January	50.1	18.5	15.2
February	51.6	21.5	17.9
March	53.6	22.9	19.1
April	51.8	19.7	16.2
May	52.7	23.2	19.4
June	51.5	20.1	17.4
July	51.9	22.9	19.4
August	51.4	22.4	19.1
September	50.4	20.7	17.2
October	47.6	16.3	13.0
November	47.9	16.0	13.1
December	48.1	16.7	13.8

2016	Average Daily Flow Rate (MGD)		
Month	Sturgeon Point WTP	Van de Water WTP	Ball PS
January	49.6	18.1	15.0
February	50.4	19.7	16.3
March	49.3	18.3	15.0
April	49.0	18.4	15.2
May	50.9	22.1	18.7
June	56.9	31.2	27.6
July	60.6	35.1	31.1
August	54.8	27.4	23.8
September	50.5	18.7	15.1
October	47.4	14.9	12.3
November	48.0	14.4	11.8
December	50.3	16.3	13.4

2017	Average Daily Flow Rate (MGD)		
Month	Sturgeon Point	Van de Water	Ball PS
January	51.3	18.0	15.0
February	51.1	19.7	16.6
March	50.6	18.9	15.9
April	50.3	18.1	15.1
May	50.1	19.1	16.3
June	51.6	23.9	20.9
July	51.6	22.1	19.2
August	45.8	23.1	20.3
September	47.1	21.0	18.5
October	45.0	16.7	13.9
November	44.5	17.2	14.4
December	44.6	19.3	16.1

Erie County Water Authority
Ball Pump Station Capital Improvement Plan
Appendix F: Historic Flow Rate Data

Annual Data

Average Day (MGD)			
Year	Sturgeon Point	Van de Water	Ball
2012	48.3	19.9	17.4
2013	47.5	18.3	16.1
2014	49.0	20.0	17.0
2015	50.7	20.1	16.7
2016	51.5	21.2	18.0
2017	48.6	19.8	16.9

Max Day and Peak Hour

Max Day (MGD)			
Date	Sturgeon Point	Van de Water	Ball
June 26th, 2007	78.4	48.1	39.5
July 14th, 2012	71.7	47.7	41.8
July 18th, 2013	56.5	34.7	29.8
June 29th, 2014	52.2 (max is 54.3 June 23rd)	28.7	25.4
July 30th, 2015	56.4(max is 57.6 July 29th)	33.9	30.0
July 14th, 2016	59.0(max is 68.4 July 24th)	45.8	39.4
June 18th, 2017	53.4(max is 55.2 June 12th)	32.1	28.8

Peak Hour (MGD)			
Date	Sturgeon Point	Van de Water	Ball
June 26th, 2007	81.2	48.1	39.5
July 14th, 2012	73.9	47.7	41.8
No hourly data 2013-2017			

Arcadis of New York, Inc.

50 Fountain Plaza

Suite 600

Buffalo, New York 14202

Tel 716 667 0900

Fax 716 842 2612

www.arcadis.com

N.

48" INLET
48" INLET
CHECK VALVE CHAMBER
CHECK VALVE CHAMBER
48" OVERFLOW
48" INLET
54" OUTLET
54"x48" REDUCER
FUTURE PUMP NO. 6
FUTURE PUMP NO. 5
SUCTION PIPING
DISCHARGE PIPING
SOUTH TANK
NORTH TANK
54"x48" REDUCER
PUMP NO.1
PUMP NO.2
PUMP NO.3
PUMP NO.4
30"
48"
BALL PUMP STATION
48"x42" REDUCER
48"x42" REDUCER
48"x30" REDUCER
42" DISCHARGE
42" DISCHARGE
30" DISCHARGE
48" OVERFLOW
36" OVERFLOW
60" OVERFLOW
36" DISCHARGE
48" DISCHARGE
36" DISCHARGE
Service Center Rd

LEGEND:
EXISTING
Proposed

ARCADIS Design & Consultancy for natural and built assets

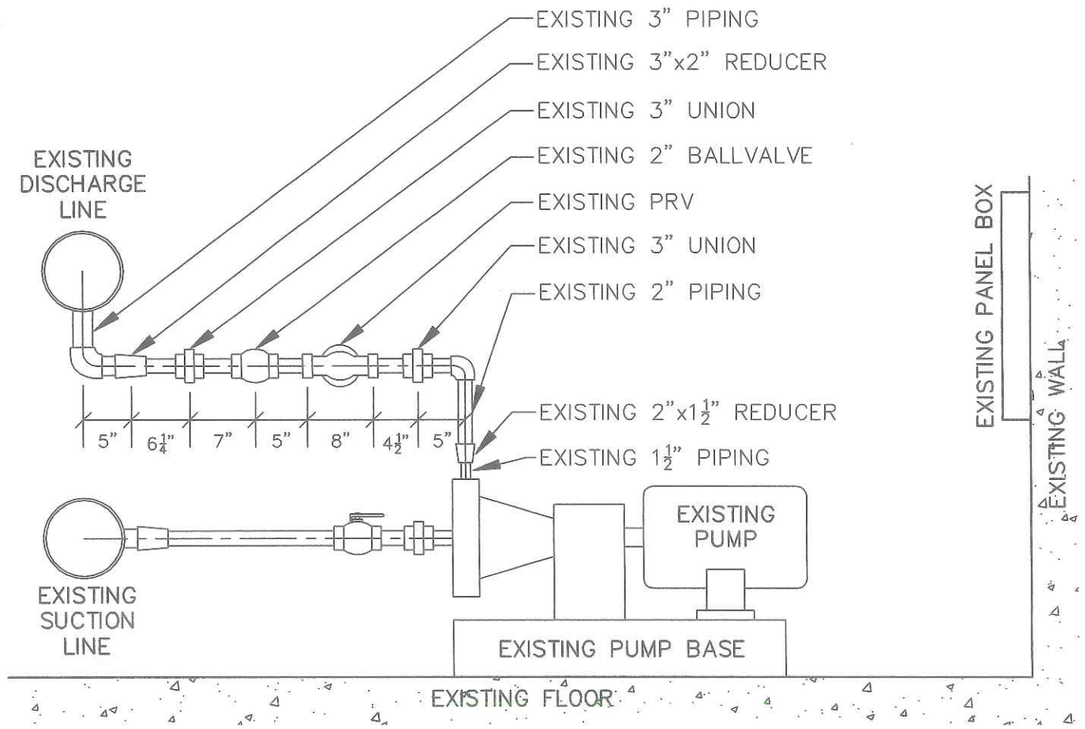
ERIE COUNTY WATER AUTHORITY

BALL PUMP STATION CAPITAL IMPROVEMENTS PLAN
PROJECT NO. 3 EXTERIOR PIPING IMPROVEMENTS

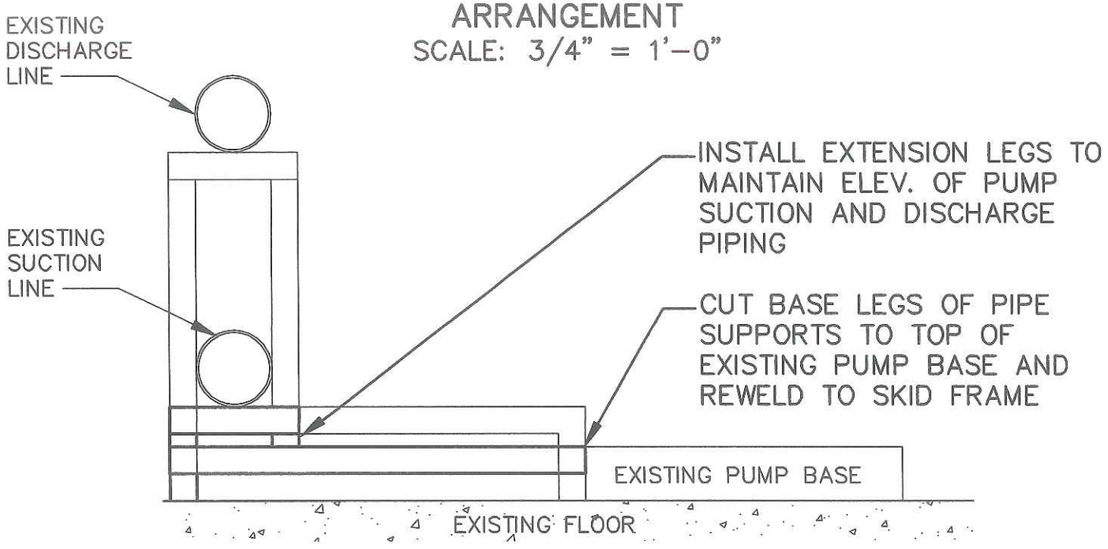
BALL PUMP STATION
SITE PIPING PLAN - REV.
NOT TO SCALE

JANUARY 2020

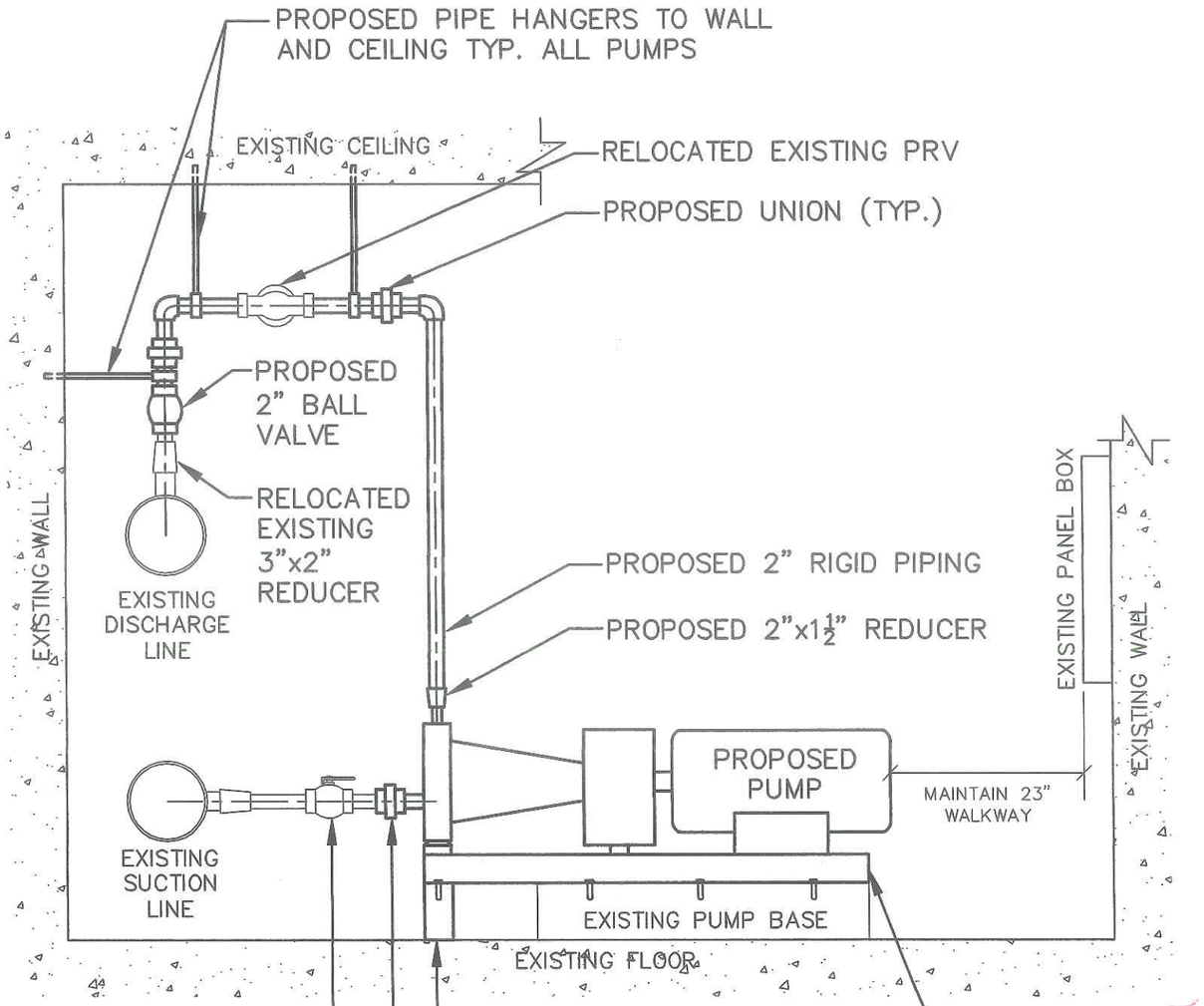
FIGURE 1



EXISTING DISCHARGE PIPE ARRANGEMENT
SCALE: 3/4" = 1'-0"



STAND MODIFICATIONS
(TYPICAL BOTH ENDS)
SCALE: N.T.S.



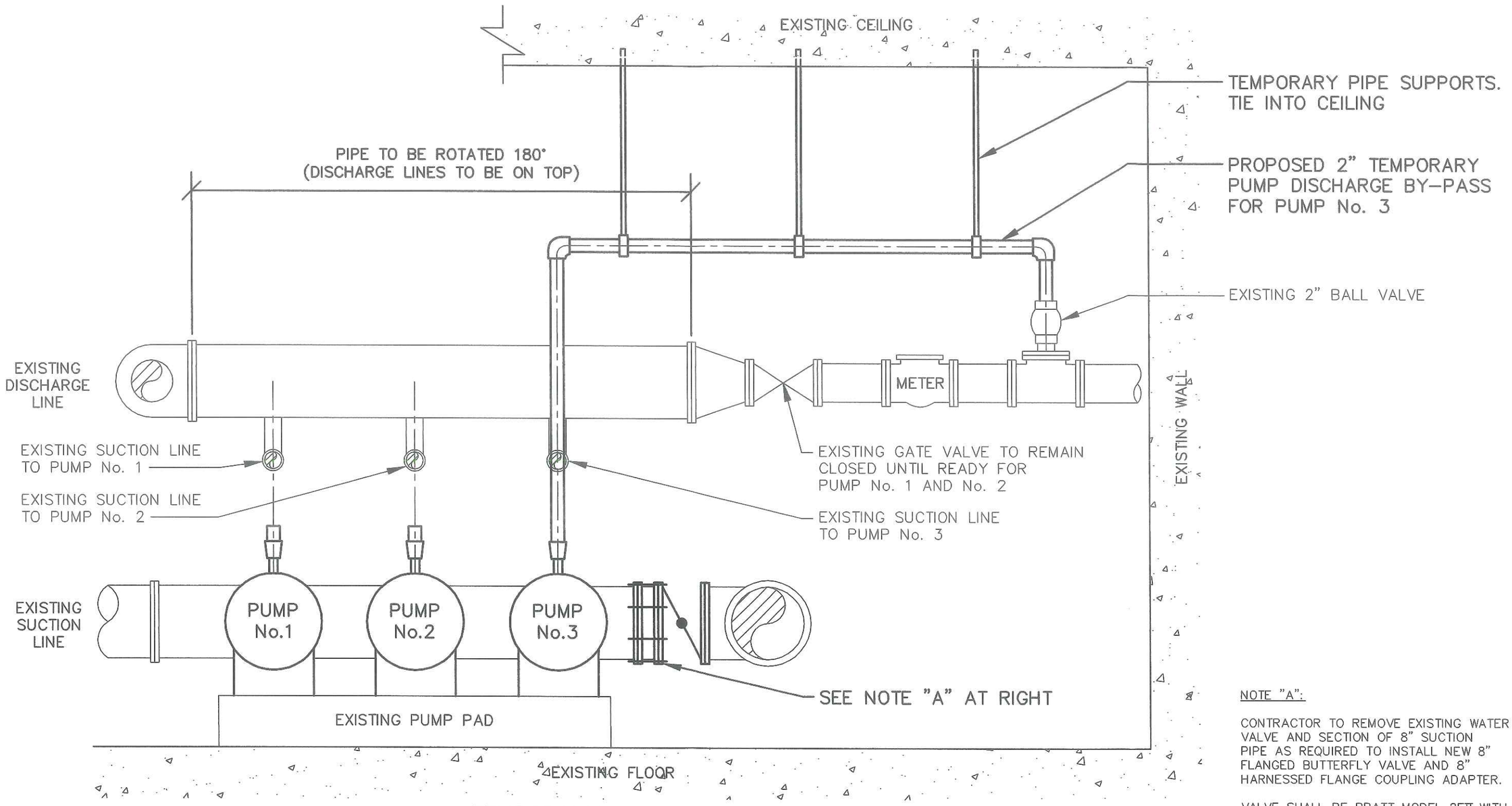
PROPOSED DISCHARGE PIPE ARRANGEMENT
SCALE: 3/4" = 1'-0"

JOB No. 046-42-4

R&D Engineering

FIGURE 1
TOWN OF AURORA
NEW YORK
DISCHARGE PIPE MODIFICATIONS
SCALE: AS NOTED

JOB No. 046-42-4



TEMPORARY PUMP DISCHARGE
SCALE: N.T.S.

NOTES:

1.) TIE TEMPORARY DISCHARGE LINE FROM PUMP No. 3 TO EXIST. 2" BALL VALVE.

2.) DISMANTLE FLANGES ON DISCHARGE HEADER, TURN 180°.

3.) MODIFY PIPE STAND BASE AS SHOWN IN FIGURE 1.

4.) ASSEMBLE NEW PUMP No. 1 AND PUMP No. 2 AND CONNECT PIPING AS SHOWN IN FIGURE 1.

5.) ADD NEW BALL VALVE TO DISCHARGE HEADER FROM PUMP No. 3.

6.) TURN "ON" PUMPS No. 1 AND No. 2.

7.) DISCONNECT TEMPORARY DISCHARGE BY-PASS AND COMPLETE PUMP No. 3.

NOTE "A":

CONTRACTOR TO REMOVE EXISTING WATER VALVE AND SECTION OF 8" SUCTION PIPE AS REQUIRED TO INSTALL NEW 8" FLANGED BUTTERFLY VALVE AND 8" HARNESSED FLANGE COUPLING ADAPTER.

VALVE SHALL BE PRATT MODEL 2FII WITH HANDWHEEL OPERATOR OR EQUAL. HARNESS FLANGE COUPLING ADAPTER SHALL BE ROCKWELL MODEL 912 WITH ANCHORS OR EQUAL.

COST SHALL BE INCLUDED IN THE LUMP SUM PRICE FOR THE WORK. CONTRACTOR SHALL VERIFY DIMENSIONS NEEDED AND SUBMIT SKETCH FOR APPROVAL.

R&D Engineering

FIGURE 2
TOWN OF AURORA
NEW YORK
DISCHARGE PIPE MODIFICATIONS
SCALE: AS NOTED