SECTION 5
SPECIFICATIONS

SECTION 011100 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 LOCATION OF THE PROJECT

A. The project is located along Lenox New Lyme and at 793 Lenox-New Lyme Road.

1.2 PROJECT DESCRIPTION

A. Contract A
   1. This project involves the installation of a new, packaged booster station to service the DFC mobile home park situated off Lenox New Lyme Road in Ashtabula County, Ohio. The new pump station will be located on East Mulberry Street, on the property of 793 Lenox-New Lyme Road.

B. Contract B
   1. This project involves the installation of waterline to serve the DFC mobile home park situated off Lenox New Lyme Road in Ashtabula County, Ohio. He waterline will extend approximately 6,675 linear feet down Lenox New Lyme Road, from the connection on Lenox New Lyme to the mobile home park. The new waterline will be 8-inch, with 6-inch branches on Penny Lane and Fairway Street and 2-inch branch to the mobile home park water distribution line.

The bid documents contain bid forms for two (2) separate contracts and a combined bid contract. The bidder may bid just one of the separate contracts, just the combined contract, any combination of contracts, or all three contracts (separate and combined). Multiple separate contracts may be awarded separately - The bidder must submit a separate bid security (cashier's check, irrevocable letter of credit, or ORC 153.571 bond) for each contract bid.

1.3 SPECIFICATIONS

A. In general, these Specifications describe the work to be performed by the various trades, other than work specifically excluded. It shall be the responsibility of the Contractor and Subcontractors to perform all work incidental to their trade, whether or not specific mention is made of each item, unless such incidentals are included under another Item.

B. It is advised that the Contractor and all Subcontractors familiarize themselves with the contents of the complete Specifications, particularly for the trades preceding, following, related or adjacent to their work.

1.4 PROJECT FUNDING

A. This project is funded by WSRLA and OEPA H2Ohio.

1.5 DRAWING SCHEDULE

A. The work to be done under this Contract is shown on the following Drawings:

Title	Sheet No.
Cover Sheet	1
Legend & Symbology	2
General Notes	3-4
Plan and Profiles	5-18
Construction Details	19-21
Site Plan	22
Booster Station	23-25

END OF SECTION 011100

SECTION 011419 – USE OF SITE

PART 1 - GENERAL

1.1 GENERAL

A. The Contractor will be allowed the use of as much of the site designated for the improvements as is necessary for his operation.

1.2 USE OF STREETS

A. During the progress of the work, the Contractor shall make ample provisions for both vehicle and pedestrian traffic on any public street and shall indemnify and save harmless the Owner from any expense whatsoever due to their operations over said streets. The Contractor shall also provide free access to all the fire hydrants, water, and gas valves located along the line of his work. Gutters and waterways must be kept open or other provisions made for the removal of storm water. Street intersections may be blocked only one-half at a time, and the Contractor shall lay and maintain temporary driveways, bridges and crossings, such as in the opinion of the Engineer are necessary to reasonably accommodate the public.

B. In the event of the Contractor's failure to comply with these provisions, the Owner may cause the same to be done, and may deduct the cost of such work from any monies due the Contractor under this Agreement, but the performance of such work by the Owner at its instance shall serve in no way to release the Contractor from his general or particular liability for the safety of the public or the work.

C. The Contractor shall repair at no cost to the Owner, all existing roads, parking areas, grassed areas that are damaged due to the execution of his work. The Contractor shall remove daily all mud, soil and debris that may be tracked onto existing streets, drives, or walks by his equipment or that of subcontractors or suppliers.

1.3 CLOSING STREETS TO TRAFFIC

The Contractor may with the approval of the Engineer, close streets, or parts of streets, to vehicular traffic. The streets are to remain closed as long as the construction work or the condition of the finished work requires or as determined by the Engineer. The Engineer shall be the judge of how many streets or parts of streets it is necessary for the Contractor to close at any time, and may refuse to permit the closing of additional streets to traffic until the majority of the work on the closed streets is completed and they are opened to traffic.

1.4 RIGHTS-OF-WAY

A. Whenever it is required to perform work within the limits of public or private property or in rights-of-way, such work shall be done in conformity with all agreements between the Owner and the owners of such. Care shall be taken to avoid injury to the premises entered, which premises shall be left in a neat and orderly condition by the removal of

rubbish and the grading of surplus materials, and the restoration of said public or private property to the same general conditions as pertained at the time of entry for work to be performed under this contract.

B. The Contractor shall not (except after consent from the proper parties) enter or occupy with men, tools or equipment, any land outside the rights-of-way or property of the Owner.

C. When the Contractor performs construction within 10 ft. of a right-of-way or easement line, he shall place tall stakes properly identified at points of change in width or direction of the right-of-way or easement line and at points along the line so that at least two stakes can be seen distinctly from any point on the line.

1.5 EASEMENTS

A. Where the work is to be constructed upon easements, such easements will be secured by the Owner without cost to the Contractor. The Contractor shall not enter upon or occupy any private property outside of the limits of the easements furnished.

B. Care shall be taken to avoid injury to the premises entered, which premises shall be left in a neat and orderly condition by the removal of rubbish and the grading of surplus materials, and the restoration of said public or private property to the same general conditions as pertained at the time of entry for work to be performed under this contract.

1.6 PROTECTING EXISTING BUILDINGS, STRUCTURES AND ROADWAYS

A. The Contractor shall, at his own expense, shore up and protect any buildings, roadways, utilities or other public or private structures which may be encountered or endangered in the prosecution of the work, and that may not be otherwise provided for, and he shall repair and make good any damages caused to any such property by reason of his operations. All existing fences removed due to the prosecution of the work shall be replaced by the Contractor. No extra payment will be made for said work or material, but the cost of this work must be included in the price stipulated for the work to be done under this contract.

1.7 SITE FACILITIES

A. The Contractor shall furnish and place sufficient quantities of portable toilet facilities at locations convenient for use by the Contractor's personnel, Subcontractors, the Engineer, and the Owner.

1.8 RESTORATION

A. The contractor shall restore all areas per the plans and specifications and if not specified, at least to the condition existing prior to the start of work.

END OF SECTION 011419

SECTION 012513 – PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 MATERIALS AND EQUIPMENT

A. In the specifications and on the Engineer's drawings, are specified and shown certain pieces of equipment and materials deemed most suitable for the service anticipated. This is not done to eliminate other equipment and materials equally as good and efficient. The Contractor shall prepare his bid on the particular materials and equipment specified. Following the award of the contract, should the Contractor desire to use other equipment and materials, he shall submit to the Owner a written request for such change and state the advantage to the Owner and the savings or additional cost involved by the proposed substitution. The determination as to whether or not such change will be permitted rests with the Owner and the Engineer.

B. Each major item of equipment shall be inspected by a manufacturer's representative during installation and upon completion of the work. The Contractor shall supply the Engineer with a certificate of such inspection.

END OF SECTION 012513

SECTION 013119 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 PRECONSTRUCTION MEETING

A. Prior to the Contractor beginning any work on the project, the Owner will schedule and hold a preconstruction meeting to discuss all aspects of the contract work.

B. The Contractor shall be present and be prepared to comment in detail on all aspects of his work.

C. The Contractor shall bring to the preconstruction meeting a proposed construction progress schedule, erosion control plan, quality control program, concrete mix designs, asphalt mix designs (JMF), etc. Approval of each by the Engineer is required prior to the start of any work.

D. Included in the construction progress schedule shall be an implementation sequence of the proposed erosion control efforts required by the contract.

1.2 PROGRESS MEETINGS

A. Monthly progress meetings will be held at a location to be determined by the Owner on a regularly scheduled day mutually convenient to the Owner, Contractor, and Engineer.

B. The Contractor shall provide an updated construction progress schedule and be prepared to comment in detail on all aspects of his work.

END OF SECTION 013119

SECTION 013216 – CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 PROGRESS SCHEDULE

A. Immediately after signing the Contract, the General Construction Contractor shall prepare a graphic progress schedule, indicating the work to be executed during each month and the rate of expected progress to secure completion on the agreed-upon completion date. The progress schedule shall be approved by the Engineer and Owner prior to starting work on the site. Copies of such graphic progress charts, upon which has been indicated the actual progress, shall be furnished to the Engineer with each requisition for payment.

This progress schedule must follow these general time frames (may vary with project):

1. Chip seal, paving fabric and/or the leveling course must start within 7 calendar days from the date of milling.

2. Casting adjustments and/or curb replacements must start within 7 calendar days from the completion of the chip seal, intermediate course and/or fabric.

3. Surface course asphalt concrete must begin installation within 7 calendar days from the completion of the casting adjustments and/or curb replacement.

4. Traffic paint, temporary or permanent must be installed within a time period as deemed adequate and desirable for each location.

B. Should the rate of progress fall materially behind the scheduled rate of progress, and unless the delay is authorized by the Engineer, each offending Contractor shall furnish additional labor, work overtime, or take other necessary means required for completion of the work on the scheduled date. No additional compensation beyond the set Contract price shall be paid for action taken or overtime expense incurred in maintaining scheduled progress.

END OF SECTION 013216

SECTION 013223 – SURVEY AND LAYOUT DATA

PART 1 - GENERAL

1.1 STAKING

A. The Contractor shall hire a surveyor licensed in the state the work is to be installed to provide all reference points not already established and staking. The Contractor shall protect and preserve the established staking and reference points as long as required for installation of the work and field verifications by any party. The Contractor's surveyor shall replace and accurately relocate all staking and reference points so lost, destroyed or moved.

1.2 LAYOUT OF WORK

A. The Contractor shall lay out his work and be responsible for correct locations, elevations and dimensions of all work executed by him under this Contract. The Contractor must exercise proper precautions to verify the figures shown on the Drawings before laying out the work and will be held responsible for any error resulting from his failure to exercise such precaution. The Contractor shall insure the new construction aligns with any existing work.

END OF SECTION 013223

SECTION 013236 – VIDEO MONITORING AND DOCUMENTATION

PART 1 - GENERAL

1.1 SCOPE

A. Provide all labor, materials, equipment, and services, and perform all operations necessary to furnish to the Owner a complete color audio-video DVD record of the surface features within the proposed construction zone of influence. This record shall include, but not be limited to, all audio-video DVDs, storage cases, video logs, and indexes. The purpose of this coverage shall be to accurately document the pre-construction condition of these surface features.

1.2 QUALIFICATIONS

A. The video DVD documentation shall be done by a responsible commercial firm known to be skilled and regularly engaged in the business of pre-construction color audio-video DVD documentation. The firm shall furnish such information as the Owner deems necessary to determine the ability of that firm to perform the work in accordance with the Contract specifications.

1.3 PRODUCTS

A. The color audio-video recording delivered to the Owner shall be on a high quality DVD format.

END OF SECTION 013236

SECTION 013319.01 - FIELD TEST REPORTING
- AGGREGATE, SOILS, CONCRETE AND ASPHALT

PART 1 - GENERAL

1.1 SUMMARY

A. The Contractor shall be responsible for the quality of all materials incorporated into the project work and shall be responsible for all costs of testing and certification of same. The Contractor shall provide the City Engineer a list of three (3) local qualified firms for the City to select from to be the Contractor's testing firm.

B. The Contractor shall provide the engineer with a Quality Control Plan in which his testing methods/procedures are defined. Said Plan shall meet with the approval of the Engineer and include identification of laboratories, types of testing, and the tentative amount and scheduling of each.

All certification of tests and/or gradations for material to be utilized in the work and all quality control testing shall be performed by an independent laboratory (not affiliated with, owned by, or managed by the Contractor). The laboratory shall be accredited by the AASHTO Materials Reference Laboratory for the type of testing performed.

C. The Owner may perform field Quality Assurance testing; however, such testing shall not relieve the Contractor from the responsibility of Quality Control testing or from supplying certificates from manufacturers or suppliers to demonstrate compliance with the specifications. It is intended that the testing by the Contractor and the Owner be complimentary toward a quality project; however, the Contractor may not assume the Owner will test or that any tests will be done in lieu of the Contractor's own Quality Control testing. In the same sense, the Contractor may not rely on Owner Quality Assurance testing as a basis of acceptance or approval of his work nor may any Owner-performed testing be reflected in his submitted plan.

1.2 TEST CRITERIA

A. The following tests at a minimum shall be included with the Contractor's Quality Control Plan in accordance with the specifications:

1. Aggregates
   a. For each material and/or different source, the laboratory shall perform soundness, gradation, and other tests for all parameters specified. Aggregates incorporated into concrete or asphalt mixes shall also be tested for moisture content daily.

2. Compaction Tests
   a. Compaction tests or field density tests shall be taken on all embankment, trench backfill, subgrade, and subbase materials.
   b. Minimum testing shall be as follows:
      Embankment testing shall be at least one (1) test/5,000 SF of each lift; Trench backfill testing shall be at least one (1) test/50 LF of each lift; Subgrade and/or subbase testing shall be at least one (1) test/200 LF of pavement or 5,000 SF of slabs; subject to greater frequency due to soil conditions or Engineer's direction.
   c. Proctors or relative density tests shall be performed as often as necessary for the differing soils or granular materials utilized. Proctors shall be run with a minimum of 5 points. Test reports shall show the wet (bulk) weight, dry weight, wet (bulk) density, dry density, moisture content weight and moisture content percentage. Both the dry curve and the wet curve shall be plotted.

3. Concrete Mix Design
   a. For each type of concrete, the laboratory shall perform the necessary mix design providing all test data as required by the specifications.

4. Concrete Field and Laboratory Tests
   a. The laboratory shall cast concrete cylinders and test beams:
      1. One set of four cylinders per 50 CY with a minimum of two sets per day. The cylinders shall be broken: one at 7 days, two at 28 days, one at 56 days, unless otherwise directed by the Engineer.
      2. One beam per 50 CY with a minimum of two beams per day.
   b. Temperature and unit weight shall be run on fresh concrete at intervals sufficient for the type of structure being placed and a minimum of once per day. Bulk weight, bucket weight, (tare), net weight, bucket factor (bucket volume) and unit weight shall be recorded on the fresh concrete report. Show all batch weights for yield calculations. Slump and air content tests shall be taken a minimum of one test per 20 CY and at least once per day.
   c. All field and laboratory testing shall be performed by technicians certified by the American Concrete Institute (ACI) for the type of testing performed.
   d. Initial cure of all cylinders shall be in a temperature controlled cure box or temperature controlled water tank with a hi-low thermometer. Hi-low temperature readings shall be recorded on the fresh concrete report.

5. Asphalt Mix Design
   a. For each type of asphalt mix, submit job mix formula (JMF) prepared by an ODOT pre-qualified laboratory from tests performed on the aggregates proposed for use.
   b. Sample and test for gradation and bitumen content per ODOT 441.

1.3 LABORATORY REPORTS

A. Reports of laboratory and field tests will be distributed to the Engineer, Owner, and Suppliers within 24 hours of completion.

END OF SECTION 013319.01

SECTION 013323 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.1 GENERAL

A. The Contractor shall submit detailed drawings, acceptable catalog data, specifications and material certifications for all equipment and materials specified or required for the proper completion of the work.

B. The intent of these items is to demonstrate compliance with the design concept of the work and to provide the detailed information necessary for the fabrication, assembly and installation of the work specified. It is not intended that every detail of all parts of manufactured equipment be submitted, however sufficient detail will be required to ascertain compliance with the specifications and establish the quality of the equipment proposed.

Shop Drawings shall be sufficiently clear and complete to enable the Engineer/Architect and Owner to determine that items proposed to be furnished conform to the specifications and that items delivered to the site are actually those that have been reviewed.

C. It is emphasized that the Engineer/Architect's review of Contractor's submitted data is for general conformance to the contract drawings and specifications but subject to the detailed requirements of drawings and specifications. Although the Engineer/Architect may review submitted data in detail, such review is an effort to discover errors and omissions in Contractor's drawings. The Engineer/Architect's review shall in no way relieve the Contractor of his obligation to properly coordinate the work and to Engineer/Architect the details of the work in such manner that the purposes and intent of the contract will be achieved. Such review by the Engineer/Architect shall not be construed as placing on him or on the Owner any responsibility for the accuracy and for proper fit, functioning or performance of any phase of the work included in the contract.

D. Shop Drawings shall be submitted in proper sequence and with due regard to the time required for checking, transmittal and review so as to cause no delay in the work. The Contractor's failure to transmit appropriate submittals to the Engineer/Architect sufficiently in advance of the work shall not be grounds for time extension.

E. The Contractor shall submit Shop Drawings for all fabricated work and for all manufactured items required to be furnished in the Contract in accordance with the General Provisions and as specified herein. Shop Drawings shall be submitted in sufficient time to allow at least twenty-one (21) calendar days after receipt of the Shop Drawings from the Contractor for checking and processing by the Engineer/Architect.

F. It is the responsibility of each Prime Contractor to furnish to all other Prime Contractors and especially the General Construction Contractor reviewed Shop Drawings for guidance in interfacing the various trades; i.e., sleeves, inserts, anchor bolts, terminations, and space requirements.

G. No work shall be performed requiring Shop Drawings until same have been reviewed by Engineer/Architect.

H. Accepted and reviewed Shop Drawings shall not be construed as approval of changes from Contract plan and specification requirements.

I. The Engineer/Architect will review the first and second Shop Drawing item submittals at no cost to the Contractor. Review of the third submittal and any subsequent submittal will be at the Contractor's expense. Payment will be deducted from the Contract amount at a rate of 2.8 times direct labor cost plus expenses.

1.2 SUBMITTAL PROCEDURE

A. All required submissions shall be made to the Engineer/Architect by the Prime Contractor(s) only. Any data prepared by subcontractors and suppliers and all correspondence originating with subcontractors, suppliers, etc., shall be submitted through the Contractor.

B. Contractor shall review and approve all Shop Drawings prior to submission. Contractor's approval shall constitute a representation to Owner and Engineer/Architect that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each Shop Drawing or sample with the requirements of the work and the Contract Documents.

C. Submittal Preparation: Mark each submittal with a permanent label or page for identification. Provide the following information on the label for proper processing and recording of action taken:

1. Location
2. Project Name
3. Contract
4. Name and Address of Engineer/Architect
5. Name and Address of Contractor
6. Name and Address of Subcontractor
7. Name and Address of Supplier
8. Name of Manufacturer
9. Number and Title of appropriate Specification Section
10. Drawing Number and Detail References, as appropriate.
11. Submittal Sequence or Log Reference Number.

    a. Provide a space on the label for the Contractor's review and approval markings and a space for the Engineer/Architect's "Action Stamp".

D. Each Shop Drawing, sample and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor:

Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements.

_____ _____

Signature Date

_____

Company

E. Shop Drawings shall be submitted in not less than six (6) copies to the Engineer/Architect at the address specified at the Preconstruction Conference. Single mylar or sepia reproducible copies of simple Shop Drawings may be submitted with prior approval of the Engineer/Architect.

F. At the time of each submission, Contractor shall in writing identify any deviations that the Shop Drawings or samples may have from the requirements of the Contract Documents.

G. Drawings shall be clean, legible and shall show necessary working dimensions, arrangement, material finish, erection data, and like information needed to define what is to be furnished and to establish its suitability for the intended use. Specifications may be required for equipment or materials to establish any characteristics of performance where such are pertinent. Suitable catalog data sheets showing all options and marked with complete model numbers may, in certain instances, be sufficient to define the articles which it is proposed to furnish.

H. For product which require submittal of samples, furnish samples so as not to delay fabrication, allowing the Engineer reasonable time for the consideration of the samples submitted. Properly label samples, indicating the material or product represented, its place of origin, the names of the vendor and Contractor and the name of the project for which it is intended. Ship samples prepaid. Accompany samples with pertinent data required to judge the quality and acceptability of the sample, such as certified test records and, where required for proper evaluation, certified chemical analyses.

1.3 REVIEW PROCEDURE

A. Engineer/Architect will review with reasonable promptness all properly submitted Shop Drawings. Such review shall be only for conformance with the design concept of the Project and for compliance with the information given in the plans and specifications and shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.

B. The review of a separate item as such will not constitute the review of the assembly in which the item functions. The Contractor shall submit entire systems as a package.

C. All Shop Drawings submitted for review shall be stamped with the Engineer/Architect's action and associated comments.

D. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer/Architect will review each submittal, mark to indicate action taken, and return accordingly. Compliance with specified characteristics is the Contractor's responsibility.

Action Stamp: The Engineer/Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

1. If Shop Drawings are found to be in general compliance, such review will be indicated by marking the first statement.
2. If only minor notes in reasonable number are needed, the Engineer/Architect will make same on all copies and mark the second statement. Shop Drawings so marked need not be resubmitted.
3. If the submitted Shop Drawings are incomplete or inadequate, the Engineer/Architect will mark the third statement, request such additional information as required, and explain the reasons for revision. The Contractor shall be responsible for revisions, and/or providing needed information, without undue delay, until such Shop Drawings are acceptable. Shop Drawings marked with No. 3 shall be completed resubmitted.
4. If the submitted Shop Drawings are not in compliance with the Contract Documents, the Engineer/Architect will mark the fourth statement. The Contractor will be responsible to submit a new offering conforming to specific products specified herein and/or as directed per review citations.

E. No submittal requiring a Change Order for either value or substitution or both, will be returned until the Change Order is approved or otherwise directed by the Owner.

APPLICATION FOR USE OF SUBSTITUTE ITEM

TO: _____

PROJECT: _____

SPECIFIED ITEM:

_____	_____	_____
Page	Paragraph	Description

A. The undersigned requests consideration of the following as a substitute item in accordance with Article 6.05 of the General Conditions.

_____

B. Change in Contract Price (indicate + or -) $ _____

C. Attached data includes product description, specifications, drawings, photographs, references, past problems and remedies, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified. For consideration of the attached data as SHOP DRAWINGS, submittal shall be in accordance with requirements of Section 013323.

D. Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments are correct:

1. The proposed substitute does not affect dimensions shown on Drawings.

2. The undersigned will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the requested substitution.

3. The proposed substitution will have no adverse affect on other contractors, the construction schedule, or specified warranty requirements. (If proposed substitution affects construction schedule, indicate below using + or -)

_____ CONSECUTIVE CALENDAR DAYS

4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item, and agrees to reimburse the OWNER for the charges of the ENGINEER for evaluating this proposed substitute item.

E. Signature: _____

Firm: _____

Address: _____

_____

Telephone: _____ Date: _____

Attachments: _____

_____

_____

_____

For use by ENGINEER:

_____Accepted as evidenced by affixed SHOP DRAWING REVIEW stamp.
_____Accepted as evidenced by included CHANGE ORDER.
_____Not accepted as submitted. See Remarks.
_____Acceptance requires completion of submittal as required for SHOP DRAWINGS.
_____Not accepted. Do not resubmit.

By: _____ Date: _____

Remarks: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

APPLICATION FOR USE OF "OR-EQUAL" ITEM

TO: _____

PROJECT: _____

SPECIFIED ITEM:

_____	_____	_____
Page	Paragraph	Description

A. The undersigned requests consideration of the following as an "or-equal" item in accordance with Article 6.05 of the General Conditions.

_____

B. Change in Contract Price (indicate + or -) $ _____

C. Attached data includes product description, specifications, drawings, photographs, references, past problems and remedies, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified. For consideration of the attached data as SHOP DRAWINGS, submittal shall be in accordance with requirements of Section 013323.

D. Signature:

_____

Firm:

_____

Address:

_____

_____

Telephone: _____ Date: _____

Attachments: _____

_____

_____

_____

For use by ENGINEER:

_____Accepted as evidenced by affixed SHOP DRAWING REVIEW stamp.
_____Accepted as evidenced by included CHANGE ORDER.
_____Not accepted as submitted. See Remarks.
_____Acceptance requires completion of submittal as required for SHOP DRAWINGS.
_____Not accepted. Do not resubmit.

By: _____ Date: _____

Remarks: _____

_____

_____

_____

_____

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_____

_____

_____

_____

END OF SECTION 013323

SECTION 013326 – PRODUCT TESTING AND CERTIFYING

PART 1 - GENERAL

1.1 QUALITY OF MATERIALS

A. Where the specifications call for mill or shop tests, the Contractor shall furnish duplicate copies of attested manufacturer's certificates showing details of quality or performance sufficient to demonstrate conformity to contract requirements. Mill, shop or witness tests shall be subject to view by the Engineer's representative, but the Engineer's representation shall not relieve the Contractor from the necessity of furnishing certificates specified. The Engineer shall be notified by the Contractor in writing, sufficiently in advance of the time of making tests, so that proper arrangements may be made. Waiving of witness of tests by the Engineer may be in writing only by the Engineer. All costs for travel, lodging, food and transportation that are necessary for the Engineer's representative and the Owner's representative to attend witness tests shall be included in the Contractor's bid for those item(s) specifically designated as being subject to witness testing.

B. Unless otherwise specified, all materials, equipment and articles shall be erected, installed, applied, or connected, used, cleaned and conditioned in accordance with the printed instructions and directions of the manufacturer.

C. The installation shall be so made that its several component parts will function together as a workable system. It shall be complete with all accessories necessary for its operation and shall be left with all equipment properly adjusted and in working order.

D. The work shall be executed in conformity with the best practice and so as to contribute to efficiency of operation, minimum maintenance, accessibility and sightliness. It shall also be executed so that the installation will conform and accommodate itself to the building structure, its equipment and usage.

E. Whenever in the contract documents a particular brand, make of material, device or equipment is shown or specified, such brand, make of material, device or equipment is to be regarded merely as a standard and such trade name shall be followed by "or equal".

1.2 QUALITY ASSURANCE

A. The equipment and materials to be furnished under this Contract shall be the products of well established and reliable firms which have had ample experience for at least five (5) years in the manufacture of equipment or materials similar in design and of equal quality to that specified. If required, the manufacturer shall submit a list of installations of similar equipment which have been in successful operation for at least five (5) years.

1.3 EXPERIENCE CLAUSE REQUIREMENT AND PERFORMANCE BONDS FOR MANUFACTURER

A. For every piece of equipment furnished under this Contract, the manufacturer will be required to have a minimum of five (5) years of experience in providing this specific type of equipment. In lieu of this experience requirement, the manufacturer will be required to provide performance bond(s) for the faithful performance of the equipment and guarantee payment in a sum of not less than one hundred and fifty percent (150%) of the total equipment price for the completed work for that item. In the absence of verifiable experience, the manufacturer will be required to provide the performance bond(s) for the same number of years that the manufacturer was found lacking in experience from the specified five (5) year period. The performance bond(s) shall be from an approved surety company, to the satisfaction of the Owner's Law Director.

B. Agents of bonding companies which write bonds for the performance and payment of the contract shall furnish power of attorney bearing the seal of the company, evidencing such agent's authority to execute the particular type of bond to be furnished, and evidencing also the right of the surety company to do business in the State of Ohio. Copy of this proof shall be attached to each copy of the contract.

C. The bond shall be purchased through a surety company with a local agent upon whom service of process can be made.

D. In event of failure of surety or co-surety, the manufacturer shall immediately furnish a new bond, as required herein. The manufacturer's bond will not be released until all provisions of the contract have been fulfilled.

E. The surety used for the bid bond and performance bond shall be listed in the latest U.S. Treasury Circular 570 and the Penal Sums shall be within the maximum specified for such company in said Circular 570.

END OF SECTION 013326

SECTION 013543 - ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.1 UNNECESSARY NOISE, DUST AND ODORS

A. The Contractor's performance of this contract shall be conducted so as to eliminate all unnecessary noise, dust and odors.

1.2 SEWAGE, SURFACE AND FLOOD FLOWS

A. The Contractor shall take whatever action is necessary to provide all necessary tools, equipment and machinery to adequately handle all sewage, surface flows and flood flows which may be encountered during the performance of the work. The entire cost of and liability for handling such flows is the responsibility of the Contractor and shall be included in the price for the appropriate item.

1.3 WORK IN FREEZING WEATHER

A. Written permission from the Engineer shall be obtained before any work is performed which, in the judgment of the Engineer, may be affected by frost, cold, or snow. When work is performed under such conditions, the Contractor shall provide facilities for heating the materials and for protecting the finished work.

1.4 POLLUTION CONTROL

A. It shall be the responsibility of the Contractor to prevent or limit pollution of air and water resulting from his operations.

B. The Contractor shall perform work required to prevent soil from eroding or otherwise entering onto all paved areas and into natural watercourses, ditches, and public sewer systems. This work shall conform to all local ordinances and/or regulations, if any, and if not otherwise regulated by local ordinances or regulations shall at a minimum conform to the Ohio EPA General Storm Water NPDES Permit for Construction Activities and the Ohio Department of Natural Resources Rainwater and Land Development manual. This work may consist of but not be limited to construction and continual maintenance of silt fence, bio bag filters, sedimentation traps, stilling basins, check dams, temporary seeding, temporary mulching, erosion mats and other means to clarify waters containing suspended materials from excavations, embankments, cleared and grubbed or stripped areas, stockpiles, well points, and disposal sites and shall be commensurate with the contractor’s schedule, sequence of work, means and methods. If a SWPPP plan is not required for the project, the contractor shall at a minimum submit a plan of his proposed erosion control prevention methods for approval by the Owner and/or other regulatory authorities having jurisdiction prior to starting any construction activities which may cause erosion.

C. The Contractor shall perform work required to prevent dust attributable to his operations from entering the atmosphere. Dust on unsurfaced streets or parking areas and any remaining dust on surfaced streets shall be controlled with water and/or calcium chloride dust palliative as needed.

D. Any material removed from sanitary or storm sewers shall be disposed in accordance with all applicable regulations.

END OF SECTION 013543

SECTION 014126 - GENERAL REGULATIONS AND PERMITS

PART 1 - GENERAL

1.1 REGISTRATION

A. All Contractors and subcontractors shall be registered with the Building Department having jurisdiction. Contact the Building Department for additional registration information.

1.2 PERMITS

A. The Contractor shall apply for and pay for all permits from the Owner and/or other authorities having jurisdiction.

1.3 ARCHAEOLOGICAL DISCOVERIES

A. Contractors and subcontractors are required under O.R.C. Section 149.53, to notify the Ohio Historical Society and the Ohio Historic Site Preservation Board of Archaeological Discoveries located in the project area, and to cooperate with those entities in archaeological and historic surveys and salvage efforts if such discoveries are uncovered within the project area.

Contact: Department Head
Resource Protection and Review
Ohio Historic Preservation Office
800 E. 17th Avenue
Columbus, Ohio 43211-2497
614-298-2000

B. Should archaeological discoveries or other activities delay progress of the work, an adjustment in contract time will be made.

END OF SECTION 014126

SECTION 014223 - INDUSTRY STANDARDS

PART 1 - GENERAL

1.1 ABBREVIATIONS

A. Abbreviations, as used, designate the following:

AASHTO	-	American Association of State Highway and Transportation Officials
ACI	-	American Concrete Institute
AIEE	-	American Institute of Electrical Engineers
AISC	-	American Institute of Steel Construction
ANSI	-	American National Standards Institute
ASTM	-	American Society of Testing and Materials
AWWA	-	American Water Works Association
CMS	-	Construction and Material Specifications
NEMA	-	National Electrical Manufacturers Association
ODOT	-	Ohio Department of Transportation
ORC	-	Ohio Revised Code
UL	-	Underwriters Laboratories, Inc.

1.2 REFERENCE TO OTHER SPECIFICATIONS

A. Where reference is made to specifications such as ASTM, AWWA or AASHTO, the latest edition shall be used, unless otherwise noted on the plans or in the specifications.

1.3 CODES AND STANDARDS

A. All work provided for by these specifications must be installed according to the provisions of the State and local building codes, subject to inspection and acceptance by the State and local inspectors.

END OF SECTION 014223

SECTION 014323 – QUALIFICATIONS OF TRADESMEN

PART 1 - GENERAL

1.1 CHARACTER OF WORKMEN AND EQUIPMENT

A. The Contractor shall employ competent and efficient workmen for every kind of work. Any person employed on the work who shall refuse or neglect to obey directions of the Engineer or his representative, or who shall be deemed incompetent or disorderly, or who shall commit trespass upon public or private property in the vicinity of the work, shall be dismissed when the Engineer so orders, and shall not be re-employed unless express permission be given by the Engineer. The methods, equipment and appliances used on the work and the labor employed shall be such as will produce a satisfactory quality of work, and shall be adequate to complete the contract within the specified time limit.

B. In hiring of employees for the performance of work under this Contract, or any Subcontract hereunder, no Contractor or Subcontractor, nor any person acting on behalf of such Contractor or Subcontractor, shall, by reason of race, sex, creed or color, discriminate against any citizen of the State of Ohio in the work to which the employment relates. No Contractor, Subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this contract on account of race, creed, sex or color.

END OF SECTION 014323

SECTION 015526 - TEMPORARY TRAFFIC CONTROL DEVICES

PART 1 - GENERAL

1.1 BARRICADES, SIGNS AND LIGHTS

A. The Contractor shall employ watchmen on the work when and as necessary. The Contractor shall erect and maintain such strong and suitable barriers and such lights as will effectively prevent the occurrence of any accident to health, limb or property. Lights shall be maintained between the hours of one-half (1/2) hour after sunset and one-half (1/2) hour before sunrise.

B. No manhole, trench, excavation will be left open awaiting connection or removal at a later date by the Contractor's forces or others but shall be temporarily backfilled and resurfaced if applicable with a temporary pavement passable to traffic at no additional cost to the Owner.

C. In addition to other safety requirements, a minimum of four (4) foot high fence will be incorporated around any shaft or manhole or other excavation left open at the end of a day's work.

1.2 MAINTENANCE OF TRAFFIC

A. The Contractor is required to provide maintenance of traffic in conformance with the Ohio Manual of Uniform Traffic Control Devices and Item 614 of the current Construction and Material Specifications of the Ohio Department of Transportation.

B. This work shall include providing suitable and satisfactorily trained and properly attired flagmen for use at any location where existing roadway is narrowed to a width of less than 2 full lanes (18 feet).

C. The Contractor is also responsible for maintaining local access to all residences and businesses along the route of the construction and to provide whatever temporary materials are necessary to provide a safe, adequate drive surface.

D. At all boring locations, Contractor shall provide suitable flashers, barricades, and traffic control devices as may be deemed necessary by the Engineer or the responsible authority in the case of the Department of Transportation, Turnpike Commission, or affected railroad. This may extend to maintain facilities on a 24-hour basis until such time as the areas are completely backfilled.

END OF SECTION 015526

SECTION 016600 - PRODUCT HANDLING AND PROTECTION

PART 1 - GENERAL

1.1 DELIVERY AND STORAGE OF MATERIALS

A. The Contractor shall be responsible for delivery and storage of all materials.

B. The Contractor shall coordinate with the Engineer on the arrangement for storing construction materials and equipment. Deliveries of all construction materials and equipment should be made at suitable times.

C. The Contractor shall store all materials required for the performance of this contract at sites designated by the Engineer.

D. All stockpiles shall be neat, compact, completely safe, and barricaded with warning lights if necessary.

E. Precautions shall be taken so that no shade trees, shrubs, flowers, sidewalks, driveways or other facilities will be damaged by the storage of materials. The Contractor shall be responsible for the restoration of all stockpile sites to their original condition.

F. Materials, tools and machinery shall not be piled or placed against shade trees, unless they shall be amply protected against injury therefrom. All materials, tools, machinery, etc. stored upon public thoroughfares must be provided with red lights at night time so as to warn the traffic of such obstruction.

G. Materials shall be so stored as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, shall again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection. Approved portions of the construction site may be used for storage purposes and for the placing of the Contractor's plant and equipment, but any additional space required therefore must be provided by the Contractor at his expense. Private property shall not be used for storage purposes without written permission of the property owner or lessee, and copies of such written permission shall be furnished the Engineer. All storage sites shall be restored to their original condition by the Contractor at his expense.

END OF SECTION 016600

SECTION 017800 - FINAL COMPLIANCE AND SUBMITTALS

PART 1 - GENERAL

1.1 The following forms and related sign-offs shall be documented in accordance with provisions of the contract. These forms shall be completed by the Contractor and approved by the Owner before final retainer is approved for release. Forms for Items A to E will be attached to the Contractor's executed copy of the contract.

A. Certificate of Substantial Completion (To be submitted at time of Substantial Completion).

B. Contractor's Certification of Completion.

C. Contractor's Affidavit of Prevailing Wage.

D. Consent of Surety Company for Final Payment.

E. Affidavit of Final Acceptance Date and Correction Period.

F. Before the OWNER will approve and accept the work and release the retainer, the CONTRACTOR will furnish the OWNER a written report indicating the resolution of any and all property damage claims filed with the CONTRACTOR by any party during the construction period. The information to be supplied shall include, but not be limited to, name of claimant, date filed with CONTRACTOR, name of insurance company and/or adjuster handling claim, how claim was resolved and if claim was not resolved for the full amount, a statement indicating the reason for such action.

G. DBE Subcontractor Participation Forms SR-EPA.7-8 (Applicable for WPCLF & WSRLA funded projects only).

H. CDBG Subcontractor List 017800 (Applicable for CDBG funded projects only).

END OF SECTION 017800

SECTION 017821 - CLEANING AND PROTECTION

PART 1 - GENERAL

1.1 GENERAL

A. On or before the completion date for the work, the Contractor shall tear down and remove all temporary structures built by him, all construction plant used by him, and shall repair and replace all parts of existing embankments, fences or other structures which were removed or injured by his operations or by the employees of the Contractor. The Contractor shall thoroughly clean out all buildings, sewers, drains, pipes, manholes, inlets and miscellaneous and appurtenant structures, and shall remove all rubbish leaving the grounds in a neat and satisfactory condition.

B. As circumstances require and when ordered by the Engineer, the Contractor shall clean the road, driveway, and/or sidewalk on which construction activity under this contract has resulted in dirt or any other foreign material being deposited with an automatic self-contained mechanical sweeper with integral water spray, vacuum and on-board or supplementary containment.

C. Failure to comply with this requirement when ordered by the Engineer or his representative, may serve as cause for the Engineer to stop the work and to withhold any monies due the Contractor until such order has been complied with to the satisfaction of the Engineer.

D. As the work progresses, and as may be directed, the Contractor shall remove from the site and dispose of debris and waste material resulting from his work. Particular attention shall be given to minimizing any fire and safety hazard from form materials or from other combustibles as may be used in connection with the work, which should be removed daily.

E. The Contractor shall wash all windows and other glass surfaces, leaving all areas free from putty marks, paint, etc.

F. During and after installation, the Contractor shall furnish and maintain satisfactory protection to all equipment against injury by weather, flooding or breakage thereby permitting all work to be left in a new condition at the completion of the contract.

END OF SECTION 017821

SECTION 017839 - PROJECT RECORDS, DRAWINGS

PART 1 - GENERAL

1.1 RECORD DRAWINGS

A. The Contractor shall furnish an authentic set of marked-up drawings showing the installation insofar as the installation shall have differed from the Engineer's drawings. The drawings shall be delivered to the Engineer for making revisions to the original drawings immediately after final acceptance by the Owner.

B. The Contractor shall furnish dimensioned drawings indicating locations of all underground mechanical and electrical facilities.

1.2 SERVICE CONNECTION RECORDS

A. The Contractor shall record the location of all service and property connections, new or existing, made to utilities constructed under this contract. Such records shall be turned over to the Owner upon completion of the work. The cost of making such records shall be included in the various unit or lump sum prices stipulated for the various items of the work.

B. The location of each sewer connection as measured along the sewer from the nearest downstream manhole and its description with respect to the sewer shall be recorded. The record shall include the depth of new stubs for future connections and the depth of existing connections as measured from the surface grade. Also, the use of any vertical riser pipe shall be noted.

C. The location of each water connection as measured along the water line from the nearest fire hydrant.

END OF SECTION 017839

SECTION 269001 – REMOTE TELEMETRY SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION

A. Furnish and install a Remote Telemetry System (RTS) with appurtenant equipment and accessories as indicated, specified and as necessary for a complete and proper operating system.

B. The RTS shall be completely wired and configured to monitor and control all of the functions listed herein for a complete and proper operating system.

C. The system supplier shall provide all engineering, installation, and/or supervision of such, startup, testing and training as specified herein.

D. The system supplier shall provide operation and maintenance manuals as specified herein.

E. The system shall be furnished by the current Owner System Integrator – Protech Systems Group – per the March 6, 2024, quotation attached to this specification section.

F. The contractor shall include an allowance in the base bid for the project, equal to the attached quotation amount.

1.2 EQUIPMENT COMPATIBILITY

A. The Contractor shall be responsible for coordinating the instrumentation equipment, communication equipment and other related equipment so that all elements are compatible and from a complete working system. Shop drawing submittals shall include sufficient information regarding component compatibility to demonstrate compliance with this requirement.

1.3 SUBMITTALS

A. Shop Drawings: Forward telemetry system information and auxiliary materials for engineer's review in accordance with General Requirements.

B. As-Built Documentation: Review connection requirements with the telemetry system vendor and produce as built connection schedule for the site.

C. O&M Manual: The manufacture shall provide copies of an operation and maintenance manual, including storage, installation, start-up, operating and maintenance instructions, and a complete parts lists. The O&M manual shall be in compliance with General Requirements.

PART 2 – PRODCUTS

2.1 MONITORING AND CONTROL SYSTEM (SYSTEM INTEGRATOR'S SCOPE)

A. Provide a telemetry control panel (RTU) in NEMA 12 enclosure to interface to control and monitor instrumentation on site.

B. RTU shall feature a cellular modem for secure communication to the central monitoring site.

C. Provide instrumentation, per the drawings and attached quotation.

2.2 OTHER MATERILAS (BY CONTRACTOR OUTSIDE OF SYSTEM INTEGRATOR'S SCOPE)

A. Contractor is responsible for all installation of all equipment provided by the System Integrator, including the RTU and instrumentation; provide all materials required to complete the installation.

B. See the Pro-Tech quote for the list of proposed I/O. For each of the discrete I/O points, provide (2) #14 in conduit from the equipment being monitored, similarly, provide #18 twisted shielded pair cable in conduit for each analog signal. Confirm with the approved final I/O schedule to be produced by the System Integrator as part of the shop drawing process.

C. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades with the work of this Section.

3.3 INSTALLATION

A. Install the work of this Section in strict accordance with the manufacturer's recommendations and shop drawings as approved by the Engineer.

B. Upon completion of the installation, carefully inspect each component and verify that all items have been installed in the proper location, adequately anchored, and adjusted to achieve optimum operation.

C. The System Integrator shall verify connections into the RTU and shall perform start-up services, including modifications to the SCADA programming at the central monitoring site.

3.4 TRAINING

A. Demonstrate to the Owner's operation and maintenance personnel the proper methods for operating and maintaining the equipment, and the contents of the operation and maintenance manual.

3.5 SERVICE

A. The Contractor shall furnish to the Owner, through the Engineer, a written certificate, signed by the System Integrator's field service technician confirming that:

1. The equipment has been properly installed in accordance with manufacturer's recommendations;

2. The equipment check out and initial start-up activities have been completed in accordance with manufacturer's recommendations and under the technician's supervision;

3. The equipment is free from any undue stress imposed by connecting conduit or anchor bolts;

4. The equipment operates satisfactorily and in compliance with the requirements of this Section.

END OF SECTION 269001

March 6, 2024
Q224123

123 E. WATERLOO RD.
AKRON, OH 44319
TELEPHONE: (330) 773-9828
FAX: (330) 773-9928
EMAIL: CHRIS@PTEINC.COM

Subject: Ashtabula County Lenox Pump Station

Thank you for the opportunity to provide a scope for the Ashtabula County Lenox Pump Station. Pro-Tech Systems Group is quoting the following equipment per the following items:

- **(1) Telemetry Panel for 3 pump station w/ generator**
  - **Cellular Communications to the Plant**
- **PLC Programming**
  - **I/O to be transmitted to CCDPW for Monitor and Control**
    - **AC Power Fail**
    - **Communication Failure**
    - **Generator Running**
    - **Low Suction Pressure Alarm**
    - **Low Discharge Pressure Alarm**
    - **Seal Fail Pump 1, 2 and 3**
    - **High Temperature Pump 1, 2 and 3**
    - **Overload Pump 1, 2 and 3**
    - **Runtimes Pump 1, 2 and 3**
    - **Start Pump 1, 2 and 3**
    - **Suction Pressure**
    - **Discharge Pressure**
- **SCADA Development**
- **Submittals**
  - **As-Built Drawings**
- **Operations and Maintenance Manuals**
- **Field Testing**
- **Startup and Commissioning**
- **Panel Installation and Electrical by Others**

Pro-Tech Systems Group Price $32,850.00

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EMAIL: CHRIS@PTEINC.COM

March 6, 2024
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***Instrumentation Calibration and Startup**

- **On-Site Instrumentation Calibration and Controls Startup is Based on (2) mobilization for (8) hours. If instrumentation, Control Panels or Network Components are not ready for Scheduled Startup and additional mobilizations will be required, additional costs will be incurred.**

***The contract price for this Municipal construction project has been calculated based on the current prices for the component building materials. However, the market for the Instrumentation and Controls materials that are hereafter specified is considered to be volatile, and sudden price increases could occur. Pro-Tech Systems Group, Inc. agrees to use our best efforts to obtain the lowest possible prices from available building material suppliers, but should there be an increase in the prices of these specified materials that are purchased after execution of contract for use in this Municipal construction project, the Builder agrees to pay that cost increase to the Pro-Tech Systems Group, Inc. Any claim by the Pro-Tech Systems Group, Inc. for payment of a cost increase, as provided above, shall require written notice delivered by the Builder to the Owner stating the increased cost, the Instrumentation and Control material or materials in question, and the source of supply, supported by invoices or bills of sale.**

123 E. WATERLOO RD.
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Standard Exclusions

Our scope EXCLUDES the mounting/installation of all devices (enclosures, instruments, field devices, etc); Field and interconnect wiring drawings; Conduit schedules; All piping (including spool pieces), conduit, wiring, cabling, and mounting hardware; Phone lines, radio towers, repeaters, poles, masts, and mounting; Installation and termination of all wiring and cabling; Furniture.

Standard Terms and Conditions of Sale

We offer our standard **TERMS AND CONDITIONS OF SALE** as Attachment 1. Issuance of an order or acceptance of this proposal constitutes acceptance of the included conditions and all conditions in Attachment 1.

Standard lead times
Submittals – 8-10 weeks
Panels – 6-10 weeks from date of release
Long lead items involving instrumentation will be clarified during the submittal process.

Many of Pro-Tech Systems Groups suppliers have advised that until further notice they reserve the right to amend the delivery date, the price and the scope or quantity of supply and/or other terms and conditions set out in their offer or quotation to the extent affected by the Covid-19 pandemic. Be advised the Pro-Tech Systems Group, Inc. considers the Covid-19 related changes imposed by our manufacturers and suppliers as outside of its reasonable control and subject to Force Majeure provisions.

This quote is valid for a period of 30 days. If you have any questions concerning this quotation, please call.

Best Regards,

Chris Viar
Project Estimator

123 E. WATERLOO RD.
AKRON, OH 44319
TELEPHONE: (330) 773-9828
FAX: (330) 773-9928
EMAIL: CHRIS@PTEINC.COM

March 6, 2024
Q224123

Pro-Tech Systems Group Terms and Conditions

ACCEPTANCE of this Order is expressly conditioned on Buyer's agreement that the terms and conditions set forth herein, together with any plans or specifications approved in writing by **Pro-Tech Systems Group,** are the sole terms and conditions of the Order and constitute a contract representing the entire agreement of the parties with respect to the subject matter thereof. No amendment, modification or waiver of the terms and conditions of this order shall be binding on **Pro-Tech Systems Group,** unless made in writing and signed by an authorized representative of **Pro-Tech Systems Group.** Any additional or different terms and conditions contained in Buyer's proper orders or responses to the Order shall be deemed objected to by **Pro-Tech Systems Group** without need of further notice of objections and shall not be effective or binding unless assented to in writing signed by an authorized representative of **Pro-Tech Systems Group.** Buyer shall be deemed to have assented to all terms and conditions contained herein upon performance or part performance by **Pro-Tech Systems Group** under this contract. Should there be a conflict with any terms or conditions in any contract or purchase order used by Buyer, the terms and conditions herein shall prevail.

TERMS OF PAYMENT: 20% Payment on customer receipt of submittals, 80% Payment on multiple invoices. Net cash thirty (30) days, with a discount of one percent (1%) net cash ten (10) days allowed. A service charge of one and one-half percent (1 1/2%) per month will be added to unpaid balances after thirty (30) days. If Buyer's financial condition at any time does not justify continuance of the work to be performed by **Pro-Tech Systems Group** hereunder on the agreed terms of payment, **Pro-Tech Systems Group** may require full or partial payment in advance. In the event Buyer's bankruptcy or insolvency or in the event any proceeding is brought against Buyer, voluntarily or involuntarily, under the bankruptcy or any insolvency laws, **Pro-Tech Systems Group** shall be entitled to cancel any order then outstanding at any time during the period allowed for filing claims against the estate of Buyer and shall receive reimbursement for its proper cancellation charges. **Pro-Tech Systems Group's** rights under this provision are in addition to any other rights available to it at law or in equity.

RETAINAGE: Pro-Tech Systems Group, Inc., Inc will allow a maximum retainage of 4% on labor only, payable within 30 days of completion of Pro-Tech Systems Group, Inc. work.

TAXES: The price quoted in this contract does not include any taxes and in the event taxes of any nature are assessed, they shall be added to the price herein, unless Buyer is exempt from tax and demonstrates such exemption to the satisfaction of **Pro-Tech Systems Group.**

WARRANTIES: Pro-Tech Systems Group warrants to Buyer that equipment furnished pursuant to this contract will be free from defects in material, workmanship and title and will be of the kind and quality specified in **Pro-Tech Systems Group's** quotation.

The foregoing equipment warranties (excluding the warranty of title) shall terminate one (1) year after the date of completion of the work or shipment of the part, requiring correction under this warranty.

Pro-Tech Systems Group warrants to Buyer that software furnished pursuant to this contract will be free from defects and will be of the kind and quality specified in **Pro-Tech Systems Group's** quotation.

The foregoing software warranties (excluding the warranty of title) shall terminate ninety (90) days after the date of completion of the work or shipment of the part, requiring correction under this warranty.

If any product covered by this contract fails to meet the foregoing warranties (except title), Buyer's exclusive remedies shall be for **Pro-Tech Systems Group** to correct any such failure by either (at the option of **Pro-Tech Systems Group**) replacing defective parts or repairing any defective parts of the equipment. **Pro-Tech Systems Group** shall not be responsible for providing working access to the defect, including the removal, disassembly, replacement or reinstallation of any equipment, materials or structures. Any portion which does not so conform will be corrected by **Pro-Tech Systems Group** upon notification by the purchaser. Upon expiration of the warranty period, all liability of **Pro-Tech Systems Group** for its equipment and services shall terminate.

Pro-Tech Systems Group limits its warranty on components not manufactured by **Pro-Tech Systems Group** to the conditions and duration of warranty offered to **Pro-Tech Systems Group** by the component manufacturer.

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March 6, 2024
Q224123

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PTSG's names and logos and all related trademarks, trade names, and other intellectual property are the property of PTSG and cannot be used without its express prior written permission.

NO CLAIMS FOR DIRECT OR CONSEQUENTIAL DAMAGES SHALL BE ALLOWED.

PRO-TECH SYSTEMS GROUP DISCLAIMS ANY MERCHANTABILITY OR WARRANTY OF FITNESS FOR ANY PARTICULAR USE WITH RESPECT TO THE PRODUCTS BEING SOLD PURSUANT TO THIS CONTACT. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION OF THE FACT OF THIS CONTRACT.

LIMITATION OF LIABILITY: Pro-Tech Systems Group shall not be liable for special, incidental, or consequential damages under any circumstances, including, but not limited to, loss of profits or revenue, loss of use of equipment, or cost of temporary equipment. **Pro-Tech Systems Group's** maximum liability, whether based in contract, tort (including negligence), or otherwise shall not exceed the price of this contract.

Unless otherwise specifically agreed to in writing by an authorized officer of **Pro-Tech Systems Group**, no Buyer, representative or any other person shall have the right to examine or audit **Pro-Tech Systems Group's** cost accounts, books, or records of any kind on any matter, or be entitled to or have control over any engineering or production prints, drawings, or technical data which **Pro-Tech Systems Group**, in it sole discretion, may consider in whole or in part, proprietary to **Pro-Tech Systems Group.**

DELAYS: Pro-Tech Systems Group will not be liable for any delay in the performance of this contract or for any damages suffered by Buyer by reason of such delay, when such delay is directly or indirectly caused by or in any manner arises from fires, floods, accidents, riots, acts of God, war, governmental interference or embargoes, strikes, labor difficulties, shortage of labor, fuel, power, materials or supplies, transportation delays or other cause or causes (whether or not similar in nature to any of those herein above specified) beyond its control.

QUOTATIONS: This quotation will expire thirty (30) days from its date unless otherwise stated in the quotation or extended in writing by **Pro-Tech Systems Group.**

PRICE POLICY: Prices are net to all purchasers. Prices are firm for contracts completed within one (1) year from the date of quotation. Equipment or services delivered beyond one (1) year from date of quotation will be subject to price escalation of one-half percent (1/2%) per month or greater based on supplier increases.

DELIVERY: Unless otherwise specified by **Pro-Tech Systems Group** delivery will be made and title passed F.O.B. point of shipment to Buyer. Risks of loss or damage pass to Buyer on delivery. If products are to be delivered by **Pro-Tech Systems Group,** such products are to be received and unloaded by Buyer at Buyer's expense and risk.

GOVERNING LAW: The law of the State of Ohio shall govern the validity, performance, interpretation and the effect of this agreement.

AMENDMENTS: This contract may not be modified nor rescinded in any manner except by the written agreement of both Buyer and **Pro-Tech Systems Group.**

Upon acceptance of the agreement Pro-Tech Systems Group will require a full set of plans and specs w/ addendums, project start and completion dates, and a project schedule.

The above Standard Terms and Conditions are accepted:

By: _____

Title: _____

Date: _____

SECTION 310000 - EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. The Work covered by this Section shall include all excavation, trenching and related work for the construction of the designated structures and pipelines, backfill and other incidental work.

B. The Work covered by this Section consists of:
1. making all necessary excavations for the construction of all Work;
2. preparing subgrade for foundations, slabs, walks, and pavements;
3. doing all pumping, fluming, and dewatering necessary to keep the trenches and other excavation free from water;
4. providing for uninterrupted flow of existing drains and sewers, and the disposal of water from any sources during the progress of the Work;
5. supporting and protecting all trench walls, structures, pipes, conduits, culverts, posts, poles, wires, fences, buildings and other public and private property adjacent to the Work;
6. removing and replacing existing sewers, culverts, pipelines and bulkheads where necessary;
7. removing after completion of the Work all sheeting and shoring or other soil support materials not necessary to support the sides of trenches;
8. removing and disposing all surplus excavated material;
9. doing all backfilling and grading, of compacting backfill to limits specified or ordered by the Engineer;
10. restoring all property damaged as a result of the Work involved in this Contract.

C. The Work includes transporting surplus excavated materials not needed for backfill at the location where the excavation is made, to other parts of the Work where filling is required, and disposal of all types of surplus material off the site.

1.2 RELATED DOCUMENTS AND SECTIONS

A. Section 013319 – Field Testing Requirements

B. Section 321000 – Pavement Replacement

C. Section 331113.01 – Water Utility Distribution System

1.3 DEFINITIONS

A. Backfill: Soil or granular materials used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, not including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding: Layer placed over the excavated subgrade in a trench before laying pipe.

C. Borrow: Satisfactory soil imported for use as fill or backfill.

D. Excavation: Removal and disposal of material encountered above subgrade or foundation elevations.
1. Additional Excavation: Excavation below subgrade or foundation elevations as directed by Engineer.
2. Trench: Narrow linear excavation
3. Unauthorized Excavation: Excavation below subgrade or foundation elevations or beyond indicated dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
4. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface or subsurface conditions encountered, including rock, soil materials and obstructions.

E. Embankment: A structure consisting of soil, granular material, shale, rock, or other approved material, constructed in layers to a predetermined elevation and cross-section.

F. Granular materials: Natural aggregate, such as broken or crushed rock, gravel, or sand that can be readily incorporated into an 8-inch layer, and in which at least 65% by weight of the grains or particles are retained in a No. 200 sieve.

G. Laboratory Dry Weight: The maximum laboratory dry weight shall be the weight provided by the laboratory when the sample is tested in accordance with ASTM D-698 Method A, C, or D.

H. Optimum Moisture: The water content at which the maximum density is produced in a soil by a given compaction effort (ASTM D-698).

I. Pavement Prism: Also referred to as the zone of influence. The area below a line drawn 45 degrees to the horizontal from the surface at the edge of pavement, sidewalk or curb.

J. Pipe Embedment: The material placed in a trench surrounding a pipe or conduit consisting of the foundation, bedding, haunching, and initial backfill.

K. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material one (1) cu. yd. or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2 inches.

L. Shale: Laminated material, formed by the consolidation in nature of soil, having a finely stratified structure. For the purpose of these specifications, the following bedrock types shall also be considered shale: mudstone, claystone, siltstone and hard clay.

M. Soil: All earth materials, organic or inorganic, which have resulted from natural processes such as weathering, decay, and chemical reaction.

N. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, pavement, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

O. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage course, or topsoil materials.

P. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Comply with all provisions of Section 013323, Shop Drawings and Submittals.

B. Product Data: For the following:
   1. Source-locations of all materials shall be identified to the Engineer.
   2. Source quality laboratory test of all fill materials as required to show compliance with material specifications.

1.5 REFERENCES

A. AASHTO M 43 Standard Specification for Size of Aggregate for Road and Bridge Construction

B. ASTM C-150 Standard Specification for Portland Cement

C. ASTM C-618 Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

D. ASTM D-698 Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop

E. ASTM D-1586 Standard Method for Penetration Test and Split-Barrel Sampling of Soils

F. ASTM D-2487 Standard Test Method for Classification of Soils for Engineering Purposes

G. ASTM D-2940 Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports

H. ASTM D-4253 Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table

I. ASTM D-4254 Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

J. State of Ohio - Department of Transportation - Construction and Material Specifications, Item 304, Aggregate Base.

K. State of Ohio - Department of Transportation - Construction and Material Specifications, Material Detail 703.16, Suitable Materials for Embankment Construction.

L. State of Ohio - Department of Transportation - Construction and Material Specifications, Material Detail 703.02.A.2, Fine Aggregate for Portland Cement Concrete

1.6 QUALITY ASSURANCE

A. Comply with all provisions of Section 014323 – Qualifications of Tradesmen.

B. Comply with all provisions of Section 014126 – General Regulations and Permits.

C. Field samples shall comply with Section 013319 – Field Test Reporting and Section 013326 – Product Testing and Certifying.

D. Before and during installation, the Contractor shall comply with provisions under Section 013119 – Project Meetings.

1.7 PROJECT CONDITIONS

A. Environmental Requirements

B. Existing Conditions

1. Existing ground elevations of the site are shown by figures and/or by contours on the Drawings. The contours and elevations of the present ground are believed to be reasonably correct, but do not purport to be absolutely so, and, together with any schedule of quantities, are presented only as an approximation. The Contractor shall satisfy himself, however, by actual examination on the site of the Work, as to the existing elevations and contours, and the amount of work required.

C. Existing Utilities

1. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
2. Notify Engineer not less than two days in advance of proposed utility interruptions.
3. Do not proceed with utility interruptions without Engineer's written permission.
4. Contact utility-locator service for area where Project is located before excavating.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver products to the site, store and protect under provisions of Section 016600, Product Handling and Protection.

B. Comply with all provisions of Section 013543, Environmental Protection.

1.9 SEQUENCING AND SCHEDULING

A. Refer to 013319 for testing laboratory service scheduling.

1.10 PROHIBITION OF EXPLOSIVES

A. The use of explosives is not permitted.

1.11 FIELD MEASUREMENTS

A. The Contract Drawings may indicate locations where certain utilities, structures or facilities might possibly interfere with the installation of new improvements. The Contractor shall dig such exploratory test pits as may be necessary to determine the exact location and elevation of the indicated subsurface structure and shall make acceptable provision for their protection, support and maintenance in operation. The Engineer shall be provided advance notification when and where excavation for test pits will take place. The Contractor shall provide the Engineer a record of field locations of all listed utilities, structures or facilities a minimum of five (5) days prior to initiating construction of the project. Locations and elevations are to be provided by a Surveyor registered in the State of Ohio.

PART 2 - PRODUCT

2.1 GRANULAR PIPE EMBEDMENT

A. Crushed gravel or crushed limestone meeting AASHTO M 43 gradation shall be used for bedding, haunching, and initial backfill as shown on the Drawings.

2.2 ONSITE BACKFILL

A. Excavated soil material, capable of meeting specified compaction, and approved by the Engineer for use as backfill in designated locations.

B. Based upon subsurface investigation, the Owner does not guarantee the onsite soils in its present state consists of the proper moisture content to achieve the specified compaction without drying or adding water.

C. Unsuitable Backfill Material

1. Onsite materials that are unsuitable for backfill, unless otherwise specifically shown in the Drawings, include rock or other materials greater than six (6) inches in their largest dimension, pavement, rubbish, debris, wood, metal, plastic, frozen earth, and the following soils classified per ASTM D-2487:

Symbol	Description
OL	Organic silts and organic silty clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity
PT	Peat, muck, and other highly organic soils

2.3 SPECIAL BACKFILL MATERIAL (ODOT Item 304)

A. Special backfill material shall meet the gradation requirements of ODOT Item 304 and shall consist of crushed gravel or crushed limestone in combination with natural sand or stone. The aggregate shall meet the following gradation requirements:

Sieve	Total Percent Passing
2 inch	100
1 inch	70-100
¾ inch	50-90
No. 4	30-60
No. 30	9-33
No. 200	0-15

2.4 LOW STRENGTH MORTAR BACKFILL

A. Low Strength Mortar shall comply with ODOT Item 613.

B. Submit test data that demonstrates that the proposed mix has a strength of 50 to 100 PSI at 28 days.

C. Each load shall be tested with 3 cylinders for strength test broken at 3, 7, and 28 days until the Engineer is assured that the mix will be between 50 to 100 PSI at 28 days. Thereafter, one set of strength tests shall be taken every 50 CY.

It is intended that the sand be fine enough to stay in suspension in the mixture to the extent required for proper flow. The Engineer reserves the right to reject the sand if a flowable mixture cannot be produced.

D. Mortar Mix Proportioning

1. The initial trial mixture shall be as follows:

Quantity of Dry Materials per Cubic Yard

Cement	100 lbs.
Fly Ash	250 lbs.
Sand (SSD)*	2700 lbs.
Water	500 lbs.

* saturated-surface dry

2. These quantities of materials are expected to yield approximately l cubic yard of mortar of the proper consistency. Adjustments of the proportions may be made providing the total absolute volume of the materials is maintained.

2.5 EMBANKMENTS

A. Soils suitable for use in an embankment must conform to ODOT 703.16 and are restricted as follows:

1. Maximum laboratory dry weight shall not be less than 90 pounds per cubic foot, except that soils having maximum dry weights of less than 100 pounds per cubic foot shall not be used in the top 12 inches of embankment.
2. Soil having a liquid limit in excess of 49 are considered as unsuitable for use in an embankment.
3. Silt from excavation or borrow identified as Ohio Classification A-4b shall be considered suitable for use in an embankment only when placed at least 3 feet below the surface of the subgrade.
4. No slag, recycled Portland cement concrete or recycled asphaltic concrete products are suitable for use in an embankment.
5. Do not use any suitable material that cannot be incorporated in an 8-inch lift in the top 2 feet of the embankment.
6. Do not use shale, hard shale, or siltstone in the top 2 feet of embankment.
7. Do not use materials that cannot be satisfactorily placed and compacted to a stable and durable condition.
8. Material excavated in the work that contains excessive moisture is unsuitable for embankment construction unless dried. Dry or aerate such material before incorporating in the work. The Contractor may elect to waste this material, instead of drying it.
9. Granular material Type E as specified in ODOT 703.16.C, is not allowed.
10. No petroleum contaminated soils are suitable for use in an embankment.

2.6 ENGINEERED FILL

A. Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940. The aggregate shall meet the following gradation requirements:

Sieve	Total Percent Passing
2 inch	100
1½ inch	95-100
¾ inch	70-92
3/8 inch	50-70
No. 4	35-55
No. 30	12-25
No. 200	0-8

2.7 ACCESSORIES

A. Warning Tape
   1. Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
      a. Red: Electric.
      b. Yellow: Gas, oil, steam, and dangerous materials.
      c. Orange: Telephone and other communications.
      d. Blue: Water systems.
      e. Green: Sewer systems.

B. Detectable Warning Tape
   1. Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
      a. Red: Electric.
      b. Yellow: Gas, oil, steam, and dangerous materials.
      c. Orange: Telephone and other communications.
      d. Blue: Water systems.
      e. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PROTECTION

A. Excavation; Temporary Sheeting, Shoring, and Bracing
   1. All excavation shall be in accordance with the Occupation Safety and Health Administration (OSHA) regulations.

2. The Contractor shall furnish and install adequate sheeting, shoring, and bracing to maintain safe working conditions, and to protect newly built work and all adjacent neighboring structures from damage by settlement.
3. Bracing shall be arranged so as not to place a strain on portions of completed work until construction has proceeded enough to provide ample strength. Sheeting and bracing may be withdrawn and removed at the time of backfilling, but the Contractor shall be responsible for all damage to newly built work and adjacent and neighboring structures.
4. All sheeting shall be removed unless specifically authorized in writing by the Engineer to be left in place.

B. Construction Sheeting Left in Place
1. The Contractor shall furnish, install, and leave in place construction sheeting and bracing when specified or when indicated or shown on the Drawings.
2. Any construction sheeting and bracing which the Contractor has placed to facilitate his work may be ordered in writing by the Engineer to be left in place. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating an obligation on his part to issue such orders. Failure of the Engineer to order sheeting and bracing left in place shall not relieve the Contractor of his responsibility under this Contract.

3.2 REPLACING, MOVING AND REPAIRING OF EXISTING UTILITIES

A. The Contractor shall:
1. replace, move, repair and maintain all utilities and all other structures encountered in the work
2. coordinate and communicate with applicable utility companies
3. repair all damage done to any of the said structures and appurtenances through his acts or neglect and shall keep them in repair during the life of this contract. The Contractor shall in all cases leave them in as good condition as they were previous to the commencement of the work and to the satisfaction of the Engineer.

3.3 DEWATERING

A. Drainage and Removal of Water
1. The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent property or structures.
2. The Contractor shall, when ordered by the Engineer, construct tight bulkheads across trench and provide pumps suitable for the removal of any water which may be encountered or which may accumulate in the trenches. Unless otherwise provided for in the Contract Documents, drainage water will not be permitted to flow through the conduit.
3. The trench shall be kept free from sewage and storm, surface, and subsurface water to at least 2 feet below the bottom of the excavation.
4. Where open water courses, ditches, or drain pipes are encountered during the progress of the Work, the Contractor shall provide protection and securing of the continuous flow in such courses or drains and shall repair any damage that may be done to them.

3.4 EXCAVATION CLASSIFICATION

A. All excavated materials are unclassified as defined in Article 1.3.

3.5 GENERAL EXCAVATION

A. All necessary excavation for buildings, structures, pavements, and site improvements shall be performed to accommodate the completion of all related Contract Work.

B. The Drawings show the horizontal and the lower limits of structures. The methods and equipment used by the Contractor when approaching the bottom limits of excavation shall be selected to provide a smooth surface and to prevent disturbing the soil below the bottom limits of excavation. All soil loosened during excavation shall be removed from the bottom of the excavation.

C. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

D. Excavation which is carried below the bottom limits of structures shall be classified as Unauthorized Excavation, unless said excavation below bottom limits of structures has been authorized by the Engineer prior to each occurrence.

3.6 TRENCH EXCAVATION

A. Excavation for trenches in which pipelines, sewers, and conduits are to be installed shall provide adequate space for workmen to space and joint pipe properly, but in every case the trench shall be kept to a minimum width. The width of trench shall not exceed the limits shown on the Drawings.

B. Excavation shall be to the depth necessary for placing of granular bedding material under the pipe as shown on the Drawings. If over-excavation occurs, the trench bottom shall be filled to grade with compacted granular bedding material.

C. Trenching operations shall not be performed beyond the distance that will be backfilled and compacted the same day.

D. In general, backfilling shall begin as soon as the conduit is in approved condition to receive it and shall be carried to completion as rapidly as possible. New trenching shall not be started when earlier trenches need backfilling or the surfaces of streets or other areas need to be restored to a safe and proper condition.

3.7 EXCAVATION OF UNSUITABLE MATERIALS

A. Unsuitable materials existing below the Contract bottom limits for excavation shall be removed as directed by the Engineer. Such excavation shall not exceed the vertical and lateral limits as prescribed by the Engineer.

B. In utility trenches, the voids left by removal of unsuitable excavated material shall be filled with AASHTO M 43 No. 1 and No. 2 aggregate conforming to the material requirements of Article 2.1 of this Section.

C. In excavations other than utility trenches, the voids left by removal of unsuitable excavated material shall be filled with material consisting or either: (1) Special Backfill Material; (2) Class B concrete; or (3) Low Strength Mortar Backfill, whichever is ordered by the Engineer.

D. Removal of unsuitable excavated material and its replacement as directed will be paid on basis of Contract Conditions relative to Changes in Work unless specific unit prices have been established for excavation of unsuitable material.

3.8 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

A. It shall be the responsibility of the Contractor to dispose of all surplus material that cannot be used in backfill or embankments at his expense outside the limits of the project. Unsuitable excavated material, including rock or large boulders, shall be disposed of outside the limits of the project.

B. Surplus material may be wasted adjacent to or incorporated in the regular construction only when ordered in writing by the Engineer.

3.9 BACKFILL

A. Pipelines, Sewers and Conduits

1. All pipe shall have bedding extending the width of the trench with depth in conformance with the Drawings. The bedding material shall be thoroughly compacted by tamping until no further densification is possible.
2. Pipe cover material shall be used for filling above the pipe bedding along the sides of the pipe and to a height of twelve (12) inches over the top of the pipe. The pipe cover material shall be brought up evenly on both sides of the pipe to eliminate the possibility of lateral displacement of the pipe and shall be thoroughly compacted by tamping until no further densification is possible. Care shall be taken to spade the aggregate under the pipe haunch below the spring line.
3. All trenches and excavations shall be backfilled immediately after pipe is laid therein, unless otherwise directed by the Engineer.
4. After the pipe cover has been placed and compacted around the pipe as specified above, the remainder of the trench may be backfilled by machine. The backfill material shall be deposited in eight (8) inch horizontal layers, and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case will backfilling material from a bucket be allowed to fall directly on a pipe and in

all cases the bucket must be lowered so that the shock of the falling earth will not cause damage.

B. Structures

1. Backfilling shall not commence before concrete has attained specified strength. Do not use equipment for backfilling and compaction operations against structures that will overload the structure.
2. Backfilling around and over structures shall be carefully placed and tamped with tools of suitable weight to a point one (1) foot above the top of same. Additional backfill may be required to protect the structure from damage from heavy equipment. Backfill shall be placed in uniform layers not exceeding eight (8) inches in depth. Each layer shall be placed, then carefully and uniformly compacted to the specified density so as to eliminate the possibility of displacement of the structure.
3. After the backfill has been placed and compacted around the structure to the height specified above, the remainder may be backfilled by machine. The backfill material shall be deposited in eight (8) inch horizontal layers, and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case will backfilling material from a bucket be allowed to fall directly on a structure, and in all cases the bucket must be lowered so that the shock of the falling earth will not cause damage.

C. Where any new, proposed, or future pavement, driveway, parking lot, curb, curb and gutter, or walk is to be placed over a backfilled area, Special Backfill material shall be used for any portion of the trench falling within the pavement prism.

D. Where it is necessary to undercut or replace existing utility conduits and/or service lines, the excavation beneath such lines shall be backfilled the entire length with approved Granular Pipe Embedment Material compacted in place in eight (8) inch layers to the required density. The approved Granular Pipe Embedment Material shall extend outward from the spring line of the conduit a distance of two (2) feet on either side and thence downward at its natural slope.

3.10 LOW STRENGTH MORTAR BACKFILL

A. Low strength mortar backfill shall be discharged from the mixer as recommended by the supplier and approved by the Engineer.

B. Low strength mortar backfill may be placed in the trench in as few lifts as may be practical.

C. Secure conduit or pipelines before placing low strength mortar backfill to prevent conduits and pipelines from floating during backfilling.

D. For low strength mortar backfill placed against existing structures of unknown strength, backfill material shall be brought up uniformly in maximum 12 inch lifts

and allowed to cure for a minimum of 24 hours or until it can carry a person's weight without leaving imprints before the next lift is placed.

E. Low strength mortar backfill shall be brought up to subgrade elevation or the pavement prism, whichever may be applicable.

3.11 EMBANKMENT

A. In making fill for embankment, the surface of the existing ground shall be cleared, grubbed, stripped of organic material, plowed, compacted according to the requirements specified in this Section, and stepped on slopes so as to enable bond or firm bearing for the new fill. The materials for these fills shall be selected of approved materials free from organic matter and placed in horizontal layers not exceeding eight (8) inches in thickness when loose, each layer being thoroughly compacted. Materials shall not be placed when fill or foundation is frozen.

B. Where fill is to be placed on side slopes steeper than one (1) vertical to six (6) horizontal, steps shall be formed into the slope before any embankment is placed. These steps shall be cut at vertical intervals at no more than two (2) feet and shall have a horizontal dimension of not less than three (3) feet.

C. As fill progress, the top shall be kept crowned or sloped for drainage. No pavement shall be placed upon embankment until it meets compaction testing requirements.

D. Fills that abut or contain concrete or masonry structures shall be placed with care to avoid undue or unbalanced loads on these structures.

E. Following the completion of embankment, all slopes shall be neatly and evenly dressed to proper elevation, grade and dimension.

3.12 SUBGRADE

A. All soil subgrade shall be prepared in accordance with this subsection.

B. Drainage
   1. The surface of the subgrade shall be maintained in a smooth condition to prevent ponding of water after rains to insure the thorough drainage of the subgrade surface at all times.

C. Unsuitable Subgrade
   1. Where unsuitable subgrade or subgrade not meeting the required bearing capacity is encountered in cuts, due to no fault or neglect of the Contractor, in which satisfactory stability cannot be obtained by moisture control and compaction, the unstable material shall be excavated to the depth required by the Engineer.
   2. Suitable material required for the embankment to replace the undercut will be paid on basis of Contract Conditions relative to changes in Work.

3. Where soft subgrade in cuts is due to the failure of the Contractor to maintain adequate surface drainage as required in this article, or is due to any other fault or neglect of the Contractor, the unstable condition shall be corrected as outlined above at no expense to the Owner.

D. Full Width New Pavement Construction

1. After the surface of the subgrade has been shaped to approximate cross section grade, and before any pavement, base or subbase material is placed thereon, the subgrade shall be compacted. When the rolling is completed, all surface irregularities shall be corrected and the surface of the subgrade shall be shaped as necessary to conform to the grade and cross section shown on the Drawings within the tolerance set forth in this Section and shall be so maintained until the overlying course is in place.

3.13 TOLERANCES

A. The Contractor shall check the work under this item with templates, slope boards or other devices satisfactory to the Engineer. The completed work shall conform to the Drawings within the following tolerances:

1. For subgrade, the surface shall at no place vary more than ½ inch from a ten-foot straight edge applied to the surface parallel to the centerline of the pavement, nor more than ½ inch from subgrade elevation established by construction layout stakes.

3.14 CONSTRUCTION WITH MOISTURE AND DENSITY CONTROL

A. All backfill and embankments, except rock embankments, shall be constructed using moisture and density control. All subgrade, except rock and shale in cut sections, shall be constructed using moisture and density control.

B. Backfill, embankment and subgrade material which does not contain sufficient moisture to be compacted in accordance with the requirements of Article 3.17 of this Section shall be sprinkled with water as directed by the Engineer to bring the moisture content to within the range of optimum plus or minus three (3) percent. Water shall be thoroughly incorporated into the material by means of discs or other approved equipment.

C. Backfill, embankment and subgrade material containing excess moisture shall be dried, prior to installation, to a moisture content not greater than three (3) percentage points above optimum, except that for material within the moisture content range specified herein that displays pronounced elasticity or deformation under the action of loaded construction equipment, the moisture content shall be reduced to optimum or below if necessary to secure stability. For subgrade material, these requirements for maximum moisture shall apply at the time of compaction of the subgrade and also at the time of placing pavement or subbase. Drying of wet soil shall be expedited by the use of plows, discs, or by other approved methods when so ordered by the Engineer.

3.15 COMPACTION REQUIREMENTS

A. The bottom of excavations upon which concrete foundations or structures are to be placed shall be compacted so as to obtain 100% of maximum dry density per ASTM D-698 in the top twelve (12) inches.

B. The top twelve (12) inches of stripped original subgrade and final subgrade shall be compacted to not less than 100% of maximum dry density per ASTM D-698.
   1. Subgrade under new, proposed, or future pavement shall be compacted 18 inches beyond the edge of pavement, paved shoulders or paved medians.

C. Compaction of subgrade for sidewalks (regardless of paving material) shall be 100% of maximum dry density per ASTM D-698 in the top six (6) inches.

D. Compaction of non-paved areas shall be 90% of maximum dry density per ASTM D-698.

E. Aggregate pipe embedment and aggregate backfill around structures shall be compacted to not less than 100% of maximum dry density per ASTM D-4253 and ASTM D-4254.

F. Final backfill shall be compacted to not less than 100% of maximum dry density per ASTM D-698.

G. Fill placed within the interior of structures shall be compacted to not less than 100% of maximum dry density per ASTM D-698.

H. Embankment shall be placed and compacted in layers until the density is not less than the percentage of maximum dry density indicated in the following table determined by ASTM D-698.

EMBANKMENT SOIL COMPACTION REQUIREMENTS

Maximum Laboratory Dry Weight Pounds/Cubic Foot	Minimum Compaction Requirements Percent Laboratory Maximum
90-104.9	102
105-119.9	100
120 and more	98

I. Test Sections
   1. If it is determined by the Engineer that the composition of the material is such that it cannot be tested for density using a nuclear densometer or other

methods; or where, in the opinion of the Engineer, in-place compaction testing is not feasible; and if approved by the Engineer, the Contractor may construct a test section to demonstrate acceptable compactive effort in lieu of in-place compaction testing. Test sections shall be constructed at no additional cost to the Owner.

2. The test section shall be completed by repeatedly compacting the material until no further density is achieved. This value shall be the Minimum Test Section Density (MTSD). The compaction equipment used to complete the test section shall be of suitable size to compact the material and shall be the same equipment used to compact the in-place material.
3. The test section shall be constructed with moisture density control as specified in this Section.
4. The material shall be compacted to at least 98% of the MTSD.
5. Each lift of in-place fill or backfill shall be densified using a compactive effort equal to or greater than the effort applied to achieve the MTSD; i.e., if six passes were required to achieve MTSD, then each lift of material shall be compacted using six or more passes.
6. Construct a new test section when, in the opinion of the Engineer, the fill or backfill material has changed character or when the supporting material has changed character.

3.16 GRADING

A. Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading
   1. Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
      a. Lawn or unpaved areas shall be graded to plus or minus 1 inch.
      b. Walks shall be graded to plus or minus 1 inch.

C. Grading inside Building Lines
   1. Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

END OF SECTION 310000

SECTION 311100 – CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Removal of surface debris.

B. Removal of trees, shrubs, and other plant life.

C. Topsoil excavation.

1.2 RELATED SECTIONS

A. Specifications sections related to this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, Division 1 and all other applicable sections in this manual.

1.3 REGULATORY REQUIREMENTS

A. Conform to all applicable and local codes for environmental requirements, disposal of debris, burning debris on site, use of herbicides, and other applicable items.

B. Coordinate clearing work with utility companies.

C. Work shall conform to the requirements of ODOT-CMS Item 201 Clearing and Grubbing.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Herbicide, if required shall conform to applicable and local codes per environmental requirements

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that existing plant life designated to remain is tagged or identified.

B. Identify a waste area and/or salvage area for placing removed materials.

3.2 PROTECTION

A. Locate, identify, and protect utilities that remain, from damage.

B. Protect trees, plant growth, and features designated to remain, as final landscaping.

C. Do not disturb any area that is not necessary for completion of this project. Disturbance shall be in accordance with projects Storm Water Pollution Prevention Plan.

D. Protect benchmarks, survey control points, and existing structures from damage or displacement. Wetlands areas are not to be disturbed.

3.3 CLEARING

A. Clear areas required for access to site and execution of Work.

B. Remove trees and shrubs within marked areas or as indicated. Remove stumps, main root ball, root system for complete removal of surface rock and other as indicated on drawings.

C. Clear undergrowth and deadwood, without disturbing subsoil.

D. Apply herbicide to remaining stumps to inhibit growth.

3.4 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

3.5 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, re-landscaped, or re-graded, marked areas, entire site, without mixing with foreign materials.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion.

D. Install perimeter silt fence around stockpile area to prevent erosion and sediment transport from occurring.

E. Stockpiled topsoil shall be used for final grading around proposed improvements.

END OF SECTION 311100

SECTION 312323.13 – COMPACTED BACKFILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish, place and compact all the materials needed from select excavated materials or furnish additional suitable material if the excavated material is deemed unsuitable or the moisture content is not or can not be made to be within acceptable tolerances of optimum moisture to achieve the specified compaction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Suitable excavated material as specified in ODOT Item 203.

PART 3 - EXECUTION

3.1 PLACING

A. Compacted backfill shall be properly placed in layers sufficient to meet the compaction requirement of 95% of maximum laboratory dry density per ASTM D 698 throughout the entire layer and thoroughly compacted with mechanical compaction equipment with moisture adjustment as needed. Should after settlement occur, the Contractor must add and compact additional material, and he must maintain the backfill at the required finished grade or sub-grade until the project is satisfactorily completed and during the correction period.

B. Approved mechanical compaction equipment shall be used for tamping backfill. Flooding, jetting or puddling of backfill will not be permitted.

END OF SECTION 312323.13

SECTION 321000- PAVEMENT REPLACEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish all of the equipment, labor and materials necessary to install, replace, and/or restore existing pavement structures together with their respective appurtenances as shown on the plans and as specified herein. This work shall include all of the subgrade preparation, subbase, base, intermediate pavement course(s), and finish pavement courses together with curbing, guttering, tack and/or prime coating, sealing and other pertinent work as necessary to meet the conditions of this contract.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 REPAIR OR REPLACEMENT WORK

A. For the repair and/or replacement of all existing pavement structures and their respective appurtenances that are removed and destroyed or otherwise damaged by the Contractor in the course of his performance of the work required under this contract, the Contractor shall furnish all equipment, labor, and materials as necessary to properly restore to a condition equal to that at his entry, and to the satisfaction of the Engineer, the Ohio Department of Transportation, the County Engineer, City Engineer, all cinder, slag, gravel, water-bound macadam, bituminous macadam, asphalt and brick or concrete driveways, curbs, sidewalks and roadways in strict accordance with the drawings and as specified herein.

B. In general, this item will include concrete, steel reinforcement, brick, stone, slag, cinders, gravel, asphalt and other bituminous materials and curbs, gutters, driveway culverts, road and curb drains and the demolition, excavation and removal of existing driveways, sidewalks and roadways.

1.5 REFERENCE TO OTHER PARTS

A. Other sections of these specifications shall apply, as and where applicable to this section and such sections will be the same as though they were included in this section.

B. For all old work where pavement is being repaired and/or replaced as a result of damages occurring thereto during the course of the work of this contract, all clearing and grubbing, removal and storage of topsoil, excavation and/or placing of compacted fill and granular backfill, shall be done as required under other parts of these specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Generally, for all repair and replacement work, all new materials shall match the existing and adjoining work in both composition and quality unless otherwise ordered, specified herein, and/or shown on the drawings. In any stone driveway or roadway, the material used for stone fill shall conform to the existing material.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. All pavement work shall be done in strict accordance with the specifications of the governmental body concerned and the latest ODOT specifications as applicable or at the direction of the Engineer.

B. All pavements disturbed by the Contractor's operations shall be relaid to the thickness of the adjoining pavement and, in all cases, the restoring of pavements, shall apply both to foundation courses and to the wearing surface.

C. Should cracks or settlements appear in adjoining pavements, the paving shall be removed to the extent necessary to secure firm and undisturbed bearing and shall be replaced in a satisfactory manner.

D. No permanent pavement shall be installed, repaired, and/or restored unless, or until, in the opinion of the Engineer, the condition of the backfill is such as to properly support the pavement.

E. Where new or replacement concrete pavement or base is placed adjacent to existing concrete pavement or base, contraction joints shall be provided in the new or replacement pavement so as to form a continuous joint with that in the existing pavement.

3.2 ROADWAY SUBGRADE

A. The entire area to be occupied by the roadways and parking areas shall be cleared, topsoil removed and stored, and the excavation or compacted fill made as required and brought to the proper cross-sections. Pipe trenches and other excavations shall be backfilled as required, and thoroughly compacted within the limits of the roadways or parking areas.

B. After the surface of the subgrade has been properly shaped and before any stone or slag is placed, the entire subgrade shall be thoroughly rolled and compacted to a depth of 12 inches under this section. Rolling shall be done with an approved type of self-propelled roller, weighing not less than ten (10) tons. All hollows and depressions which develop during the rolling shall be filled with acceptable materials, and the subgrade rerolled. The process of filling and rolling shall be repeated until no depressions develop, and the entire subgrade has been brought to a uniform condition of stability.

C. All places which, in the opinion of the Engineer cannot be properly rolled, shall be tamped with handheld mechanically or pneumatically powered tampers.

D. In making the compacted fill and in doing the final subgrade rolling, the Contractor shall see that the material to be compacted and/or rolled has the proper moisture content to secure maximum compaction. When, in the opinion of the Engineer, the material is too wet, the compacting shall be delayed until the material has dried sufficiently. When, in the opinion of the Engineer, the material is too dry, the material shall be sprinkled with water in an amount to secure the proper moisture content.

END OF SECTION 321000

SECTION 321216 - ASPHALT CONCRETE PAVING AND MATERIALS

SECTION 1 - MATERIALS

1.1 The asphalt concrete mixture and installation thereof shall meet Ohio Department of Transportation (ODOT) Specifications except as modified in these specifications.

1.2 In the ODOT Specifications substitute "Engineer" for "Department" (except as stated below in reference to ODOT 403 for Department VA testing and acceptance).

1.3 No steel slag shall be used as coarse or fine aggregate for any asphalt concrete.

1.4 All asphalt cement utilized on this project shall meet AASHTO Provisional Standard MP1 or any superseding AASHTO specification for performance graded asphalt cement binder in conformance with PG 64-22.

1.5 The following exceptions shall be made for the Asphalt Concrete for the Asphalt Concrete Surface Course:

A. The coarse aggregate material shall be only limestone
B. No Recycled Asphalt Product (R.A.P.) will be permitted

1.6 Except where designated otherwise in the plans or specifications all asphalt concrete mixes shall be designed for medium traffic volumes. Where light or heavy traffic pavements are designated in the plan, the contractor shall use an asphalt concrete mix designed for such traffic conditions.

1.7 Acceptance of the mixture will be based upon the certification that the mixture was produced according to the approved JMF within the production control and composition tolerances of the specifications. The Contractor shall hire and pay for an independent testing lab approved by the Engineer to perform all sampling, testing, monitoring, analysis and certification required by the Laboratory, Monitoring Team or Department in ODOT 403 and 441. All work by the independent laboratory shall be performed by personnel with ODOT Level II Bituminous Concrete certification.

1.8 ODOT 401.20 - "Asphalt Binder Price Adjustment" shall not apply to this contract.

1.9 Monument box and valve box risers shall be East Jordan Iron Works No. 8626, No. 8631, or approved equal. The Contractor shall follow the manufacturer's recommended installation procedure. New manhole frames and grate or frame and cover shall be EJIW 1710.

1.10 Brick used for manhole, catch basin, or inlet basin castings adjusted to grade under ODOT 611.10 Method D.1. shall be red shale or clay sewer brick meeting the requirements of ASTM C32 sewer brick, grade SM.

1.11 Risers used for manhole castings adjusted to grade under ODOT 611.10 Method D.2. shall be manufactured by Manhole Systems, Model MS-101TB, or approved equal.

1.12 All inlets and manholes shall be adjusted to grade after installation of the intermediate course(s), if any and prior to installation of the surface course.

1.13 All materials delivered to this project must have been weighed on a platform scale with electronic imprinter to show gross, tare, and net weights. No payment will be made for materials which are not correctly weighed as necessary. Material weight shall not exceed the current legal allowable limit.

1.14 Unless specified elsewhere in the specifications, material for berms shall be limestone only. Recycled concrete and asphalt concrete will not be permitted.

SECTION 2 - PAVING EQUIPMENT

2.1 All spreading equipment shall be self propelled. The Contractor shall identify the make and model of the paving machine that will be used for the intermediate and surface courses for approval prior to the pre-construction meeting.

2.2 All equipment, tools, and machines used in the performance of this work shall be maintained in satisfactory working order at all times. The Contractor shall be prepared to furnish proof of certification that all equipment to be used on the project has been calibrated within the past six (6) months.

SECTION 3 - GENERAL - PAVING

3.1 All paving shall be done on a single-lane basis.

3.2 If traffic loop detectors are encountered and broken, the Contractor is to repair as per local specifications. The cost for this work will be paid under the loop detector replacement bid item, if any; at negotiated unit prices; or by time and materials as directed by the Engineer.

3.3 Tack Coat, Item 407, shall be applied at the rate of from 0.05 to 0.15 gallons per square yard as appropriate for the surface conditions with sand cover if required.

3.4 Asphalt driveway aprons shall be matched to new pavement with 24" transition sections or as shown on the drawings or required by the Engineer. The Contractor shall install apron wedge as required in the detailed drawings.

3.5 Unless otherwise shown on the drawings, jointing of new to existing pavement shall be by milled butt joints six (6) feet in width (or as shown on the plans) from edge of pavement to edge of pavement. Depth of this milled area shall equal the total of subsequent intermediate course and surface course as specified.

3.6 One (1) copy of each hauled/weighed material truck load ticket (plant ticket) for materials incorporated in this project shall be provided to the project representative daily. All bulk materials delivered to this project must have been weighed on a platform scale with electronic imprinter to show gross, tar and net weights. No payment will be made for materials which are not correctly weighed as necessary. Material weight shall not exceed the current legal allowable limit. If a partial load is used, the Contractor's foreman and the project representative shall confer and come to an agreement as to what portion of the product was used. The percent of material of this load, as reported by the project representative, is what shall be recorded as utilized.

3.7 For variable depth courses where tonnage tickets are used for determining quantities for payment, the conversion to cubic yards shall be number of tons verified and approved by the Engineer divided by 2.00 regardless of the actual density of the mix.

3.8 Positive drainage is to exist subsequent to the completion of the surface course. The Contractor shall take any necessary measures to assure positive drainage of the surface course. It shall be the responsibility of the Contractor to repair any low/puddled areas at his own cost by milling out the affected areas to a minimum depth equal to the nominal depth of the course being repaired and replacing with the specified asphalt concrete to grades that will correct the drainage problem.

3.9 Surface tolerances for all completed surface courses shall be as noted in ODOT 401.19. This tolerance shall apply regardless of whether or not an intermediate course is installed.

3.10 At the direction of the Engineer, periodic weight checks of asphalt concrete in loaded trucks shall be made by the Contractor and verified by the Engineer.

3.11 All quality control testing data performed on material incorporated into this project shall be forwarded to the Engineer for review as soon as it is available.

3.12 Quantity verification (but not necessarily payment quantity) for all asphalt concrete incorporated into the work shall be by weight tickets as produced by the plant or supplier or other means approved by the Engineer. Tack coat shall be verified by a ticket filled out and signed by the Contractor's tack truck driver based on weights taken or observations of level indicators. All verification tickets are required to be submitted to the Engineer on the day the material is incorporated into the work; however, the Engineer may, at his sole discretion, accept verification tickets for any items up to seven (7) calendar days subsequent to the work being performed. **After that date additional verification tickets for material will not be accepted for consideration of payment.**

3.13 No work is to be performed without the presence of the Engineer or his designated Project Representative. Forty-eight (48) hour advance notice of work shall be given to the Engineer and Owner by the Contractor.

3.14 All edges of surface courses abutting curbs or other appurtenances shall be sealed with hot AC-20.

3.15 The asphalt concrete, intermediate or surface course work will conform to ODOT Items 448-1 – Intermediate and Surfaces Courses and 448-2 – Intermediate Course. The paving foreman, at the Engineer's request, will be required to correctly calculate the asphalt concrete "yield." "Yield" is defined as the rate of material used, in cubic yards, in proportion to the area paved. The Contractor must be aware if he is under or over plan quantities for the area in question.

END OF SECTION 321216

SECTION 329200.19 – SEEDING AND MULCHING

PART 1 - GENERAL

1.1 SUMMARY

. Installation of seeded areas shall be to the extent shown on Contract Drawings and shall include supplying all seed, topsoil, soil conditioning materials, mulching materials and watering, and the incorporation of these materials into the work as specified.

A. The Contractor shall place topsoil at the depths specified in those areas requiring seeding. Topsoil shall be furnished by the Contractor.

1.2 SUBMITTALS

A. Product Data: For the following:

1. Provide copies of soils tests for both new topsoil (provided) and onsite topsoil for review and approval. This applies to all areas that require seeding, including reconditioned areas.

2. Provide location of properties from which topsoil is to be obtained, names and addresses of owners, depth to be stripped, and crops grown in the past 2 years.

3. Provide the name of the seed supplier, name and phone number, list of the seed, including varieties of seed, labels, and an analysis of the seed for review, 4 weeks prior to the start of seeding.

4. Provide soil amendments information based on soils test requirements.

5. Hydroseed mixture, mulch and application rates prior to performing the work.

1.1 QUALITY ASSURANCE

A. Any subcontracted restoration work shall be performed by a qualified firm specializing in landscape work.

B. The Contractor shall have a soils test done at his expense and analyzed by a state approved testing agency. Soil tests shall be done on both the topsoil stockpiled from the site and new topsoil brought to the site. A minimum of two (2) tests shall be done. The tests shall include percent organic matter, pH, Buffer pH, Phosphorus, Exchangeable Potassium, Calcium, Magnesium, Cation Exchange Capacity and Percent Base Saturation with recommendations for nitrogen, phosphate, potash, magnesium and lime based on plant type and use.

B. Seed: All seed specified shall meet O.D.O.T. specifications as to the percentage purity,

weed seed, and germination. All seed shall be approved by the State of Ohio, Department of Agriculture, Division of Plant Industry, and shall meet the requirements of these specifications.

D. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.

1.4 PROJECT CONDITIONS

B. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.

C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, such conditions shall be rectified by the Contractor before planting, with approval from the Owner's Representative.

D. Soil Stabilization: The Contractor shall provide permanent or temporary soil stabilization to denuded areas within fifteen (15) days after final grade is reached on any portion of the site. Any such area which will not be regraded for longer than fifteen (15) days shall also be stabilized. Soil stabilization includes any measures which protect the soil from the erosive forces of raindrop impact and flowing water. Applications include seeding and/or mulching, or the use of other erosion control measures as directed by the Owner's Representative. If necessary, the Contractor shall coordinate soil stabilization practices with the local Soil and Water Conservation District.

D. Spring-sown work shall be installed between April 1st and May 30th and Fall-sown work shall be installed between September 1st and October 15th. No permanent seeding shall take place between May 30th and September 1st and between October 15th and April 1st. The dates for seeding may be changed at the discretion of the Owner's Representative.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Topsoil shall be furnished by the Contractor. Stockpiled material, if any, shall be utilized prior to obtaining additional topsoil.

B. All topsoil shall conform to the U.S. Department of Agriculture soil texturing triangle and shall contain between 3% to 8% organic matter. Topsoil shall be loamy and not consist of more than 38% clay. New topsoil shall be screened to remove clay lumps, brush, weeds, litter, roots, stumps, stones larger than ½" in any dimension and any other extraneous or toxic matter harmful to plant growth.

New topsoil shall be obtained only from naturally well drained sites where topsoil occurs in a depth of not less than 4". Do not obtain from bogs or marshes.

C. Soil amendments shall be added according to the soils test requirements. Amendments can include, but are not limited to fertilizer, lime, compost, sand, and organic matter. Organic matter shall consist of composted leaves or other approved material.

2.2 SEED

A. Seed shall be vendor mixed, delivered in original bags and shall be proportioned as follows:

Common Name	Proportion by Weight
Kentucky Blue Grass	50%
Perennial Rye	50%

2.3 MULCH

A. Mulch shall be clean straw free of seed and weed seed.

1. Anchoring for mulch shall be an ODOT specified SS-1 at 60 gal./ton non-toxic tackifier such as Hydro-stik, or equal, or by securing with a photo degradable netting.

B. If hydroseeding is used, wood fiber mulching material shall be used and shall consist of virgin wood fibers manufactured expressly from whole wood chips and shall conform to the following specifications.

- Moisture content	10.0% $\pm$ 3.0%
- Organic content	99.2% $\pm$ 0.8% O.D. Basis
- pH	4.8 $\pm$ 0.5
- Water holding capacity, minimum (grams of water per 100 grams of fiber)	1,000

Wood fiber mulching material shall be processed in such a manner as to contain no growth or germination inhibiting factors, and must contain a biodegradable green dye to aid in visual metering during application.

PART 3 - EXECUTION

3.1 PREPARATION - GENERAL

A. Rough grading to a depth necessary to accept the specified thickness of topsoil must be approved prior to placing topsoil.

B. Loosen subgrade, remove any stones greater than ½" in any dimension. Remove sticks, roots, rubbish, and other extraneous matter.

C. Spread topsoil to a minimum depth of 4 inches, to meet lines, grades, and elevations shown on plan, after light rolling and natural settlement. Remove sticks, roots, rubbish, stones

greater than 1/2" in any dimension, and other extraneous matter. Topsoil shall be tilled thoroughly by plowing, disking, harrowing, or other approved methods. Add specified soil amendments and mix thoroughly into the topsoil.

D. Preparation of Unchanged Grades: Where seed is to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil for planting as follows: Till to a depth of not less than 6 inches. Apply soil amendments and initial fertilizers as specified. Remove high areas and fill in depressions. Till soil to a homogenous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter. Soils test requirements apply here as well.

1. Prior to preparation of unchanged areas, remove existing grass, vegetation and turf. Dispose of such material outside of project limits. Do not turn existing vegetation over into soil being prepared for seed.

   If necessary, supply and install topsoil in areas where there is no topsoil left after vegetation has been removed.

2. Apply specified soil amendments at rates specified in the soils test and thoroughly mix into upper 2 inches of topsoil. Add topsoil if existing grade has less than 4" of topsoil. Delay application of amendments if planting will not follow within two (2) days.

E. Fine grade areas to smooth, even surface with loose, uniformly fine texture. Roll, rake, and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Remove sticks, roots, rubbish, stones greater than 1/2" in any dimension, and other extraneous matter. Limit fine grading to areas which can be planted immediately after grading.

F. Moisten prepared areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

G. Restore areas to specified condition, if eroded or otherwise disturbed, after fine grading and prior to planting.

3.2 SEEDING

A. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage. Seed shall not be sown when the ground is frozen, muddy, or when weather conditions prevent proper soil preparation, interference with sowing and/or proper incorporation of seed into the soil.

B. Sow seed using a spreader or hydroseeder. Do not seed when wind velocity exceeds 5 miles per hour. Distribute seed evenly over entire area by sowing 3 lbs. per 1000 S.F. at right angles to each other. Total amount to equal a minimum of 6 lbs. per 1000 S.F.

C. For seed sown with a spreader, mulch shall be spread uniformly to form a continuous blanket at a rate of 100 lbs. per 1,000 S.F. Mulch shall be 1 1/2" loose measurement over seeded areas and shall be anchored.

D. Contractor has the option to hydroseed large lawn areas, using equipment specifically designed for such application. The rate of application of wood fiber mulching materials is 40 lbs./1,000 S.F. Contractor shall not hydroseed within close proximity to buildings and structures, or when unfavorable wind conditions may blow the hydroseed material onto the structure. Contractor shall clean all areas not to be seeded of overspray.

E. The seeded area shall be watered, as soon as the seed is applied, at the rate of 120 gallons per 1000 square feet. The water shall be applied by means of a hydroseeder or a water tank under pressure with a nozzle that will produce a spray that will not dislodge the mulching material. Cost of this watering shall be included in the cost of seeding and mulching.

3.3 DORMANT SEEDING METHOD

A. Seeding shall not take place from October 15 through November 20. During this period prepare the seed bed, add the required amounts of lime and fertilizer, and other amendments, then mulch and anchor.

B. From November 20 through April 1, when soil conditions permit, prepare the seed bed, lime and fertilize, apply the selected seed mixture, mulch, and anchor. Increase the seeding rate by 50 percent.

3.4 RECONDITIONING EXISTING LAWNS

A. A soils test shall be required for existing lawns prior to any reconditioning.

B. Recondition all existing lawn areas damaged by Contractor’s operations including storage of materials and equipment and movement of vehicles. Also recondition existing lawn areas where minor regrading is required.

C. Provide soil amendments as called for in the soils test.

D. Provide new topsoil, as required, to fill low spots and meet new finish grades.

E. Cultivate bare and compacted areas according to the topsoil specifications.

F. Remove diseased and unsatisfactory lawn areas; do not bury into soil. Remove topsoil containing foreign materials resulting from the Contractor's operations, including oil drippings, stone, gravel, and other loose building materials.

G. All work shall be the same as for new seeding.

H. Water newly planted seed areas. Maintenance of reconditioned lawns shall be the same as maintenance of new lawns.

3.5 ESTABLISHMENT

A. Maintain work areas as long as necessary to establish a uniformly close stand of grass over the entire lawn area. A uniformly close stand of grass is defined as the seeded areas having 90%+ coverage of grass at 60 days after seeding. 90%+ coverage is defined as very little or

no dirt showing when seeded area is viewed from directly overhead.

B. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading and replanting as required to establish a smooth acceptable lawn.

1. Mowing
   a. Mow lawn areas during the period of maintenance to a height of 2 inches whenever the height of the grass becomes 3 inches. A minimum of 3 mowings is required during the period of maintenance.
2. Refertilizing
   a. Distribute fertilizer on the seeded area between August 15 and October 15, during the period when grass is dry, and in accordance with the manufacturer's recommendations. The fertilizer shall be as specified in the soils test.
3. Reseeding
   a. Reseed with the seed specified for the original seeding, at the rate of 4 lbs. per 1,000 S.F. in a manner which will cause minimum disturbance to the existing stand of grass and at an angle of not less than 15 degrees from the direction of rows of prior seeding.
4. Watering

   a. The Contractor shall keep all work areas watered daily to achieve satisfactory growth. Water shall be applied at a rate of 120 gallons per 1,000 square feet. If water is listed as a pay item, it shall be separately paid for based on the actual amount of water used, measured in thousands of gallons.
5. Any mulching which has been displaced shall be repaired immediately. Any seed work which has been disturbed or damaged from the displacement of mulch shall be repaired prior to remulching.

3.6 INSPECTION AND ACCEPTANCE

A. When seeding work is complete and an acceptable stand of growth is attained, the Contractor shall request the Owner's Representative to make an inspection to determine final acceptance.

B. Acceptance shall be based upon achieving a vigorous uniformly stand of the specified grasses. If some areas are satisfactory and some are not, acceptance may be made in blocks, provided they are definable or bounded by readily identified permanent surfaces, structures, or other reference means. Partial acceptance decisions may be made by the Owner's Representative. Excessive fragmentation into accepted and unaccepted areas shall not be allowed. Unaccepted areas shall be maintained by the Contractor until acceptable.

C. No payment shall be made until areas are accepted.

D. All seeded areas shall be guaranteed for one full growing season to commence upon final acceptance of the areas.

END OF SECTION 329200.19

SECTION 331113.01 – WATER UTILITY DISTRIBUTION SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

A. Furnishing all labor, materials, tools, equipment, and services for all waterlines as shown on the Drawings.

B. Although such is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a functional and complete installation.

1.2 RELATED DOCUMENTS AND SECTIONS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions (if included), and Division 1 Specifications Sections, apply to this Section.

1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Granular pipe bedding and cover material specified in Section 310000 – Earthwork.

B. Special backfill material specified in Section 310000 – Earthwork.

1.4 DEFINITIONS

A. Bedding: Material placed under, beside and directly over pipe for the full width of the trench up to a distance of 6 inches over the top of the pipe barrel prior to subsequent backfill operations.

1.5 SUBMITTALS

A. Manufacturer's Affidavit: The manufacturer shall furnish an affidavit indicating that all pipe, fittings, valves, fire hydrants, and appurtenances have been manufactured and tested in accordance with the requirements of the applicable referenced Standards. A copy of the affidavit shall be forwarded to ENGINEER prior to construction.

B. For butt fusion joints, submit a printout giving all the parameters of each joint as required under paragraph 3.8.F.

C. For polyethylene encasement, submit sample.

D. Shop Drawings: Submit per 013323.

E. Method of construction with detailed drawings and written descriptions of the entire construction procedure to insert the pipe, and connections to water services, fire hydrants, and intersecting water mains. Drawings shall show, but are not limited to, excavation

locations, access pits, dimensions, shoring, method of dewatering, adjacent utilities, and traffic control.

1.6 REFERENCES

A. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings

B. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems

C. AWWA C110 - Ductile-Iron and Gray-Iron Fittings

D. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

E. AWWA C116 - Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings

F. AWWA C150 - Thickness Design of Ductile-Iron Pipe

G. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast

H. AWWA C153 - Ductile-Iron Compact Fittings

I. AWWA C213 - Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings

J. AWWA C301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type

K. AWWA C400 - C400-03: AWWA Standard for Asbestos-Cement Pressure Pipe, 4 In. through 16 In. (100 mm through 400 mm), for Water Distribution Systems

L. AWWA C502 - Dry-Barrel Fire Hydrants

M. AWWA C504 - Rubber-Seated Butterfly Valves

N. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service

O. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service

P. AWWA C550 - Protective Interior Coatings for Valves and Hydrants

Q. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances

R. AWWA C651 - Disinfecting Water Mains

S. AWWA C800 - Underground Service Line Valves & Fittings

T. ASTM A36 - Standard Specification for Carbon Structural Steel

U. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings

V. ASTM A48 - Standard Specification for Gray Iron Castings

W. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

X. ASTM A181 - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping

Y. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts

Z. ASTM A307 -Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

AA. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings

BB. ASTM B88 - Standard Specification for Seamless Copper Water Tube

CC. ASTM B124 - Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes

DD. ANSI B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings

EE. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3))

1.7 QUALITY ASSURANCE

A. Comply with all provisions of Section 014323 – Qualifications of Tradesmen.

B. Comply with all provisions of Section 014126 – General Regulations and Permits.

C. Field samples shall comply with Section 013319 – Field Test Reporting and Section 013326 – Product Testing and Certifying.

D. Before and during installation, the Contractor shall comply with provisions under Section 013119 – Project Meetings.

E. All pipes, fittings, valves, fire hydrants and appurtenances shall be appropriately marked for identification purposes. The materials and methods of manufacture, and completed pipes, fittings, valves, and appurtenances shall be subject to inspection and rejection at all times. Owner and Engineer have the right to make inspections.

1.8 PROJECT CONDITIONS

A. Existing Conditions
   1. Verify locations of underground utilities.
   2. Protect existing structures and utilities from damage. Repair if damaged by this work.
   3. Do not change pipe sizes without securing written approval of Engineer.

B. Field Measurements

1. If it becomes necessary to change location of waterlines due to underground utility interference, secure approval of Engineer.
2. If Contractor initiated, make changes approved by the Engineer without added cost to Owner.

1.9 DELIVERY STORAGE AND HANDLING

A. Deliver products to the site, store and protect under provisions of Section 016600 – Product Handling and Protection.

B. Comply with all provisions of Section 013543 – Environmental Protection

1.10 SEQUENCING AND SCHEDULING

A. Perform no pipe work in fill areas until embankment or fill has been completed to at least two (2) feet above proposed top of pipe and fill has been properly compacted.

PART 2 – PRODUCTS

2.1 WATERMAIN PIPE AND FITTINGS

A. Ductile Iron Pipe and Fittings
1. Pipe shall be designed in accordance with AWWA C150, minimum Thickness Class 52, minimum Pressure Class 350, with polyethylene encasement when buried except Thickness Class 56 for river crossing pipe; manufactured in accordance with AWWA C151; furnish in minimum nominal 18 foot laying lengths, except river crossing pipe to be in full length joints with shorter lengths required to facilitate installation supplied by pipe manufacturer (no field cutting permitted).
2. Fittings: AWWA C110 or C153, with C153 fittings to be polyethylene encased when buried.
3. Exterior Coating: Asphaltic material. Fittings may be coated with a fusion-bonded epoxy coating in accordance with AWWA C116.
4. Interior Lining: AWWA C104 cement mortar with seal coat, or AWWA C116 fusion-bonded epoxy coating.
5. Joints: AWWA C111, rubber gasket, push-on or mechanical type, with restrained type joints and river crossing pipe joints to be provided within the lengths noted on Drawings.
    a. For all bolted joints, bolt length shall be such that all threads of the nut will be engaged.
    b. Restrained push-on joints shall be completely boltless; McWane Super-Lock, American Flex-Ring, U.S. Pipe TR Flex, or as approved. Restrained mechanical joints shall be MEGALUG with Mega-Bond Coating System as manufactured by EBAA Iron, Inc., or as approved, of ductile iron and with a working pressure of at least 250 psi and a minimum safety factor of 2:1.
    c. River crossing pipe joints shall be boltless, self-restraining, push-on type, gasketed ball and socket joints; Clow Ball and Socket Pipe, American Flex-Lok Boltless Ball Joint Pipe, U.S. Pipe USIFLEX, or as approved.

B. PVC/PVCO Pipe and Ductile Iron Fittings

1. Pipe shall be designed in accordance with AWWA C909, Pressure Class 235 for 4 inch through 24 inch diameter; cast iron equivalent O.D.; integral wall-thickened bell end type incorporating elastomeric gasket; furnished in nominal 20 foot laying lengths.
2. Fittings: ANSI/AWWA C153/A.21.53, AWWA C111 rubber gasket joints, with C153 fittings to be polyethylene encased when buried.
3. Joints: Push-on, with joints within the lengths noted on Drawings to be restrained type joints.
    a. Restrained joints shall be MEGALUG or retainers with Mega-Bond Coating System, as manufactured by EBAA Iron, Inc., or as approved, of ductile iron and with a working pressure at least equal to that of the PVC pipe on which to be installed, and a minimum safety factor of 2:1.

2.2 VALVES

A. Materials

1. Valves bodies shall be of either gray or ductile cast iron and shall have the name, monogram, or initials of the manufacturer cast thereon.
2. Valves shall have nonrising stems, open by turning left or counter-clockwise and be provided with either a 2-inch square nut for buried valves or handwheel for exposed valves unless otherwise noted. The direction of opening shall be indicated by an arrow cast on the body and/or the actuator.
3. All body bolts and nuts shall be bronze or stainless steel for buried, submerged or nonprotected applications and cadmium plated for exposed or interior applications that will receive protective finish coatings.

B. Tapping Sleeves
1. Type: Mechanical joint made in two halves for assembly around main.
2. Branch Flange: Accommodate tapping valve.
3. Materials: Cast iron with gaskets extending entire length of sleeve to form water-tight joints.

C. Gate or Tapping Valves
1. AWWA C500, or AWWA C509 cast iron, bronze-mounted. or AWWA C515 ductile iron, bronze-mounted, polyethylene encased when buried installation; designed for 200 psi working water pressure; mechanical joint ends, AWWA C111, except for tapping valves; non-rising stem type with standard AWWA nut; stem seal consisting of at least two Buna-N rubber O-rings; open by turning left (counterclockwise) right (clockwise); bolts, nuts, and washers used by manufacturer to assemble valves to be Type 304 stainless steel.
2. The valve shall have a smooth, unobstructed waterway free from any sedimentation pockets. Valve shall provide a 100% port of nominal pipe size when fully open. Tapping valve port shall be sized to permit a full pipe port tap.
3. Verify direction of valve with OWNER.
4. Body style shall be mechanical joint type for buried service, flange joint type for exposed service and when required, to include special end connections for tapping requirements or otherwise if indicated on the contract drawings.
5. Stuffing boxes shall be O-ring seal type with two (2) rings located in steam above thrust collar.

6. Thrust bearings shall be of the low friction torque reduction type, located both above and below the steam collar.
7. Valves shall be as manufactured by; American-Darling, Clow, M & H, Stockham, U.S. Pipe or an approved equivalent.

D. Protective Coatings
1. All iron parts of valve assemblies shall be painted before leaving the shop.
2. All exterior and internal waterway ferrous surfaces of each valve, except finished or bearing surfaces shall be shop painted with a liquid or powder epoxy coating of approximately 10 mils dry film thickness conforming to AWWA C550.

E. Extension Stems and Stem Guides
1. When required by drawings, schedule or project details, provide an extension stem made of cold-rolled steel material and the same size as the stem of the valve it operates. If the extension is more than 8 ft. long, intermediate stem guides shall be installed and supported from the wall by suitable brackets at a maximum spacing of 8 ft.
2. Brackets and stem guides shall be made of cast iron and fully adjustable. The guide block shall be bronze bushed where it contacts the extension stem. Stem guides shall be as manufactured by the Eddy Valve Co., Rodney Hunt, or equal. Secure stem guides to walls with stainless steel bolts. In the event of off-set of misalignment, provide off-set extension road with universal end fittings at valve actuator and stem drop connection.
3. Extension stem shall have connecting socket for 2-inch square nut and pin socket to lock on valve operating nut.

F. Valve Boxes
1. Valve boxes shall be cast iron, 5-1/4" shaft, three-piece screw type, adjustable boxes. The top section to have a drop lid of which to be marked for service which it is used cast thereon. Cover and boxes shall be round pattern.
2. Provide proper base size and shape to straddle the valve bonnet without touching or being supported by the valve mechanism. Use No. 6 base size for 6-inch and 8-inch gate valves or typical butterfly valve operators, No. 160 oval base size for 12-inch and larger gate valves or other size necessary to suit a particular valve manufacturer's requirements.
3. Extension sections shall be provided where the depth of trench is such that they are needed to bring the top of the box to finished grade. The valve box shall be installed so that it is perfectly vertical and centered on the valve operating nut.

2.3 FIRE HYDRANT ASSEMBLIES

A. Includes fire hydrant, watch valve and valve box, piping, and appurtenances.

B. Fire Hydrant:
1. Manufacturers: Mueller, or as approved.
2. AWWA C502, compression type, 5-1/4-inch valve opening, open by turning left (counterclockwise) right (clockwise); traffic model with frangible barrel section and stem coupling; positive operating drain valve installed in open position; 6 inch

mechanical joint base, designed so water hammer will be prevented when properly operated. If drain valve, install with drain valve plugged.

3. Two 2-1/2-inch hose nozzles, and one 4-inch Storz.
4. Suitable for setting in trenches of depths and in locations shown; CONTRACTOR responsible for determining hydrant depth of bury based on locations shown.
5. Verify that the direction of opening, hydrant pumper nozzle, operating nut, outlet nozzle cap nuts and hose threads conform to those in the system before the new hydrants are shipped.

C. Watch Valves and Valve Boxes: Watch valves and valve boxes shall be gate valves and valve boxes as specified in Articles 2.3 and 2.6, with valves to have ends suitable for receiving the spigot end of 6 inch anchoring pipe.

D. Piping:
1. Ductile Iron Pipe: AWWA C150, AWWA C151; asphaltic material, or AWWA C116 fusion-bonded epoxy exterior coating, AWWA C104 cement mortar with seal coat, or AWWA C116 fusion-bonded epoxy interior lining.
2. AWWA C110 or C153 mainline tees with standard mechanical joint branch for connecting to anchoring pipe and fittings, and mechanical joint anchoring type branch when connecting to a watch valve; coated and lined as specified for pipe. C153 fittings to be polyethylene encased when buried.
3. Anchoring pipe, plain end mechanical joint type incorporating an integral cast shoulder and follower gland.
4. Anchoring Pipe Manufacturers: American Cast Iron Pipe Company, Clow Corporation, United States Pipe and Foundry Company, or as approved.

2.4 POLYETHYLENE ENCASEMENT

A. AWWA C105, 8 mil linear low-density polyethylene tube or 4 mil high density, cross-linked polyethylene tube; 2 inch wide plastic-backed, adhesive tape, bond to both metal surfaces and polyethylene film.

2.5 TRACE WIRE

A. Inert bonded layer plastic with metallized foil core, 6 inches wide, resistant to alkalis, acids and other destructive chemical components encountered in soils; APWA Uniform Color Code, brightly colored; imprinted indicating pipe type; Griffolyn Company Terra Tape "D", Seton Name Plate Corporation, or an approved equivalent.

B. Use with non-metallic water main pipe materials.

2.6 PIPE INSULATION

A. Cellular glass insulation with an aluminum jacket; thickness as required to prevent freezing at 0 degrees F, but in no case less than 1 inch; suitable for burial; Pittsburgh Corning Corporation FOAMGLAS, or as approved.

2.7 JOINT BOLTS AND NUTS

A. Unless otherwise specified or noted, bolts and nuts on buried piping shall be low alloy steel cathodic to pipe with a minimum yield strength of 45,000 psi, and all other bolts and nuts shall be low carbon steel, ASTM A307, Grade B, zinc-plated.

2.8 SPARE PARTS

A. Hydrant Wrenches: Provide 2 spare hydrant wrenches with pentagon hydrant nut operator on handle, constructed of stainless steel, and a minimum length of 36-indhes

B. Valve Keys: Provide 2 spare valve keys with standard AWWA valve nut operator. Valve keys shall be 8 feet long and have a 4 ft long turn handle centered at top.

PART 3 – EXECUTION

3.1 ALIGNMENT AND GRADE

A. Horizontal and Vertical Control
   1. All horizontal and vertical control required for the complete layout and performance of the Work under this contract shall be done by a registered surveyor at the Contractor's expense, and any observations by the Engineer of the Contractor's methods will not relieve the Contractor of his responsibility.
   2. The Contractor shall be solely responsible for the accuracy of all horizontal and vertical control.

B. Alignment and grade shall be established by means of a laser beam.

3.2 PREPARATION

A. String pipe sections along the route of the mains so as to interfere least with pedestrian and vehicular traffic and to protect the pipe.

B. Excavate trench for Work of this Section; follow Section 02225.

C. Location of service connections and insertion valves indicated are approximate. Final locations will be established during construction by OWNER.

D. Do not install service connections until new mains have been successfully tested, disinfected, and placed in service.

E. Prior to ordering tapping sleeve assembly, expose existing main and verify circumference of existing pipe.

F. Prior to ordering insertion valve and sleeve assembly, expose existing main at point of installation and verify circumference, actual caliper diameter and roundness of existing pipe. In addition, identify the exterior condition of the pipe with respect to pitting, scaling, electrolysis, or other defects which would affect manufacturing dimensions or exact location of the insertion.

G. Verify that polyethylene encasement is in place, where required, before placing bedding.

H. For river crossing pipe, inspect trench just prior to laying pipe to ensure that it is in suitable condition.

3.3 BEDDING

A. Place bedding material at trench bottom and shape for accurate placement and proper support of pipe.

B. Place in 6 inch layers, loose measurement, and compact by hand or mechanical tamping to not less than 95 percent of maximum density as determined in accordance with ASTM D698 (Standard Proctor).

C. Carefully place and tamp so as not to damage or displace joints or pipe. Do not drop material directly on pipe.

D. Maintain optimum moisture content of bedding material to attain required compaction density.

E. Construct thrust blocks at fittings, dead ends, and valves as shown. Place against firm, undisturbed soil. Provide straps and anchors as indicated; repair cuts and other damage to galvanized surfaces by applying two coats of cold galvanizing compound. Securely strap or block plugs and caps.

F. Construct concrete encasement as shown.

3.4 PIPE INSTALLATION

A. The Contractor shall furnish all of the proper tools and equipment required for the safe, proper handling and laying of all pipe, fittings, and specials that are to be installed in this work. All storage, handling, laying, and backfill methods shall be performed so as to avoid damaging either the interior or the exterior surfaces of all pipe fittings, specials, joint materials, or other appurtenances, and any such damage shall be remedied at the Contractor's expense.

B. Before any pipe is lowered into the trench, it shall be inspected for damage, and any unsatisfactory lengths shall be rejected. Cast metal pipe and fittings shall be inspected for cracks by ringing with a light hammer while suspended. The interior and exterior of each pipe length used shall be cleaned as necessary to remove all dirt or other foreign material before it is inspected. The interior of the pipe shall be kept clean until the work is accepted.

C. No pipe shall be laid in water, mud or when trench conditions or weather is unsuitable for such work.

D. If mud, surface water, leaves and/or other debris have been permitted to enter the strung-out pipe, the inside shall be cleaned with a strong hypochlorite solution after all such foreign materials are completely cleaned from the pipe and before the pipe is lowered into the trench.

E. Pipe shall not be pushed off the bank nor shall it be permitted to fall into the trench. Each type of pipe, fitting, special or other appurtenances shall be handled in strict accordance with recommendations of its respective manufacturer.

F. No rocks, stones, metal, concrete, bricks, pavement pieces, wood, soil lumps or other hard materials too big to pass through a six (6") inch screen shall be permitted within six (6") inches of the pipe after it is laid in the trench. Any pipe endangered by such debris shall be subject to removal and disposal at the Contractor's expense.

G. When pipe laying is not in progress, the open ends of installed pipe shall be closed by appropriate means to prevent the entrance of dirt and water. In the event ground water, sewage water or other potential contaminants enter any portion of the pipeline, after it is laid, cleaning and preliminary disinfection with a strong hypochlorite solution shall be done.

H. Pipe lengths shall not be deflected at the joint to any greater degree than recommended by the manufacturer of the particular joint being used. Where deflections in excess of such recommendations are necessary, the appropriate specifications for the particular type of pipe being installed shall govern the mode of accomplishing such excessive deflections.

I. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

J. Use suitable fittings, usually 1/8 bends, when abrupt grade changes of the pipe are necessary to avoid existing utilities or other obstructions, so as to secure and easy flow of liquid and to provide sufficient cover below same unless noted otherwise.

K. Install pipe to allow for expansion and contraction without stressing pipe or joints.

L. Deflect pipe joints in strict accordance with the pipe manufacturer’s instructions. For river crossing pipe, in no case shall joint deflection exceed 15 degrees during installation and 12 degrees after installation unless otherwise approved by manufacturer.

M. With push-on joints, wipe surfaces that contact rubber gasket clean and dry just prior to making joint. Use lubricant in accordance with the manufacturer’s instructions when making joint.

N. With mechanical joints, brush surfaces that contact rubber gasket with soapy water to remove all sand and grit just prior to making joint.

O. Make butt fusion joints in accordance with pipe manufacturer’s and fusion machine manufacturer’s instructions. The wall thickness of the adjoining pipes shall have the same DR at the point of fusion.

P. For butt fusion joints, the fusion unit shall include a battery-operated data logger designed for field use and for providing complete fusion data documentation from the beginning to the end of the fusion process, ensuring joint integrity and reliability. Data logger shall:
   1. Record actual joint data, retrieve stored data recorded, print out joint data, and download data stored to a PC.
   2. Display total elapsed time, a resetable stopwatch, actual machine pressure, recommended machine pressure, and actual number of data points being recorded.

3. Provide a summary plot indicating pressure used to seat the heater, if correct shift sequence was used, duration of the melt cycle, magnitude of the fusion pressure, and duration of the cool cycle.
4. Provide a computer download printout giving all the parameters of each joint on one page.

Q. Install trace wire continuous over top of PVC or polyethylene pipe; locate 18 inches below finished grade.

3.5 VALVES

A. Installation
1. Valves shall be carefully handled and placed so as not to permit any damage to the interior coatings, disc or seat. Internal type lifting devices shall not be permitted. Do not use handwheels or stems as lifting of rigging points.
2. All valves shall be carefully installed in their respective positions free from distortion and stress. Connecting joints shall conform to applicable requirements of the specifications.
3. Stem guides shall be accurately aligned.
4. If the valve box is tipped or otherwise not centered on the valve operating nut or not installed at the proper elevation, the Contractor shall, at his own expense, make whatever correction is required to remedy the defect promptly, upon notice to do so by the Engineer.

B. Testing
1. All valves shall be tested in place by the Contractor as far as practicable under conditions for the pipelines, in which they are placed, and defects revealed in valves or connections under test shall be corrected at the expense of the Contractor to the satisfaction of the Engineer.

C. Operation and Maintenance Manuals
1. Prior to or with the delivery of equipment, the manufacturer shall provide copies of an operation and maintenance manual including storage, installation, start-up, operating and maintaining instructions, and a complete parts and recommended spare parts list. The O & M Manuals shall be in compliance with the General Requirements of these specifications.

3.6 SERVICE CONNECTION ASSEMBLIES; BACTERIA SAMPLING AND FLUSHING ASSEMBLIES; BLOW-OFF ASSEMBLIES

A. Install assemblies as shown or noted; comply with component manufacturer's instructions.

B. Set valves plumb and on solid bearing; center and plumb valve box over valve; set box cover flush with finished grade; provide expansion joint material around portion of box in concrete pavement or sidewalks.

C. Place stone fill under blow-off assemblies.

D. Provide drain hole where indicated for blow-off assembly.

E. Remove bacteria sampling and flushing assemblies after notice from OWNER that mains have passed all tests and have been placed in service.

F. For existing service connections to be abandoned on existing water mains to remain in service, dig up (expose) and turn off the existing corporation stop at the connection to the existing main.

3.7 SERVICE CONNECTION PIPE

A. Installation pipe under street and highway pavements by pushing or boring, with no excavation closer than 5 feet to edge of pavement. No joints permitted within these limits.

B. When boring, if opening exceeds by 2 inches the outside diameter of the pipe installed, the opening around the pipe shall be filled with grout.

C. For existing service connections, intercept or extend as shown or noted to connect to new water mains.

3.8 JOINTING

A. The particular method of making up pipe joints shall be governed by the type of pipe material and type of joint in accordance with the drawings and/or specifications.

3.9 CONNECTION TO AND INSERTIONS INTO EXISTING MAINS

A. Existing mains into which valves are to be inserted cannot be shut down or taken out of service. The entire operation of installing the valves shall be accomplished below 100 psig at the point of installation.

B. Connect new mains to existing mains using proper fittings and in a manner acceptable to OWNER and ENGINEER.

C. Expose existing mains at connection points 10 days prior to making connections to determine elevation, verify type of pipe, confirm outside diameter of pipe, and identify type of restraints existing.

D. No cut-ins or connections to existing mains shall be made unless at least 48 hours notice is given to OWNER and ENGINEER.

E. Plan all connecting work to reduce number of shutoffs.

F. Two days prior to shutting valves on existing lines, notify all affected property owners, local official in charge of the water works system, and ENGINEER of such shutoff.

G. Keep shutoff time to a minimum and do at off-peak hours.

H. A representative of OWNER shall operate existing valves. CONTRACTOR shall not operate existing valves.

I. OWNER and ENGINEER assume no responsibility for any delay occasioned by special requirements or conditions which must be met in making connections.

J. Take extreme care in making connections to prevent contamination of existing mains.

K. Before making cut-ins or connections to existing mains, wash all fittings, valves, and pipe with clean water, and then disinfect by washing with a chlorine solution having a residual chlorine strength of not less than 50 ppm.

L. Plugs removed from existing mains that are not damaged may be reused within the Project, and those remaining after completion of construction shall remain the property of OWNER.

M. Connections to AC pipe shall be made with appropriate fittings specifically designed for AC pipe connections, and shall be acceptable to OWNER. All connections to AC pipe shall be via pad adapters. AC pipe must not be cut with a saw. All cuts shall be accomplished by snap cut.

3.10 ANCHORAGE

A. All hydrants, plugs, caps, tees and bends shall be provided with a reaction backing or shall be restrained by attaching suitable metal rods, clamps, anchored fittings or harnessed joints, as shown on the plans or as specified so as to prevent movement.

B. Reaction backing shall be of concrete, with steel reinforcement as required, unless otherwise shown on the drawings. Backing shall be placed between solid ground and the fitting or other part of the pipeline to be anchored; the area of bearing on the pipe and on the ground in each instance shall be that as indicated on the plans. The backing shall be so placed unless otherwise directed, that the pipe and fitting joints will be accessible for repair.

C. Steel tie rods or clamps of adequate strength to prevent movement may be used instead of concrete backing. Steel tie rods or clamps shall be used to connect the hydrant watch valves to the main and to connect the hydrant to the water valves when shown on the drawings. Steel rods or clamps shall be painted with three coats of an approved bituminous paint or coat tar enamel.

3.11 BACKFILLING

A. Backfilling shall be accomplished in a two-step procedure as follows: 1) partial backfill before leakage tests, and 2) completion of backfill after tests. Departure from this procedure due to traffic or other conditions shall be approved by the Engineer.

3.12 MAINTENANCE OF EXISTING DITCHES

A. The Contractor shall use the utmost care in maintaining ditches and other waterways, and, if either bottoms or banks of such ditches are disturbed, they shall be promptly restored and maintained for the life of the guaranty period. Similar care shall be used in preventing damage to existing pavement by caving of trench walls and undermining such pavement. If pavement is damaged, the Contractor shall repair same at his own expense.

3.13 CLEARING SITE AND RESTORING DAMAGED SURFACES

A. Upon completion of the backfill work, the Contractor shall immediately remove and dispose of all surplus materials including dirt and rubbish.

B. Unless otherwise called for on the plans, the Contractor shall replace all pavement, sidewalks, sod, or other surfaces disturbed to a condition equal to that existing before the work was started, furnishing all materials, labor, equipment, etc., at no additional cost to the Owner.

3.14 LEAKAGE TESTS

A. All pipeline construction shall be subjected to hydrostatic leakage testing of each valve section, as it is completed, unless otherwise directed by the Engineer. All pipes, valves, fittings, etc. shall be laid in such a manner as to leave all joints watertight.

B. Each section of pipe being tested shall be filled slowly with water, and, before applying the specified test pressure, all air shall be expelled from the pipe. The method of obtaining and placing test water(s) into the pipeline shall be approved by the Engineer.

C. The test shall be observed by the Engineer or his designate. The Owner will furnish a pressure gauge for measuring the pressure on the water main. The Contractor shall furnish a suitable pump, pipes, bulkheads and all appliances, labor, fuel, and other appurtenances necessary to make these tests.

D. The test pressure shall be maintained for sufficient length of time to allow for a thorough examination of joints and elimination of leakage where necessary. The pipeline shall be made absolutely tight under the test pressure.

E. The Contractor shall drain each section of the waterline piping after it has been tested. If the drains are connected to valve or drain vaults, then, within a reasonable period of time after the test has been completed, the Contractor shall pump all water out of the vaults.

F. In cold weather, immediately after testing a section of the waterline piping, the Contractor shall open all valves, air cocks, by-passes, and drains; shall drain that section of the pipeline, including the bonnets of all valves contained therein, and shall take all other precautions necessary to prevent injury due to freezing to the water main, piping and appurtenances.

G. Every precaution must be taken to remove, valve-off, or otherwise protect delicate control equipment in or attached to pipelines to prevent damage or injury thereto.

H. Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, as required to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled as herein required.

I. In calculating leakage, the Engineer will not make allowance for any leakage at the valves, the removable bulkheads, etc.

J. The evaluation of actual leakage to standard pressure leakage is calculated by the application of the ratio determined from the square root of respective pressures, other factors being equal.

K. The test pressure shall be 250 psi unless otherwise specified elsewhere in these specifications. Testing procedure shall be as specified herein for the particular pipe material contained in the section tested and shall be subject to modification as required

by a particular pipeline material specification or part thereof, as contained elsewhere in these specifications.

L. For cast iron pipe (CIP) or ductile iron pipe (DIP), AWWA C600 shall govern the test, except that the allowable leakage rate shall be 12 gpd per mile of pipe per inch of diameter.

M. All defective materials and construction found in the pipeline as a result of leakage tests shall be corrected by removal of the defective materials and reconstruction with sound materials and construction. The entire section shall then be retested in accordance with the foregoing.

N. Any testing performed without the knowledge of the Engineer shall not be considered a test for the purpose of this specification.

O. The lack of hydrants, branch shutoff valves, or any other attachments to the line being tested shall not preclude the testing of each valved section as it is completed. In the event that hydrants, branch shutoff valves or any other attached appurtenances are not available for installation prior to testing of each valved section, then plugs or other approved means of containing line pressure must be utilized so as to test each valved section of main line as it is completed. A retest of each valved section will then be necessary after all appurtenances are installed. There will be no additional payment for any such retests.

P. The Contractor shall provide all pressure test equipment. The Owner shall provide all test water required and shall provide test gauges.

3.15 DISINFECTION

A. Prior to disinfection, all pipeline construction shall be flushed to remove any foreign material. Flushing shall be performed after completion and approval of the leakage tests. The minimum requirements for flushing are as follows:

Pipe Size	Minimum GPM Required
6"	220
8"	390
10"	610
12"	880
14"	1,200
16"	1,565
18"	1,980
20"	2,450
24"	3,500

B. Flushing at these rates shall be continued for at least five (5) minutes. In the event the foregoing requirements cannot be met due to the Owner's facilities being inadequate, alternate rate(s) and duration(s) of flushing shall be used.

C. Disinfecting water mains shall be in accordance with AWWA C651 and as specified herein.

D. The following disinfectants may be used: Chlorine or chlorine water; calcium hypochlorite; sodium hypochlorite solution, or chlorinated lime-water mixture. Chlorine shall be applied at one extremity of a pipe section via a corporation stop (installed in the top of the pipe by the Contractor) and bled at the opposite extremity of a properly segregated section. Precautions shall be taken to prevent dosed water from flowing into the potable water supply. All high points on the section treated shall be properly vented for air escape.

E. The rate of applying the disinfectant shall provide at least 25 ppm (mg per liter) chlorine dose at the outlet end of the line section being treated. The disinfecting period shall be twenty-four (24) hours, and, at the end of this period, a chlorine residual of at least 10 mg per liter shall exist at the outlet end of the line.

In the event of unfavorable or unsanitary conditions of installation, poor packing, or high pH, the period of disinfection may be extended. For shorter periods of disinfection, higher dosages shall be required.

F. Sterilizing water shall be disposed of in a satisfactory manner by the Contractor. If the foregoing disinfection procedure fails to provide thorough disinfection of the line, it shall be repeated as necessary in the pipeline for a period of 20 - 30 days after it is placed into operation.

G. Tests for efficacy of sterilization shall be made by the Owner, and repeated sterilization shall be carried out by the Contractor when required.

H. Contractor shall provide all disinfectants and disinfection equipment. Owner shall provide all test waters needed

END OF SECTION 311113

SECTION 331443 – PACKAGED WATER BOOSTER STATION

PART1 - GENERAL

1.1 SCOPE OF WORK

A. The booster pumping station manufacturer shall design, furnish, and deliver the specified factory-built station, with all the necessary piping, controls, foundation, sitework, and appurtenances as shown on the plans and as specified herein. The completed station shall be one (1) piece when delivered and require only off loading, installation on the foundation, pipeline and drain line hook up, and electrical service hook up, telemetry supply and install, to complete installation. The booster pumping station shall be complete when delivered and will not require internal construction.

B. The manufacturer of the factory-built booster pumping station shall have the complete design, manufacturing, delivery and installation responsibility for the aforementioned equipment. The booster pumping station manufacturer shall be responsible for all sections of this specification. All work shall be completely coordinated with that of all other trades as directed by the Engineer or Owner.

C. Approval to bid does not exempt the booster pumping station manufacturer from meeting all requirements of the Contract Documents nor does it give any prior acceptance of any equipment, software or services. Nor does it exempt the booster station manufacturer from providing the required contract design with bid submittals described hereinafter. The Contract Documents are the final authority for acceptance of the work provided.

1.2 BASIS OF DESIGN

A. Being sole sourced does not exempt the booster pumping system manufacturer from meeting all requirements of the Contract Documents nor does it give any prior acceptance of any equipment, software or services. Nor does it exempt the booster system manufacturer from providing the required contract design with bid submittals described hereinafter. The Contract Documents are the final authority for acceptance of the work provided.

B. Alternate equipment manufacturers are eligible to offer equipment proposals for this work provided "NO EXCEPTIONS OR DEVIATIONS" are taken to the plan design and product specifications. Contractors may voluntarily list adds or deducts for pre-approved alternate manufacturers in the separate space for alternate manufacturers provided on the bid form.

C. The submission of a proposal by a booster system manufacturer will constitute an incontrovertible representation by the booster system manufacturer that without exception the proposal is premised upon all work as required by this specification and will be completed fully as specified.

1.3 CONSIDERATION OF BIDS AND BIDDERS

A. These specifications, drawings and related contract provisions are intended to establish a minimum acceptable level of quality, experience, serviceability and performance. The plans and specifications allow for the providing and assembling of materials, components, controls, software, and communication protocols that are readily available and non-proprietary in distribution; likewise, these specifications and plans allow for complete shop assembling, manufacturing, and site construction of the specified equipment using process techniques expected to be within the capability of any manufacturer regularly designing and manufacturing packaged pumping equipment to serve the municipal potable water distribution market. The Engineer and Owner's decision shall be considered the sole judge of the merits of the bidders to bid.

B. Award of the contract for this work will not be based solely on price. Each booster pumping station manufacturer will be required to provide a complete design as detailed in the submittal with bid requirements, see the related section "DESIGN WITH BID SUBMITTAL". All booster station manufacturers must submit a complete design with construction ready plans and equipment submittals to the Engineer with their proposal. Any equipment proposal without the complete design with bid submittal as specified herein will be rejected as non-responsive.

C. The design with bid submittal will be carefully evaluated by the Engineer and Owner to ensure the manufacturer's proposal conforms to the contract specifications and plans. Overall Booster Pump Station design, price, qualification of the bidder, qualification(s) of subcontractor(s), and the demonstrated intent by the booster station manufacturer to adhere to all aspects of this design with bid plans and specifications will all be factors in determining the award.

D. Liability for the design and performance of the booster pumping station and controls as specified herein will remain with the booster station manufacturer. It is the responsibility of the booster station manufacturer to fully understand the application as specified herein, and to design and manufacture the booster pumping station and controls to an acceptable quality standard, to perform as required by the Engineer and Owner.

E. Note: The booster pumping station and controls must be designed for flow and pressure synchronization and surge compensation and prevention. The booster station manufacturer is responsible for designing the software, controls, and SCADA such that flow and pressure are synchronized and pipeline surges are dampened and eliminated by the booster station controls such that surge stresses to the pipeline are prevented. The surge control system utilized shall include provision for surge control for pump starts, pump stops, and instantaneous loss of power, including provision to control both the positive and negative aspects of the pipeline surge wave produced by these events.

F. The booster pumping station manufacturer is responsible for reconnoitering the site so as to be aware of, and plan, for any unusual conditions that could influence the design and construction of the station and controls. Failure to understand conditions of the site limitations, and site access will not alleviate the booster station manufacturer from the responsibility to design, deliver and construct as specified, the equipment as detailed herein.

1.4 COMPONENT SELECTION

A. Where within this specification certain components are identified by manufacturer's name, or the product name and model number, and NOT followed by "or pre-approved equal" there will be no substitutions allowed for these named components. These are components of known quality level and serviceability and their use is to the benefit of the Owner.

1.5 PROVISION FOR ALTERNATE COMPONENT MANUFACTURERS

A. Where in these specifications component manufacturers, software, or communication protocols are named, followed by "or pre-approved equal," those manufacturer's materials, components, software, and communication protocols are readily available, non-proprietary in distribution, of known quality and performance and establish the minimum acceptable level of quality for this project.

B. Provision is made herein for pre-approval by the Engineer of alternate manufacturers for the components, software, or communication protocols named herein which are followed by "or pre-approved equal." The booster station manufacturers must submit to the Engineer a list of alternate components for consideration with cut sheets fifteen (15) days prior to the date equipment proposals are due. No alternate component manufacturer or software, proprietary in distribution, or communication protocol, or lower in quality will be considered.

C. All booster station manufacturers must recognize that, if an alternate component manufacturer is submitted, ultimately pre-approved by the Engineer, then is later found not to meet or exceed the physical and dimensional standards nor perform as specified in the judgment of the Engineer or Owner, the booster pumping station manufacturer shall be required to promptly replace the alternate component with the component named in this specification at no additional cost to the Owner. Full design, manufacturing, and application product liability for the use of any alternate component manufacturer or software remains with the booster station manufacturer.

D. The Engineer will notify all booster station manufacturers seven (7) days prior to the date equipment proposals are due of any pre-approved alternate components.

1.6 DESIGN WITH BID SUBMITTAL

A. To assure that the Owner is well served; ALL booster pumping system manufacturers must submit a complete project specific design, with the equipment submittals at the same time as the Contractor bids are due. Because the manufactures are submitting their own design for the booster pumping system for evaluation as part of the proposal consideration, no proposal will be accepted for consideration from a manufacturer who fails to fully comply with the submittal with bid requirements as outlined below.

B. The submittals shall be bound in an electronic pdf format, and contains at a minimum the following:

1. **Mechanical Drawings**: Fully to scale, 24" x 36" size plan sheets, showing all mechanical equipment and devices, and electrical panels and locations in a minimum of three views, showing plan, length, and width. These drawings shall be fully denoted as

to sizing and dimensions, and include pump performance data, and illustrate working and electrical clearances per section 110-26 of the National Electric Code.

2. **Structural Drawings**: Fully to scale, 24" x 36" size plan sheets fully dimensioned, denoted and project specific showing plan, length, and width views of all piping bracing, piping and pump supports, and joint restraining devices, as to exact location, size of support, and restraint members, and methods of attaching or affixing and (2) showing the base skid plan, structural reinforcing members including exact size, location, and method of attaching, (3) and the anchoring system. The structural drawing is to include the structural steel sizes or shapes to be utilized with weights and the total weight of all structural steel, piping, and components equaling the total weight of the proposed booster pumping system.

3. **Foundation Drawings**: Fully to scale, 24” x 36”, size plan showing the concrete foundation/pad required and reinforcing bar plan for the booster station, including anchoring detail required to counter the thrust of water hammer. A frost wall/footer shall be provided as required by the local building code. A minimum of 2000 pounds per square foot shall be assumed for soil loading in designing the booster station foundation. If the design calculations so indicate, a spread footer shall be utilized.

4. **Electrical Power And Instrumentation Schematics**: 24" x 36", size plan sheets showing the full electrical schematic for all power, control, instrumentation, telemetry and SCADA devices and circuitry wiring fully denoted as circuit protection devices, wiring, all conduit sizes, wire sizes and ampere loading for all main and branch circuits, including all 120/240/480, single and three phase devices. Additionally provide an Input/Output listing for all PLC/RTU and SCADA/Telemetry interfacing. Schematics shall clearly denote any field wiring, verses factory wiring. Separate notation of any field wiring to be installed by other than the booster pumping system manufacturer for this division, shall be included. The instrumentation and control panels, layout drawings must be included. The panel drawings supplied shall include dimensions for each panel, console, mounting plans, etc., the internal arrangement of components, the external arrangement of components on the outer door or the inner door with nameplate designations. Signal wiring shall include shielding, jacketing, and grounding requirements. There shall be listed any and all requirements for liquid sample lines, liquid waste lines, special valving, regulators and flow control devices on the liquid lines.

5. **Generator Load Schedule**: Provide a load schedule demonstrating with three pumps operating and with the booster station loads included the generator is not overloaded.

6. **Process and Instrumentation Drawing, (P&ID):** 24" X 36" size plan sheets showing all signal and control devices in the accepted ISA diagrammatic convention.

7. **Equipment Component and Software Listing**: Provide a complete listing by manufacturer and full model number of all mechanical, electrical, telemetry, HVAC, components to be used. Provide a list of all software to be used with site specific licenses. The component and software list is to be grouped separately and be site specific, and provide fully descriptive catalog sheets for each of the listed components,

devices, and software with site licenses, including pump material data, performance curves, horsepower requirements at design, and selected motor horsepower.

8. **Corrosion Protection**; Clear drawings, notes and details showing surface preparation prior to welding, after welding, and prior to coating, priming and coating applications denoting treatment, coating application and method of testing the integrity of the application and full details of the required anodic/ cathodic protection system, all of these shown to meet or exceed the requirements of the specifications to be signed by an officer of the company and so notarized on the enclosed form.

9. **Warranty Statement**: A clear statement of the warranty to be provided as specified herein under "Warranty" to cover the booster pumping system, and all devices and assemblies therein, all controls, telemetry, SCADA and software, so as to stipulate the booster pumping system manufacturer as the only provider of the stipulated and specified warranty to cover all labor and material costs over the two year warranty life, said warranty statement to be signed by an officer of the company and so notarized on the enclosed form.

10. **Factory Startup and Service Statement**: A clear statement of the startup and service to be provided as specified herein under "Factory Startup Service" to cover the booster pumping system, and all devices and assemblies therein, all controls, telemetry, and software, so as to stipulate the booster pumping system manufacturer as the only provider of the stipulated startup and service to include all labor is to be by direct factory employees only, said startup and service statement to be signed by an officer of the company and so notarized on the enclosed form.

11. **Certified Welding and Steel Statement**: A clear statement that all structural and pipe welds shall be performed by certified welders only as specified herein, including copies of the current welding certificates of the booster pumping system employees who are to perform the booster pumping system welds. This statement is to include confirmation that new domestic steel only shall be used in fabrication of the booster pumping system, said statement to be signed by an officer of the company and so notarized on the enclosed form.

12. **Standards and Agency Testing**: List the standards and agency listing governing the fabrication, construction, assembly, wiring, and mounting of the components, assemblies and furnished booster pumping system as stipulated herein, including a full size photocopy of the manufacturer's combination UL/manufacturer logo Packaged Pumping Systems label which must include the entire booster pumping system with the enclosure as specified herein. This listing is to be signed by an officer of the company and so notarized on the enclosed form.

13. **Verification of Conformance to Specification:** A copy of the entire specification section for the booster pumping system with addenda and all referenced specification sections with addenda, with each paragraph initialed by an officer of the booster pumping system manufacturer to indicate bid specification compliance as required. Failure to include a copy of the marked-up specification sections with the bid form will result in rejection of the entire submittal with no further review or consideration. This

copy of the entire booster pump station specification is to be signed by an officer of the company, and so notarized.

C. It is the intent of this specification the booster system manufacturer's submittal with the bid constitutes a complete construction ready design of construction ready plans and submittals. The Engineer will return, approval as noted, with the notice to proceed.

D. Items (1) through (3) above sealed by an Ohio registered professional engineer who can attest the design work revealed in the submittal with bid was performed by that engineer or by persons under their specific direction, and certified pump performance curves shall be supplied after receipt of approved submittals and subsequent purchase order.

E. Note: Failure to meet all of the above criteria will deem the submittal with bid information as "non-responsive." Being sole sourced does not exempt the booster pumping system manufacturer from meeting all requirements of the Contract Documents nor does it give any prior acceptance of any equipment, software, or services. The Contract Documents are the final authority for acceptance of the work provided.

PART 2 - PROJECT COORDINATION

2.1 COORDINATION WITH THE OWNER

A. The Engineer and Owner reserve the right to dictate the sequence and order of manufacture, delivery, and construction of the booster pumping system. Based on weather conditions and other factors that might legitimately affect the installation scheduling, the manufacturer may be required to hold the station deliveries up to 90 days; but in doing so, the equipment manufacturer may submit a pay request for the cost of the stored materials along with any insurance or other documentation requested by the Engineer and Owner.

2.2 INTEGRATION OF CONTROLS

A. The single source pumping system manufacturer shall be the System Integrator and will have complete responsibility and Related Control Functions. Specifically, this shall include identifying all electrical, mechanical, and plumbing schematics and wiring interconnect diagrams, providing instrument installation details, preparing input/output listing, writing software, performing software and hardware integration, debugging, calibrating and tuning the various components and subsystems and providing training and warranty services.

B. Design, manufacture, and integration of the controls shall be an essential part of the requirements of the specified single source booster system manufacturer. One or several coordination meetings may be required to make sure the integration is seamless. Failure to consider and account for this expected need for coordination, as a cost factor will not be accepted as a reason for a request for extra monies or a failure to complete this project as required.

2.3 COORDINATION OF START-UP AND TRAINING SERVICES

A. The coordination of equipment start-up, operator training and follow-up operational check out visits will be dictated by the Engineer and Owner. Proper notice for the start-up and

initiation activities will be provided by the Engineer and Owner so all parties have the proper personnel and equipment in place for a coordinated start-up of each piece of equipment.

B. As is stated in the "Factory Start-up" section of this specification, start-up of the manufacturer's equipment shall be done only by factory personnel, who are direct employees of the manufacturer of record and who can demonstrate good and proper training and experience; an affidavit to this effect is required, see "Pre-Bid Design Submittal" section.

C. **Third party** contractors or the personnel of a representative of the manufacturer will not be acceptable for doing the tasks involved in starting up and servicing the manufacturer's equipment. The failure of competent factory start-up and service personnel completing the required tasks on a timely basis gives rise to intolerable disputes and differences that are not in the Owner's best interest.

2.4 PROJECT MANAGER

A. To ensure requirements of the project coordination are met, the booster pumping system manufacturer shall stipulate one individual within the company who has an acceptable level of training and experience as determined by the Engineer and Owner to be the project manager for this work over the full term of the contract. The project manager is required to attend all construction or progress meetings at the Engineer and Owners direction.

2.5 FACTORY INSPECTION & ACCEPTANCE TEST

A. At the option of the Engineer and Owner, its representative shall visit the station manufacturer's factory site to inspect the finished booster pumping system and controls for conformance to all aspects of the specification. The station manufacturer shall be required to assemble or disassemble certain portions of the finished station to reveal conformance. The station manufacturer shall advise the Engineer and Owner a minimum of two (2) weeks prior to factory completion of the station so the inspection trip can be scheduled. Shipment of the station may not be allowed until the inspection is completed and the equipment is accepted for shipment. Any inspection by the Engineer or Owner or its representative does not relieve the booster pumping system manufacturer of full responsibility for the design, manufacture, and construction of the booster pumping system as detailed herein.

B. The booster pumping system manufacturer shall completely demonstrate to the Owner and, if the Owner desires, the Owner's Engineer the operation of the equipment and logic built for this project. This demonstration shall be performed at the booster pumping system manufacturer's facility at which the system was engineered, assembled and programmed. The Factory Acceptance Test shall consist of the following:

1. Use of panels and instrumentation for this project. Off- the-shelf or stock item substitutions are not allowed.

2. System communications installed in the panels. Hardwired communications around the system's communication equipment will not be allowed.

3. System logic shall be tested in a methodical step by step manner. The system's Operation Description in this specification will serve as the basis for the system logic demonstration.

C. The system manufacturer shall provide for transportation, lodging and meals for the Owner and the Owner's chosen attendee. The Factory Acceptance Test shall be at least one 8-hour day in length.

2.6 SHIPMENT AND DELIVERY

A. The booster pumping system manufacturer will be required to deliver the booster pumping system completed and undamaged by the manufacturer's carrier to the site fully assembled and ready for the power, telemetry and inlet, outlet, and drain piping connections to be completed on site.

2.7 QUALITY ASSURANCE

A. The equipment and materials covered by these specifications are intended to be standard equipment of proven reliability and as manufactured by reputable manufacturers having experience in the designing, manufacturing, and construction of such equipment. The equipment furnished shall be designed, manufactured, installed and constructed in accordance with the best practices and methods and shall operate to the Engineer and Owner’s satisfaction.

B. It is intended that the manufacturer of the selected equipment shall be a business regularly engaged in the manufacture, assembly, construction, start-up and maintenance of water distribution equipment and controls of the type required for this project. The manufacturer shall have **at least ten (10) years** of successful experience in providing booster pumping system, software, and controls of the type, design, function and quality as required for this project to the municipal potable water market.

2.8 THIRD PARTY INSPECTION LISTING (STATIONS 600V MAX.)

A. The station manufacturer shall be required to affix to the station an UNDERWRITERS LABORATORIES (UL) LABEL attesting to the compliance of the station equipment under the PACKAGED PUMPING SYSTEMS (QCZJ) UL Listing Category and/or INTERTEK TESTING SERVICES (ETL) LABEL attesting to the compliance of the station equipment under PACKAGED PUMPING SYSTEMS. The ETL label shall state the station conforms to UL STD 778 and is certified to CAN/CSA STD C22.2 NO. 108. **Equipment manufactured without this third party certification or equipment manufactured by an outside source or "brokered equipment" defined as systems not assembled on the premises of the named manufacturer by that company's employees WILL NOT be allowed.**

2.9 FACTORY START-UP SERVICE

A. Start-up and warranty service shall be performed by the booster pumping system manufacturer. No representative, contract service organization or third party of any sort shall be directed to perform such services by the booster pumping system manufacturer; any attempt to do so will mean forfeiture of the performance and/or warranty bonds.

1. Start-up and warranty service technicians shall be regular factory direct employees of the booster pumping system manufacturer.

2. As part of submittal covering this equipment, list factory service manager, his telephone number with extension and his number of years with the company. List also each start-up service technician, and years of service with the company.

3. Verify that one (1) or more of the service technicians listed above will perform the required start-up and warranty service on the equipment covered in the submittal.

4. A total of two (2) days for startup and training on site is required.

5. Start-up service to include two (2) bound O&M manuals for the booster pumping system and one (1) electronic OEM in pdf format.

6. Start-up service report attested to by start-up technician and representative of Owner or Engineer.

7. Service report distributed to:

   a. Manufacturer's File

   b. Engineer's File

   c. Contractor's File

   d. Owner's File

2.10 TRAINING AND FOLLOW-UP

A. The program for employee training shall educate all employees who will be required to operate and maintain the system. The objective of the training will be to provide a common working knowledge concerning all significant aspects of the system being supplied.

B. The training program shall consist of one (1) day working with the full set of employees and work shifts. The training course outline shall be submitted to the Engineer at least two weeks prior to the requested start of the training program.

C. The supplier shall provide all materials, equipment, and manuals to conduct the training program.

2.11 OPERATION AND MAINTENANCE MANUALS

A. The booster pumping system manufacturer and controls integrator shall provide two (2) electronic O & M's in pdf format containing as built final system drawings, I/O listings, wiring diagrams, and operating and maintenance information. The submitted manuals shall be sufficient to facilitate the operation, removal, installation, programming, and configuration, adjustment, calibration, testing and maintenance of each and all components and instruments. Final software listings of the operational ladder logic shall be provided herewith.

2.12 WARRANTY

A. The warranty is the sole responsibility of the booster pumping system manufacturer and that warranty shall be provided in written form for inclusion with both the pre-bid design

submittal covering the specified equipment and the O&M manuals provided with that equipment.

B. The warranty shall at a minimum cover:

1. A period of two (2) years commencing upon **station startup**.

2. The **two (2) year period** shall be inviolate regardless of any component manufacturer's warranty for equipment and components within the station.

3. The warranty shall cover **all** equipment, components, controls, software, or installation services, provided under this contract by the booster pumping system manufacturer exclusive of those components indicated below or supplied by, and/or installed, by others independent of the control of the booster pumping system manufacturer of record for this booster pumping system and controls. Unauthorized startup, alteration, misuse, or items requiring replacement due to normal wear, such as pump seals, light bulbs, etc., are excluded.

4. The warranty shall provide for the booster pumping system manufacturer to bear the full cost of labor and materials for replacement and/or repair of faulty or defective components, controls, or software, on site as required so there shall be **no cost** incurred by the owner for this work during the warranty period.

5. No assumption of contingent liabilities for any component failure during warranty is made.

C. It is the intent of this warranty specification section to hold for the Owner, the booster pumping system manufacturer as the single party responsible warranting all components on site including all aspects of performance specified herein. "Second party" or "pass through" warranties will not be accepted. **If the written warranty provided in the "PREBID DESIGN SUBMITTAL" does not meet the minimum requirements set forth above, that bid shall forthrightly be rejected as non-responsive.**

2.13 EMERGENCY WARRANTY SUPPORT SERVICE

A. In addition to the onsite services outlined above during the warranty period, the booster pumping system and controls manufacturer shall provide emergency support service via phone support and remote diagnostics services.

2.14 FINAL WARRANTY INSPECTION

A. Prior to the end of the warranty period the Engineer and Owner shall conduct an inspection and review of the booster pumping system with the manufacturer of the booster pumping system. A punch list shall be provided by the Engineer and Owner indicating any deficiencies which must be corrected prior to release of the warranty bond.

2.15 DEFINITION OF ACCEPTANCE

A. Station system acceptance shall be defined as that point in time when the following

requirements have been fulfilled:

1. All O&M documentation has been submitted, reviewed, and approved by the Engineer and Owner.

2. The startup of the station system and controls and successfully completed all testing and operational requirements specified.

3. All training as specified has been completed.

4. A full warranty statement as specified herein with the warranty commencement date (date of acceptance by the Owner) spelled out shall be presented to the Owner. The warranty statement shall clearly identify the station manufacturer as responsible for warranty service.

2.16 MANUFACTURERS GENERAL / PRODUCT LIABILITY INSURANCE

A. In addition to the construction insurance requirements in the general conditions, the booster pump station manufacturer shall furnish premises/ operations and products/completed operations general liability insurance from an insurance company with a rating of A-V according to the most recent Best's Key Rating Guide, in an amount equal to $10,000,000 per occurrence. The insurance certificate must be included with the manufacturer's design submittal. The coverage must be provided by an insurance carrier licensed and admitted in the state of manufacture.

2.17 CERTIFIED WELDING AND STEEL

A. All building skid, structural, transmission piping, pipe and equipment supports, and restraint, welding; shall only be performed by certified welders. As part of the equipment submittal, the booster pumping system manufacturer shall provide copies of the current welding certificates of the employees who are to perform the building skid, structural, transmission piping, equipment supports, and restraint welds.

B. All transmission piping or pressure vessel welding must be performed by individuals certified to weld carbon steel pipe under ASME CODE SECTION IX.All other welding must be performed by individuals certified under ASME CODE SECTION IX or by the American Welding Society (AWS) Structural Welding Code, Section 9.10.

C. Prior to welding all structural supports, transmission piping, pipe and equipment supports, and restraints, shall be grit blasted to **near white blast cleaning (SSPC-SP10).**

D. All steel used for fabrication of the booster pumping system shall be manufactured in the United States. This includes, but is not limited to, all steel used in fabricating the building skids, all structural steel, all supports and bracing, and all transmission piping, flanges, and fittings. The booster pumping system manufacturer shall provide a statement that the booster pumping system is to be fabricated from United States steel content only, said statement to be attached to the design submittal.

2.18 PROGRESSIVE PAYMENTS

A. The contractor may carry with their pay requests a request for progressive payments on the part of the equipment manufacturer for the equipment covered in this section. The Manufacturer shall submit a proper and timely pay request to the Contractor. The pay request shall cover a detailed listing of stored materials and sub-assemblies and work-in-process.

B. No more than an aggregate ninety percent (90%) of the contractor purchase value shall be approved for payment prior to the delivery of the equipment.

C. The Manufacturer's pay request to the Contractor shall include electronic or printed photographs of work-in-process with a proper description of the item and its use in the equipment.

D. The manufacturer's pay request shall include an affidavit signed by an officer of the manufacturing company and notarized, attesting in detail to the on-site presence of the materials and the condition of the work-in-process.

PART 3 - PRODUCTS AND COMPONENTS - ON-GRADE EQUIPMENT BUILDING

3.1 BUILDING DESIGN CRITERIA

A. The station building enclosure shall be a factory assembled, modular structure of one (1) compartment attached to the station base structure and requiring no additional assembly at the job site.

B. The building design criteria shall be: (1.) To withstand snow load based on ASCE 7-10 Ground Snow Loads for the state and county of installation (2.) To withstand wind loads based on ASCE 7-10 for wind speeds; (3.) Be designed for site specific seismic requirements based on local conditions as dictated by the Available Ground Motion Parameters according to ASCE 7 and IBC established by zip code and a live floor load of 125 PSF; (4) Be designed to IECC 2015 version of the energy code, or current version.

C. The modular building enclosing each of the stations is shown at its minimum size so that National Standards mandated clearances are maintained above, below and around equipment for proper and safe servicing, removal and reinstallation of this equipment.

D. The building specified shall be of the size shown on the drawings. Building sizes less than those shown will not be allowed.

3.2 STATE OF OHIO - INDUSTRIALIZED UNIT AUTHORIZATION

A. The pump station manufacturer shall be an authorized manufacturer of Industrialized Units for the State of Ohio as defined by the Ohio Revised Code, Chapter 3781 and 3791 and the Ohio Administrative Code 4101:1-1-17. The pump station shall bear the required insignia

from the Ohio Board of Building Standards, as required by the Code, which shall be located on the face of the electrical service entrance panel. One (1) set of approved construction documents with the Board of Building Standards' approved stamp along with a copy of the manufacturer's Industrialized Unit Authorization letter shall be sent with the submittal booklets to the contractor for use in obtaining the required building permits.

3.3 BUILDING CONSTRUCTION

A. The materials specified are specifically chosen to be resistant to moisture degradation and infestation and to be maintainable.

B. Insulation values for the walls and roof structure shall be a minimum R-21 in the walls and the roof. Insulation within the roof and wall panels shall be foam-in-place polyurethane material applied between the interior and exterior sheathing forming a closed cell bounded by the steel framing. The insulation shall have a minimum density of 2.0 lbs/cu. ft. nominal and shall be applied to the thickness required to provide a minimum R value of 21. The insulation shall have an ASTM E-84 flame spread Class 1 < 25 and smoke development Class 1 < 450.

C. Building framing materials shall comply with the A.I.S.I. Specification for the Design of Cold-formed Steel Structural Members and to Standards ASTM C-955, ASTM C-1007, ASTM C-645, ASTM C-754 and ICBO 4782P. and 4784P. A framing design incorporating the members covered by the listed specifications and standards shall develop a structure meeting or exceeding the building design criteria listed previously.

D. Metal-clad, foam insulated panels or SIPS will not be allowed.

E. The building structure shall be fabricated using steel C-studs as wall framing members and C-joists for roof support. The size, placement and spacing of studs and joists shall be in accordance with the design criteria and material standards. The wall C-studs shall be a minimum 2" x 3 5/8" size of 16 gauge material minimum. The roof C-joists shall be a minimum 1-5/8" x 8" size of 16 gauge material minimum.

F. The exterior wall sheathing shall be 1" thick, 15 psi polystyrene foam board insulation with an R-5 insulative value.

G. The exterior roof sheathing shall be 5/8" thick, exterior, CDX grade plywood.

H. The interior wall and ceiling sheathing shall be 3/4" thick, exterior, CDX grade plywood.

I. All interior wall & ceiling surfaces shall be covered with .090" thick FRP (fiberglass reinforced plastic) sheeting of pebble grain, gloss, white finish. The individual wall faces shall be covered with one continuous sheet. The FRP sheets shall be glued to the sheathing requiring no fasteners. Corner moldings of like FRP material shall be installed & finished in a workmanlike manner.

J. Openings in the sidewalls and/or roof shall be as shown and be fully framed out and

supported using single or multiple framing members sufficient to support and fasten those devices or equipment items requiring a framed opening, these being access hatches, HVAC equipment, pipe passages, conduit passages, door and window openings and other special purpose openings as might be shown and required. The attaching of devices or equipment to the building at a framed opening shall be done fully according to the device manufacturers mounting instructions.

K. The building shall be warranted by the station manufacturer for a period of ten (10) years from the date of delivery.

3.4 HEAVY DUTY STEEL DOORS

A. Doors, single and double leaf and of the size shown, are manufactured of 18-gauge galvanealed steel. All doors shall be full flush construction and 1-3/4 inches thick. Doors shall be reinforced, stiffened, insulated, and sound deadened with a solid polystyrene foam board permanently bonded to the inside of each face skin. The lock and hinge edge of each door shall be welded with a center hairline seam the full height of the door. The lock edge shall be reinforced full height by a 14-gauge continuous one-piece channel extruded templating. The hinge edge shall be reinforced full height by a 14-gauge continuous one-piece channel, formed and tapped for hinges. Top and bottom of the door shall be closed with 16-gauge channels. Doors shall be thoroughly cleaned and receive an iron phosphate treatment prior to receiving one coat of prime paint. Door closures and rim panics are reinforced with 14-gauge channels.

B. Doors shall be fully-mounted in frames produced for pre-hanging of commercial 1-3/4" doors. Frames are formed to 16-gauge commercial quality cold rolled steel conforming to ASTM A366 or A620 and A568. Frames are produced in two welded units, to be mechanically joined during installation. The base side is prepared for all required hardware. Both units, base and trim, are furnished with welded mitered faces. Frame anchoring includes compression anchors and stud screws. Door hinges shall be continuous gear hinges, fabricated of extruded 6063-T6 aluminum alloy/temper with pinless assembly. The doors shall have a lockset, exterior handle, and top mounted-door closer with hold-open device.

C. Doors and frames shall be finished with a two-component, aliphatic/acrylic polyurethane coating, white in color, with a high gloss finish. The coating shall be resistant to a wide range of solvents and chemicals under splash and spill conditions. The coating system is V.O.C. compliant.

D. Door sizes and locations are as shown on the drawings.

3.5 MOUNTING AND FASTENING

A. The building shall be fabricated up from and securely attached to a framework fabricated of 2" x 6" steel tubing welded at each corner to form a base frame serving as a stable base for handling and transporting the building prior to attaching the building to the station base skid. To hold the building framing to the 2" x 6" base frame, 5/8" anchor studs will be welded to the base frame. In assembling the building framing to the base frame a 3 1/4" x 4" x 1/4"

thick anchor plate under a flat washer, lock washer and 5/8" nut shall be used to fasten the building framing to the framing base as shown. The base frame shall be grit blasted to a SP-6 finish and coated with the specified coating material.

B. The building enclosure shall be firmly and securely attached to the steel base structure by lag bolting from inside the station, through evenly spaced 9/32" holes pre-drilled into a 2" by 1-1/2" by 1/8" thick angle piece that has been continuously welded to the steel floor. The lag bolts shall screw into the 2" x 6" tubular base frame upon which the building has been built.

C. The lag bolts shall be plated steel, size 5/16" diameter x 2" long. The number and location of the lag bolts shall be as determined by structural analysis so as to maintain the live load and wind load ratings as specified and to resist shearing and tearing in the process of transporting and placing the finished station.

3.6 EXTERIOR FINISHES

A. EXTERIOR HOUSEWRAP

1. The station manufacturer shall apply a layer of housewrap to the exterior of the building. The housewrap shall reduce air infiltration and moisture penetration and damage.

2. The housewrap shall be stapled to the exterior sheathing.

B. FAUX BRICK PANELS

1. The station manufacturer shall apply at the factory and prior to shipment fabricated veneer panels with an exterior face in a running bond pattern of kiln-fired clay brick finish applied with polymer epoxy resin on mineral fiber reinforced cement board.

2. Kiln-fired clay brick finish shall be manufactured with sanded epoxy giving deep rake joints between bricks. Epoxy color to be similar to face brick color unless otherwise specified. All material shall be obtained from one source to match color as nearly as possible.

3. Epoxy resin finish shall conform to requirements of MIL Spec. MIL-R-9300B and MIL-R-21931A.

4. Mineral Fiber reinforced cement board (M.F.B.) substrate shall meet the following minimum requirements:

    a. 7000 lb/in^2 Compressive Strength
    b. 2000 lb/in^2 Flexural Strength
    c. 0.15 Thermal “R” Value
    d. 0/5 Flame/Smoke Burn Character

5. Brick veneer shall be kiln-fired clay brick of sever weather exterior grade meeting requirements of ASTM-C-1088-94 and shall be modular sixed; 7-5/8” x 2-1/4” x ½”.

6. Panel substrate and brick finish shall withstand the following tests without noted change in appearance in material failure:

   a. 1000 hours in Atlas Twinarc weatherometer
   b. 14 cycles of salt, fog and thermal shock
   c. 100 cycles at -50 to +150 F.

7. The panels shall be installed according to the manufacture’s installation guide with the necessary accessories recommended by the manufacturer.

8. The manufacturer shall provide a five (5) year warranty from date of purchase against defective materials or workmanship.

9. Materials shall be manufactured by Fullerton Finish Systems Inc., Sand Springs,

3.7 ROOF SYSTEMS

C. METAL ROOF SYSTEM

1. The roof sheathing shall be covered with a 26-gauge metal panel system to form a standing seam roof as shown. The panels shall have a Galvalume® substrate with a Kynar 500® finish. The panels shall meet UL Standard 2218, Class 4 impact resistant and Class A fire resistant rating. The system shall be complete with fascia and soffit. The minimum roof slope shall be 3:12.

2. The ridgeline of the roof shall be covered end to end with a broken edge panel open along the sides to create a roof vent along both sides of the entire ridge line. The top of the broken edge panel along the ridge line shall cover over the top of the standing seams to provide a finished appearance.

D. FACTORY INSTALLED TRUSSED ROOF SYSTEM

1. The building manufacturer shall provide wooden roof trusses, plywood sheathing, underlaying felt to be factory applied and be covered by the finished roof surface which shall be factory applied to the building to form a hipped roof system as shown.

2. When installed, the trusses shall be covered by 1/2" thick C-C Grade plywood. The selected roof material shall be called out in these specifications.

3. When required, the roof structure shall include the roof hatches being built into the roof field by the station manufacturer using the same materials as specified above.

4. Metal Facia and Soffits shall be installed on the building by the building

manufacturer. These materials for the facia and soffit shall be complimentary in color and texture and approved by the Engineer. (FACIA AND SOFFIT WILL NOT BE INSTALLED AT THE FACTORY IF FIELD APPLIED EXTERIOR IS INVOLVED. THIS NEEDS TO BE CLEARLY CALLED OUT IN THE SPEC THAT IT IS THE CONTRACTORS RESPONSIBILITY TO INSTALL IN THE FIELD).

5. A ridge line, metal airvent system shall be installed as a part of the roof.
6. For review by the Engineer-of-Record, the roof system shall be designed and stamped by a Registered Professional Engineer in the State of Ohio and provided with the equipment submittals.

3.8 BRIDGE CRANE SYSTEM SUPPORTS

A. The supports for the bridge crane running beams shall be attached into the building structure or shall be supported by structural steel, vertical columns placed along the sidewalls in sufficient numbers to fully support the bridge crane structure and any lifted load at any point within the building.

3.9 TRAVELING BRIDGE, CHAIN HOIST & TROLLEY

A. The hoist shall be rated for 2,000 lbs. with 10' of lift. A Weston-type load brake shall be supplied that requires no lubrication. To minimize jamming and slipping, the hoist shall be supplied with hand wheel covers with guide slots. The chain will be hardened. The hook shall be forged steel, equipped with a safety latch and swivel.

B. The trolley shall be manufactured of high quality rolled steel. The wheels shall be double row, ball bearing design for greater wear capacity. The bearings shall be pre-packed with lifetime lubricant and protected with dust covers. The trolley shall quickly adapt to a wide range of beams with the “Dial-Fit” collar system. The trolley beam shall be a "W4x13" flange steel I-beam conforming to ASTM-A36 standards.

3.10 DELIVERY - LIFTING DEVICE

A. An adjustable spreader type lifting device, built to lift the building structure without impinging the lifting chains/cables on the building sidewalls, shall be provided by the installing contractor for use by the installing contractor for the purpose of unloading station from trailer.

3.11 REGISTERED PROFESSIONAL ENGINEER REVIEW

A. The base substructure, building and the bridge crane system and the means of attaching the building to the foundation shall be reviewed and stamped by an Ohio Registered Professional Engineer.

3.12 BUILDING SUBSTRUCTURE

A. The base/floor system substructure shall be made up of steel plate and standard structural steel shapes of the sizes and weights sufficient to bear the loading placed on

the base by shipping and operation. The substructure shall be designed to support the building live and dead loads plus the burden imposed by loading, transporting and unloading of this equipment.

B. All steel plates used in the substructure shall meet or exceed the requirements of ASTM-A36. The structural shapes (channels and angles) shall be of the thickness/weight as shown on the plans for this item and shall meet or exceed the requirements for ASTM A-36. The structural rectangular or square tubing shall be of the wall gauge as shown on the plans for this item and shall meet or exceed the requirements for ASTM A-500 Grade B.

C. On the substructure on the floor plate, indented approximately 6", there shall be welded a 1-1/2" x 2" x 1/8" steel angle iron with drilled holes. This angle steel piece shall be the bracket through which the building is attached to the base substructure.

3.13 SKID INSULATION

A. The steel skid underside shall be insulated with a isocyanurate (flame retardant urethane) foam insulating material. The insulation shall be applied in each of the spaces between the structural members and the interior perimeter of the skid by spray and other approved methods. The insulation shall be 2 inches thick and have a minimum density (compressibility) of 1.7-1.8 lbs/cu. ft. nominal. The insulation shall have a ASTM E-84 flame spread rating of less than 30.

3.14 FLOOR DRAIN

A. The station shall have floor drains as shown on the drawing.

B. The floor drains shall be a 4" grated opening with 4" I.D threaded hub for connection of a drain line up under the station floor.

3.15 PIPING FLOOR PENETRATIONS

A. Where suction and discharge piping, or any other pressure piping, passes through the station floor plate and base sub-structure, that area of the floor shall be provided with a grout sleeve made up of steel pipe of 9" height and of sufficient annular diameter to pass a full size pipe flange for the pipe size shown.

B. The steel sleeve shall be welded into the floor plate with a 1" projection above the floor in the station. Following installation of the inlet and outlet pipes, the installing contractor shall be responsible for furnishing and installing grout to close the opening around the installed pipe.

3.16 SAFETY FLOOR MATTING

A. The walkway areas shall be covered with a rubber drainage runner. The runner shall be medium duty, 1/2 inch minimum thickness of open slot design allowing fluids to drain understanding or walking surfaces. The runner shall have a tread design to promote sure footing. The underside of the runner shall have a raise knob design to permit aeration and drainage, and to reduce runner fatigue. The runner shall not be glued to the floor.

3.17 PUMP OPERATING CONDITIONS - PUMP STATION

A. The pump station shall be capable of delivering the fluid medium at the following capacities and heads when operating at 0 feet minimum suction pressure.

3.18 DOMESTIC PUMPS #1 AND #2

A. The pumps shall be Close Coupled End Suction or approved equivalent.

Design Point: 50 GPM @ 85 feet TDH;
Suction Pressure: 39 PSI;
Pump Efficiency at Design Point: 64.84%
Pump Power: Non-overloading for 3 rated h.p.
Motor Speed: 3600 rpm nominal.

3.19 HIGH-CAPACITY PUMP #3

A. The pumps shall be Close Coupled End Suction by Paco as Model 40157LC or approved equivalent.

Design Point: 1000 GPM @ 175 feet TDH;
Maximum Point: 1473 GPM @ 97 feet TDH;
NPSHr: 15.07 feet;
Suction Pressure: 39 PSI;
Pump Efficiency at Design Point: 76.13%
Pump Power: Non-overloading for 75 rated h.p.
Motor Speed: 1800 rpm nominal.

3.20 PUMPS – CLOSE COUPLED HORIZONTAL END SUCTION, CENTRIFUGAL

A. The pumps employed within the pump station shall be of the close coupled, horizontal end suction, centrifugal configuration.

B. The pumps shall be of close grain cast iron construction complete with bronze trim. The pumps shall conform to the detailed specifications as set forth below:

1. The pumps shall be Volute style with the pump casing bolted to adapter, with recessed lock fit to insure alignment. No stud or bolt holes are tapped through casing to liquid ways. Tapping openings provided for priming, venting, draining and suction and discharge gauge connections. Piping connection are to be as

shown on the pump data sheets.

2. Impellers are to be single suction type, cast in one piece. All impellers are to be statically balanced to insure smooth operation, also hydraulically balanced except in some small sizes where end thrust is but a minor factor.

3. Wearing rings shall be renewable, be set on both the impeller and body and be set maintain proper running clearance with impeller hubs to minimize leakage between the suction and discharge.

4. Shaft sleeves shall be shouldered onto the shaft near impeller to cover the full length of shaft from impeller hub to motor end bracket by being in compression over the shaft protecting shaft from contact with liquid.

5. The stuffing box shall be cast integral with the pump casing. The stuffing box shall contain a single face type mechanical seal. The seal shall have a carbon rotating head against a Ni-Resist stationary face and be complete with a Buna-N boot with stainless steel spring and spring retainer.

6. The motor adaptor shall maintain a rigid, bolted, registered assembly between motor and the casing by a machined lock between adapter and motor end bracket keeping the adapter and casing in permanent alignment with motor and motor shaft.

7. Motor configuration shall be as a close-coupled assembled as an integral part of the complete units. The extended motor shaft carries the impeller and shaft sleeve. Motor bearings are ball bearing type, designed to carry all radial and thrust loads, and are installed in sealed housings which retain lubricant and exclude dirt and moisture.

3.21 PUMPS – VERTICAL, CENTRIFUGAL DIFFUSER, MULTI-STAGE

A. The booster pumps employed with the booster pump station shall be of the vertical centrifugal diffuser type, multi-stage, designed specifically for low flow- high head operation.

B. The pumps shall conform to the detailed specifications as set forth below:

1. The pump suction/discharge chamber, motor stool and pump shaft coupling shall be constructed of cast iron.

2. The impellers, pump shaft, diffuser chambers, outer discharge sleeve and impeller seal rings or seal ring retainers shall be constructed of stainless steel.

3. The impellers shall be secured directly to the pump shaft by means of a stainless steel tapered split cone and locking nut.

4. Intermediate and lower shaft bearings shall be Tungsten Carbide and Ceramic or

Silicon Carbine.

5. Pumps shall be equipped with a high temperature mechanical balanced cartridge seal assembly with the Silicon Carbide seal faces mounted in stainless steel seal components with EPDM or Viton elastomers.

3.22 PUMP MOTOR CONFIGURATION

A. The pump driver shall be a NEMA Design B, three phase, alternating current, (squirrel cage) induction motor, continuous duty rated, with motor insulation as Class F for Class B Heat Rise.

B. Motor efficiencies shall be Premium Efficient as stated in NEMA MG 1, 2011 Part 12, Table 12-12 for the motor enclosure, open or closed.

C. Motor Service factor shall be 1.15 on the nameplate, reduced to 1.0 when used with variable frequency drives per NEMA MG 1 – 2011, Part 31.3.7.

D. The motor enclosure shall be Open Drip Proof (ODP).

E. Motors of 600 volts or less shall meet the requirements of NEMA MG 1 2011 Part 31.4.4.2 for ability to sustain voltage spikes when used with variable frequency drives under usual conditions.

F. These motors are for use with variable frequency drives.

3.23 PUMP/MOTOR VIBRATION ISOLATION PADS

A. The pump/motor assembly shall be mounted to a fabricated steel base built specifically for the pump/motor to be mounted. Each mounting or attachment point shall be complete with a vibration isolation pad. The pad will be in two (2) parts, a 1/4" base layer followed by a 5/8" upper layer and be a nominal 2" x 2" square size for pump/motor combinations weighing up to 1500 pounds.

3.24 PUMP SUPPORT STANDS

A. The pump support stands shall be structural steel C-channel, standard weight or steel plate bent to form a channel. The bent steel plate shall be of sufficient thickness to support the pump and motor. A plate or channel shall be welded between the pump supports to form an “H” configuration for rigidity. The base of the legs shall be continuously welded to the steel floor.

3.25 PIPING-TRANSMISSION – STEEL PIPE

A. The piping shall conform to AWWA Standard C-200.

B. Piping 3 inches in diameter and above shall be steel and conform to material specification

ASTM A-53(CW) for nominal pipe size four (4) inch and smaller and ASTM A-53(ERW) Grade B for nominal pipe size five (5) inches and larger. Steel butt-welding fittings shall conform to material specification ASTM A-234 Grade WPB and to the dimensions and tolerances of ANSI Standards B16.9 and B16.28 respectively.

C. Forged steel flanges shall conform to material specification ASTM A-105 Class 60 and/or ASTM A-181 for carbon steel forgings and to the dimensions and tolerances of ANSI Standards B16.5 as amended in 1992 for Class 150 and Class 300 flanges.

D. The piping sizes shall be as shown on the drawing.
Size 10 inch and below - Schedule 40
Size 12 inch and above - Standard weight (.375" wall)

3.26 PIPE WELDING

A. All pipe welds shall be performed by certified welders employed by the pump station manufacturer. As part of the equipment submittal, the pump station manufacturer shall provide copies of the welding certificates of the employees who are to perform the pipe welds.

B. Shop welders shall be certified in accordance with ASME BPVC Section IX or AWS D1.1. Certification shall be done by an independent testing laboratory giving certification for the weld positions for which the tests were performed.

3.27 PIPE SURFACE PREPARATION

A. All piping inside and outside surfaces shall be prepared by grit blasting, or other abrasive blasting, prior to any welds taking place to minimum SP-6 finish.

3.28 PIPE CUTTING

A. Piping of 4" diameter and smaller may be cut by saw.

B. Piping of 6" diameter and larger shall be bevel cut, and Oxyfuel or Plasma-arc cutting techniques shall be used to assure and facilitate bevel pipe cuts.

3.29 SADDLE CUTS AND WELDS

A. Saddle cuts in pipe made in preparation for a saddle weld of a pipe at an angle to a pipe shall be made with numerically controlled, plasma cutting machines. Similarly, saddle end cuts to pipes to make a saddle mating piece shall be done with the same numerically controlled plasma cutting equipment.

B. When the two saddle cut pieces are mated and welded with the MIG process, the internal finished weld shall be smooth and free of inclusions, crevices and other corrosion sites.

3.30 PIPE WELDING TECHNIQUES

A. Pipe welds shall be performed by metal added, inert gas shielded arc welding (MIG) techniques wherein the weld heat settings, the wire feed speed and the traverse speed of the work below the welding are numerically set to assure proper weld fusion and penetration and repeatable welds.

B. In all cases, short circuit transfer, spray transfer or pulse-arc transfer modes of the gas metal arc welding process shall be used.

C. When utilizing the short circuit mode, shielding gas consisting of 50% carbon dioxide and 50% argon gas shall be used. When utilizing the spray or pulse-arc transfer modes, a shielding gas consisting of 5% carbon dioxide and 95% argon shall be used.

D. In all cases, welding wire with a minimum tensile strength of 70,000 psi shall be employed.

E. All flange welds and butt welds of equal size pipe shall be a single continuous nonstop weld around the complete circumference of the pipe. Whenever possible, vertical up weld passes will be applied to all pipe welds. No vertical down weld passes will be allowed.

F. Completed pipe welded assemblies shall create no internal obstruction, restriction or create any unintended sources of water deflection.

G. Piping of six (6) inch diameter and larger shall require a minimum of two (2) weld passes to complete each weld. The first pass, or root pass, shall be applied at the bottom of the bevel cut using the short circuit transfer welding mode, and the second pass, or cap pass, shall be applied over the root pass using the spray or pulse arc transfer welding modes to insure that at a minimum the total weld thickness shall be equal to thinnest of the two pieces being welded together.

H. The pipe shall be sand blasted, as specified elsewhere, before pipe weld and after pipe weld, before fusion bonded epoxy is applied.

3.31 WELD STANDOFFS

A. No welding shall be performed on fusion bonded coated piping after the coating process has been performed.

B. Where any piping is to be welded after the application of fusion bonded epoxy coating to the inside of the pipe, at the point of the weld, a weld standoff must be welded to the pipe prior to the coating. The weld shall be made to the standoff and not onto the pipe.

3.32 PIPE SUPPORTS

A. Pipe supports by minimum sizing for:

- 8" and smaller piping shall be 2" x 3" x 3/16" wall rectangular tubing;
- 10" and larger piping shall be 3" x 4" x 1/4" wall rectangular tubing;
- 6" and larger piping shall be provided with "kick" bracing projecting fully from the underside of the pipe to the floor at an angle of no less than 15E from vertical out at a right angle to the run of the pipe being supported. These "kick" braces shall be in addition to the vertical pipe supports called out above.

B. Pipe supports are to be fully welded at both end points to the pipe and steel floor where required.

C. Where components are to be supported and may require disassembly at some time, the supports for these components shall be welded at the bottom and bolted at the top by use of a bolt yoke welded to the top of the support and bolted into the flange connection picking up at least three bolts.

3.33 RISER PIPE VERTICAL SUPPORTS

A. All of the inlet and outlet vertical riser pipes shall be provided each with, two (2) structural steel, angle pipe support welded to the weldment plates on the vertical riser pipe to down to the floor. These supports shall be opposed by at least 120 degrees around the pipe. The minimum member size for these supports shall be 3” x 4” x 1/4” tubular steel.

3.34 FUSION BONDED EPOXY INTERNAL PIPE COATING

A. The internal surfaces of piping to be fusion bonded coated shall be grit blasted to an SP-10 finish with the finish profile required by the coating material manufacturer.

B. The internal, wetted surfaces of the steel transmission piping shall have applied to it a Fusion Bonded Epoxy Coating on the interior pipe surface. The coating shall be applied and meet the testing requirements of Table 1 and Table 2 with the exception of Table 2 section 7 per AWWA C-213.

C. The powder coating product shall be National Sanitation Foundation (NSF) Standard 61 certified material.

D. Prior to shipment of the station, the station manufacturer shall provide in writing to the Engineer certification that the fusion bonded epoxy coating has been applied to all internal surfaces of the steel piping using the proper method. Said certification shall show under the station manufacturer's letterhead:

- Date of application;
- Material manufacturer and product designation including a product data sheet for the coating;
- Applier of the fusion bonded coating, name, address and phone number;
- Notarized signature of an officer of the station manufacturing company stating the fusion bonded epoxy coating was applied to AWWA Standard C213-91 or the latest revision.

3.35 COATINGS - CORROSION PROTECTION

All interior and exterior surfaces of the exposed steel structure, transmission piping, and fittings shall be gritblasted equal to commercial blast cleaning (SSPC-SP6). Following fabrication all exposed surfaces of the station, interior and exterior, shall be coated according to the following requirements.

A. WELDMENT PRIME COATING

1. All weldments will be pretreated by hand to provide additional corrosion protection using the same product as the base coat. Following the pretreatment full coating application shall take place.

B. BASE COATING

1. The base coating shall take place immediately after surface preparation. The protective coating shall consist of a two-component, high solids, high build, fast drying epoxy system for protection and finishing of steel and having excellent corrosion resistant properties. The epoxy system shall be self-priming and require no intermediate coatings.

C. TOP COATING

1. Following the base coating application, a full finish coating application shall take place. The protective coating shall consist of a two-component, high solids, high build, fast drying epoxy system for protection and finishing of steel and having excellent corrosion resistant properties. The epoxy system shall be self-priming and require no intermediate coatings. The base and finish coats shall provide a total dry mil thickness of 8.0 mils. The finish shall be “flint gray” in color.

D. POST-ASSEMBLY COATING

1. Following assembly and just prior to shipping, there shall take place a thorough cleaning of the floor of the station followed by a rolled on coating of the two part epoxy coating to cover over any scuffing or scaring that might have occurred during assembly.

3.36 FLOOR COATING AND CORROSION PROTECTION SYSTEM

A. The exposed surfaces of the structural steel base shall have a non-skid coating of a two-component, 100% high performance aromatic polyurea spray elastomer system with zero VOC (Volatile Organic Compounds), 100% solid. The coating shall offer outstanding performance and superior elastomeric protection for various substrates. The coating shall be designed as a user-friendly product for moisture insensitive applications because of its pure polyurea chemistry, and offer exceptional adhesion properties for properly prepared substrates. The high performance formulation shall produce an excellent skin formation for chemical resistance and moisture protection. The coating shall be dark gray in color.

B. Both the Iso “A” Side and Resin “B” Side shall be preconditioned between 70-90°F before application. Iso “A” and Polyol “B” components must be pumped by low-pressure transfer pumps to a suitable high-pressure proportional pumping system.

Temperature Settings:	
Iso “A” Block Heater:	140-160°F
Resin “B” Block Heater:	140-160°F
Hoses (Iso and Polyol)	140-150°F
Equipment Hydraulic Pressure:	2,000-2,500PSI

CHEMICAL TECHNICAL DATA:	
Mix Ratio by Volume: Gel Time:	1A:1B 6-9 Sec
Tack Free Time:	9-12 Sec
Viscosity (cps) @ 77°F	
“A” Iso Side:	1,000±100
“B” Resin Side:	370±50
Material Density (lbs/gal) @ 77°F “A” “A” Iso Side:	9.5 lbs/gal
“B” Resin Side:	8.4 lbs/gal.

BASIC PHYSICAL PROPERTIES:		
All tests are performed by OCM Test Laboratories.		
• ISO 17025 Certified		
• American Association for Laboratory Accreditation (A2LA)		
Test Name	Test Methods	Value
Hardness Shore D	ASTM D2240	60±1
Coefficient of Friction	ASTM D1894	
Static		0.305
Kinetic		0.127
Dielectric Const.	ASTM D150	3.6
Dissipation Factor	ASTM D150	0.031
Volume Resistance	ASTM D257	2.3x1014 ohm cm
Elongation	ASTM D412	162%
Flexural Strength ASTM D790		2,630 PSI
Flexural Modulus	ASTM D790	0.056 MSI
Fungus Test	MIL-STD 810F	Pass
Pull-off Test–Adhesion	ASTM C297	
To Metal – No Primer		1,800 PSI
To Metal – XPM Primer		1,910 PSI
To Metal – LXSF515 Primer		1,870 PSI
Taber Abrasion	ASTM D4060	0.06980
(gm Loss/1000 cycles)		

Tear Strength	ASTM D624	783 ppi
Tensile Strength	ASTM D412	3,432 PSI
Water Vapor Trans.	ASTM E96	0.499 Grains/Hr Sq.Ft.

C. The chemical resistance testing for the coating shall be per ASTM D543 for immersion in fluids methods. Additional product certifications shall include USFDA Coatings for Incidental Food Contact Applications Certified by Keller and Heckman LLP and MIL-STD-810F.

3.37 SERVICE CONNECTIONS ON INTERNAL PIPING

A. All plumbed devices within the station eventually requiring service, such as meters, control valves, pumps and like equipment, shall be easily removed from the piping by the presence of appropriately placed and sufficient quantity of adaptors and couplings as shown on the drawings; no less than the quantity of couplings and adaptors shown shall be allowed.

3.38 RESTRAINING POINTS

A. The main inlet and outlet piping to the station shall each be provided with two (2) or four (4) restraining points as welded on "eyes" or similar device welded to the underside of the base structure framing as shown to facilitate the attachment of joint restraint tie rods or other device to be used in retarding any pipe movement at the connections.

3.39 COMPRESSION COUPLINGS

A. The station piping shall include a variety of compression type, flexible coupling to prevent binding and facilitate removal of associated equipment. These couplings are to be where shown on the plans. In lieu of a compression coupling, a flanged coupling adapter (FCA) may be used.

B. Grooved fittings may not be used under any circumstance.

C. All compression couplings or flanged coupling adapters (FCA), and flexible connectors/expansion joints shall include a minimum of two (2) zinc coated steel threaded rods across the joint with appropriate bolted restraining points.

3.40 ELASTOMER PIPE CONNECTOR

A. The inlet side of each booster pump shall include an elastomer connector to help isolate vibration and noise in the piping system. The elastomer connector shall be of single sphere design, constructed of neoprene and nylon with bias-ply tire reinforcing cord to provide a 225 psi working pressure rating to a minimum of 120 degrees F. The elastomer connector shall pass through the plate steel flanges designed to grip the connector so the connector seals without gaskets when the flange bolts are drawn up.

B. A control joint limiting pipe connector movement shall be supplied with each pipe connector.

3.41 LINE PRESSURE GAUGES

A. Combination pressure gauges shall have a built-in pressure snubber and have 4-1/2" minimum diameter faces and turret style case, black fiberglass-reinforced thermoplastic with a clear acrylic window with Buna-N gasket. The movement shall be rotary; the bourdon tube shall be copper alloy C-type. The gauge shall have a 1/4" MNPT lower mount process connection and contain a 0.6mm copper alloy restrictor. Combination pressure gauge range and scale graduations shall be in psi and feet of water as follows:

1. Gauge ranges shall be established by the Engineer for each of the suction and discharge gauges for each pump station.

2. All gauges will be panel mounted off the pipeline and be connected to their respective sensing point. The gauge trim tubing shall be complete with both isolating and vent valves and the tubing shall be so arranged as to easily vent air and facilitate gauge removal. Gauges mounted directly to the pipeline or at the sensing point will not be accepted.

3. Gauge ranges, markings and gauge location shall be identified in the submittal documents.

3.42 STATIC AND SENSING LINES

A. All gauge, switch and transmitter sensing lines shall be minimum 1/4” OD white polypropylene tubing run from the sensing point and a ball valve to the point of device mounting.

B. The pilot tubing shall be run in a workmanlike manner with elastomeric/stainless steel mounting straps to securely hold the tubing to be free of stress and vibration. The alignment and organization of the sensing lines shall be continuously rising.

3.43 SAMPLE TAP

A. A single, right angle outlet, smooth nose, brass sample tap shall be affixed to the manual vent ball valve for the low suction lockout and suction pressure gauge assembly.

3.44 HOSE BIBB WITH VACUUM BREAKER

A. There shall be provided a standard hose bibb with valve and vacuum breaker on the suction piping. The hose bibb connection shall be through a pressure regulator if the header pressure would exceed 60 psi.

3.45 BALL VALVES

A. The ball valves will be 2-piece, full-port design with blow-out proof stem. The seats, packing and seal shall be PTFE. Ball valves shall be provided with an adjustable stem packing nut. The body and retainer shall be lead free brass (DZR). The ball shall be lead free brass (DZR), chrome plated for sizes ¼”-1” and 316SS for sizes 1-1/4”-4”. The handle shall have a distinctive white “lead free” handle grip and blue “lead free” hanging tag. The valves

will be NPTxNPT threaded pattern. Maximum working pressure shall be 600 psi up to 2” and 400 PSI for sizes 2-1/2” to 4”.

3.46 SILENT CHECK VALVES – WAFER STYLE

A. Silent check valves shall be wafer style, non-slam and made to set between ANSI Class 125 flanges.Sizes shall be as shown.

B. The body of the check valve shall be cast iron. The plug and seat shall be bronze and conform to ASTM Designation B-584. The seat shall contain a Buna-N seal to provide zero leakage. The seal design shall provide for both a metal to metal low and high pressure without over-loading or damaging the Buna-N seal. The guide bushings shall be bronze copper alloy and conform to ASTM Designation B-584. The valve spring and seat retainers shall be stainless steel and conform to ASTM Designation A-313. The valve plug shall be guided at both ends by a center shaft integral with the valve plug. Alignment of the center shaft shall be provided by guide bushings.

C. Silent Check Valve manufacturer:

1. Val-Matic Model 1400
2. APCO Series 300A

3.47 GATE VALVES

A. Gate Valves shall conform to the latest version of AWWA Standard C-515 covering Resilient Seated Gate Valves for Water Supply Service.

B. The valves shall be 150# flanged with a ductile iron body and bonnet. The wedge shall be totally encapsulated with rubber. The sealing rubber shall be permanently bonded to the wedge to meet ASTM tests for rubber metal bond ATSM D249. Working pressure for valve sizes 2”-12” shall be 250 PSI.

C. Valves shall be supplied with O-Ring seals at all joints. No flat gaskets shall be allowed.

D. The valves shall be non-rising, opening by turning left to right. The handwheel shall have the "Open" and an arrow cast in the metal to indicate the direction to open.

E. Stems for NRS assemblies shall be cast bronze with integral collars in full compliance with AWWA. The stem shall operate with bronze stem nuts, independent of stem. The stem shall have (2) O-Rings located above thrust collar and (1) O-Ring below. O-Rings shall be replaceable with valve fully opened and subjected to full pressure. Stems shall also have (2) low torque thrust bearings located above and below stem collar to reduce friction during operation.

F. Waterway shall be smooth, unobstructed and free of all pockets, cavities and depressions in the seat area.

G. The body, bonnet and stuffing plate shall be coated with fusion bonded epoxy, both interior and exterior on body and bonnet. Epoxy shall be applied in accordance with AWWA C550 and be NSF61 and NSF372 certified.

H. Each valve shall have a maker's name, pressure rating, and year in which it was manufactured cast in the body. Prior to shipment from the factory, each valve shall be tested by hydrostatic pressure equal to requirements of AWWA.

I. Valves shall have all brass components cast and assembled in the USA.

J. Valve manufacturer:
   1. Kennedy Valve
   2. M&H
   3. Clow

3.48 HYDRAULIC ACTUATED CONTROL VALVES

A. The valve configuration as shown shall be hydraulically operated, single diaphragm actuated. The valve shall consist of three major components: the body with seat installed, the cover with bearing installed, and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls. Valve body and cover shall be epoxy coated. The stainless steel seat with integral bearing shall be of the solid, one piece design.

B. The diaphragm assembly shall contain a non-magnetic stainless steel stem of sufficient diameter to withstand high hydraulic pressures. The stem shall be fully guided through its complete stroke by a removable bearing in the valve cover and an integral bearing in the valve seat. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary.

C. The flexible, non-wicking, FDA approved diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.

D. The pilot control system shall include CK2 isolation valves.

E. The pilot system shall include closing speed control on all valves.

F. Pilot controlled sensing shall be upstream of the pilot system strainer so accurate control may be maintained if the strainer is partially blocked.

G. The pressure relief pilot shall be a direct-acting, adjustable, spring-loaded, diaphragm valve designed to permit flow when controlling pressure exceeds in the adjustable spring setting.

The pilot control is normally held closed by the force of the compression on the spring above the diaphragm and it opens when the pressure acting on the underside of the diaphragm exceeds the spring setting. The pressure relief valve shall be supplied with the Dura-Kleen® stem (KD option).

H. The valve shall be equipped with a brass valve stem rod rising through a compression bushing in the top of the valve.

I. The valve shall be equipped with One (1) body mounted limit switch with adjustable cams on the valve stem rod. The limit switch shall be 120 VAC powered back through the Station controls as so noted elsewhere in these specifications.

The Control Valve shall be a Cla-Val Model 50-01BKCKD.

3.49 COMBINATION AIR VACUUM RELEASE VALVES

A. Combination air valves shall be of the single housing style that combines the operating features of both an air/vacuum and air release valve and be placed as shown on the drawings and of the size shown.

B. The air/vacuum portion shall automatically exhaust large quantities of air during the filling of the pipeline and automatically allow air to re-enter the pipeline when the internal pressure of the pipeline approaches a negative value due to column separation, draining of the pipeline, power outage, pipeline break, etc.

C. The air release portion shall automatically release small pockets of air from the pipeline while the pipeline is in operation and under pressure.

D. The combination air valve shall be 1" NPT inlet and outlet connections and a 5/64" diameter orifice for a minimum working pressure of 300 psi.

E. The materials of construction shall be: body, cover and baffle of cast iron; float and all other trim shall be of stainless steel with the exception of the Buna-N seat and adjustable viton orifice button.

F. The combination air valve shall be Val-Matic Model 201.C.

3.50 LINE STRAINER

A. Each station shall be equipped with a Line strainer in the location and of the size shown on the drawings. The strainer shall be ANSI Class 150 flanged rated for 250# operating pressure.

B. The strainer body material shall be ANSI 16.42 Ductile iron with epoxy coating.

C. The strainer shall 316 stainless steel 10 mesh/2000 micron/0.078 inch openings.

D. The cap hardware shall be stainless steel with a lid sealing gasket of Buna N.

E. The strainer shall be a CLA-VAL Model X43H.

3.51 TRANSIT TIME METER

A. Approved Manufacturers:

Flexim America Corporation
Edgewood, NY 11717
Phone: (631) 492-2300
salesus@flexim.com

Approved equal.

B. Technical Data

Measuring principle: Transit time difference correlation principle
Quantities of measurement: Volume flow, mass flow, flow velocity, thermal energy flow
Transmitter processor: 32 bit or greater
Flow velocity: 0.03 to 82 ft/s
Repeatability: 0.15% of reading ± 0.03 ft/s
Calibrated transducer accuracy:
± 1 % of reading ± 0.03 ft/s with certificate of calibration
Gaseous and solid content: < 10 %
The Meter shall meet AWWA C-750-16

C. Transducers

Operating temperature: -30 ° F to +120 ° F
Built in RTDs for temperature compensation per ASME MFC 5M
Coupled to pipe with permanent coupling pads
NEMA 4X enclosure
Material: 316 Stainless Steel
Protective cap 316 Stainless Steel
Hazardous area classification: NA

3.52 PRESSURE TESTING

A. When the station plumbing is completed, the pressure piping within the station (including valves, pumps, control valves, and fittings), connections as make up the entire system shall be hydrostatically tested at a pressure of 150 psi or a pressure equal to the lowest test pressure rating of the equipment within the tested system, whichever is lesser pressure. The test pressure shall be applied for a minimum of 20 minutes, during which time all joints, connections and seams shall be checked for leaking. Any deficiencies found shall be repaired and the system shall be retested.

B. The results of this testing shall be transmitted in writing to the Engineer prior to shipment of the station and shall note test pressure, time at full pressure and be signed by the Quality Control Manager or test technician.

PART 4 – ELECTRICAL

4.1 ELECTRICAL DESIGN, ASSEMBLY & TEST

A. The electrical apparatus and control panel design, assembly, and installation, and the integration of component parts will be the responsibility of the manufacturer of record for this booster pumping equipment. That manufacturer shall maintain at his regular place of business a complete electrical design, assembly and test facility to assure continuity of electrical design with equipment application. Control panels designed, assembled or tested at other than the regular production facilities or by other than the regular production employees of the manufacturer of record for this booster pumping equipment will not be approved.

4.2 CONFORMANCE TO BASIC ELECTRICAL STANDARDS

A. The manufacturer of electrical control panels and their mounting and installation shall be done in strict accordance with the requirements of UL Standard 508A and the National Electrical Code (NEC), NFPA 70 latest revision so as to afford a measure of security as to the ability of the eventual owner to safely operate the equipment.

B. No exceptions to the requirements of these codes and standards will be allowed; failure to meet these requirements will be cause to remove the equipment and correct the violation.

4.3 U.L. LISTING

A. All service entrance, power distribution, control and starting equipment panels shall be constructed and installed in strict accordance with Underwriter's Laboratories (cUL) Standard 508A "Industrial Control Equipment." The cUL label shall also include an SE "Service Entrance" rating stating that the main distribution panel is suitable for use as service entrance equipment. The panels shall be shop inspected by cUL, or constructed in a cUL recognized facility. All panels shall bear a serialized cUL label indicating acceptance under Standard 508A and under Enclosed Industrial Control Panel or Service Equipment Panel.

4.4 E.T.L. LISTING

A. All control panels shall be E.T.L. Listed by Interek Testing Services (ITS) under the Industrial Control Panel (ICP) Category. Each completed control panel shall bear an ETL listing label stating that the panel conforms to UL STD 508A and is certified to CAN/CSA STD C22.2 NO. 14. The listing label shall include the station manufacturer's name, address and telephone number. The station manufacturer shall have quarterly inspections performed by ETL at the manufacturer's facility to ensure that the products being listed comply with the report and procedural guide for that product.

4.5 EQUIPMENT GROUNDING

A. Each electrical equipment item in the station shall be properly grounded per Section 250 of

the National Electrical Code. Items to be grounded include, but are not limited to, pump motor frames, control panel, transformer, convenience receptacles, dedicated receptacle for heater, air conditioner, dehumidifier, lights, light switch, exhaust fans and pressure switches.

B. All ground wires from installed equipment shall be in conduit and shall lead back to the control panel to a copper ground buss specific for grounding purposes and so labeled. The ground buss shall be complete with a lug large enough to accept the installing electrician's bare copper earth ground wire. The bus shall serve as a bond between the earth ground and the equipment ground wires.

4.6 PANEL MOUNTING HARDWARE

A. Metal framing channel and hangers shall be used exclusively for mounting of electrical panels and electrical components except for those specifically designated otherwise.

B. When mounting panels in buildings with ¾" plywood interior sheathing, certain panels and components may be mounted by screwing these devices into the wall. The maximum weight of a panel mounted with four lag screws cannot exceed 250#. The lag screws must either be 5/16" or 3/8" diameter and be fully threaded.

4.7 ELECTRICAL SERVICE

A. The electrical service provided for this station will be 480Y/277 volt, 3 phase, 60 Hertz, 4 wire.

4.8 ELECTRICAL DISTRIBUTION PANEL

A. The distribution panel shall be a single section, bolt-on panelboard, surface mount, NEMA 1 enclosure for three phase, four wire, power and with aluminum bus. Circuit Breakers are rated for 35KAIC.

B. The main circuit breaker shall be rated for 300 amp service.

C. The distribution panel shall be complete with the following branch circuit breakers:

One (1)	3-pole, 300 amp Main Breaker;
Two (2)	3-pole, 15 amp 3 HP Pump Motor Breakers;
One (1)	3-pole, 150 amp 75 HP Pump Motor Breakers;
One (1)	3-pole, 30 amp Surge Protection Device Breaker
One (1)	3-pole, 15 amp Phase Monitor Breaker;
One (1)	2-pole, 40 amp Primary Transformer Breaker.

Nameplates will be provided in etched phenolic.

4.9 SECONDARY CIRCUIT BREAKER (LIGHTING) PANEL

A. The lighting panel shall be a single section, bolt-on panelboard, surface mount, NEMA 1 enclosure for single phase, three wire, 240/120 VAC power and with copper bus. Circuit Breakers are rated for 10 KAIC.

B. There shall be provided, thermal-magnetic trip circuit breakers as follows:

1. One (1) Transformer Breaker, Secondary Side, 80 amps;
   Auxiliary Circuit Breakers, as follows:

a.	1-pole,	15amp Controls
b.	1-pole,	15amp Telemetry
c.	1-pole,	15amp Lights
d.	1-pole,	15amp Convenience Outlets
e.	1-pole,	20amp Generator Block Heater
f.	1-pole,	15amp Generator Battery Charger
g.	1-pole,	15amp Pump Room Dehumidifier
h.	1-pole,	15amp Spare
i.	1-pole,	15amp Spare
j.	1-pole,	20amp Spare
k.	1-pole,	20amp Spare

4.10 ELECTRICAL APPARATUS - CONTROL PANEL

A. The Programmable Logic Controller (PLC), Operator Interface Terminal (OIT), and control relays shall be incorporated into one (1) NEMA 1 control panel.

4.11 ELECTRICAL APPARATUS - ADJUSTABLE FREQUENCY DRIVES (3/4 HP PUMP MOTORS)

A. This specification is to cover a complete Variable Frequency Drive (VFD aka: VFD, AFD, ASD, Inverter, AC Drive, et al) designed for use with a standard AC induction motor in water and wastewater applications. The VFD must provide a V/Hz or sensor-less vector mode of operation.

B. The VFD package as specified herein shall be UL61800-5-1 listed and CSA C.22.2 No. 274-17 listed as a complete assembly. The VFD shall be furnished in an UL Type 1 (NEMA 1) listed enclosure rated as specified for operation at ambient temperatures between -15°C and 40°C at an altitude not exceeding 3300 feet, with relative humidity less than 95% and no condensation allowed.

C. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum. The VFD efficiency shall be 96.5% or better at full speed and load. The VFD shall have a DC bus voltage controller to automatically maintain the DC bus levels in high or low line conditions for the purpose of maintaining full motor voltage at all times. The short term normal duty overload current capacity shall be 110% of rated current for one (1) minute out of ten (10) minutes.

D. All VFDs shall have the same customer interface, including digital display, and keypad,

regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs. Control connections shall remain consistent for all power ratings.

E. The control panel shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bump-less transfer" of speed reference when switching between "Auto" and "Hand" modes. There shall be a possibility to reset the VFD from the control panel. The control panel shall include a backlit LCD. The display shall be in complete words, in a language selectable by the user, for programming and fault diagnostics (alphanumeric fault codes are not acceptable). The control panel shall have a real-time clock with battery backup for adding time stamps to events, faults, warnings and also timer functions utilizing real-time clock. There shall be an editable home-view in the control panel to allow different customer specific configurations.

F. A dedicated "Help" button shall be available on the control panel. The Help button shall provide context sensitive assistance for programming and troubleshooting. The control panel shall provide interactive assistants (wizards) to help to commission and use the drive.

G. The control panel shall provide a clear, interactive, context sensitive menu based user interface to make it easy to adjust the settings of the drive. The control panel shall provide an easy to use I/O menu, where the user can see the status and function of all the analog and digital inputs and outputs. The control panel shall have a menu, which contains diagnostic data about the drive operation collected in one single location. The data shall include data about active faults, warnings and events. In addition the data shall contain a summary of VFD active control sources.

H. The user shall be able to take a screen capture snapshot of the display with the control panel and be able to download the screen capture for user's computer for further purposes. The user shall be able to connect a PC tool with a USB cable to the control panel to be able to set up and control the VFD. It shall be possible to connect the USB cable without using any tools.

I. The VFD shall have 2 quick ramps that allow for quick acceleration and/or deceleration of the pump motor.

J. The VFD shall offer a pump cleaning feature to reduce build-up of debris on the pump impeller. This feature can be activated by: Every start or Stop, when drive is in a underload / overload condition, timed interval or digital input. The cleaning cycle status shall be visible in the panel screen when cleaning is active. The VFD shall operate normally after the cleaning cycle is completed.

K. The VFD shall offer torque boost for applications where increased torque is needed for initial starting of the pump motor.

L. The VFD shall have intelligent pump control (IPC) with multi-pump functionality and an intelligent master/follower configuration for controlling up to 8 parallel pumps equipped

with VFDs without additional modules. VFD shall have a parameter synchronization feature to program the PID, IPC and AI parameters in all parallel VFDs. The Functionality to start and stop the pumps based on capacity, operating time or efficiency of the pump to ensure each pump is operated regularly. The IPC shall be capable of level control, flow control, pressure control and pump alternation.

M. The VFD shall have soft pipe filling functionality, can be used to fill an empty pipe, by having programmable pipe fill time.

N. The VFD shall have a programmable Sleep functionality for PID control in pumping systems to stop the pump during low demand. "Sleep Boost" shall be available to reduce short cycling of the pump. The boost function will boost the pressure or water level before the pump shuts down to sleep.

O. The VFD shall provide a PLC kind programming capability as standard. It shall be possible to use different kinds of arithmetic, logical, selection, comparison and operation function blocks to monitor and control the VFD, functions, inputs, outputs and variables. There shall be a possibility to run different kinds of function block programs in different states and to set the criteria, when to change the state.

P. Real-time clock and calendar shall be available as standard for giving true time and date information to fault event history. The real-time clock should have a minimum of 10 years power-off back-up without optional components. Back-up battery shall be replaceable without opening the VFD enclosure. Real time clock shall be possible to use with timed functions, which shall allow controlling the VFD and its functions based on time of the day, day of the week, seasons of the year, holiday periods and holiday dates and special working periods and working days.

Q. Timed functions should be possible to use for starting and stopping the drive, for selecting the speed reference, for selecting the PID loop controller's set-point, for controlling the relay outputs, for selection the control location, for giving the run permissive or interlock signal to the VFD, etc. There shall be also a boost function, which allows starting the VFD and/or its functions regardless, time of the day, day of the week, seasons or holidays.

R. The VFD shall be capable of controlling an induction motor, permanent magnet motor and synchronous reluctance motors as standard. Have a maximum allowed motor cable length 1000 feet (300 meters). The VFD shall commission an induction motor, permanent magnet motor and synchronous reluctance motor with the motor nameplate values only, without the need to get the motor values from other sources.

S. Scalar and vector control modes shall be supported and there shall be independent control chains and parameters for both of the motor control modes.

T. The overload rating of the VFD shall be 110% of its rated normal duty current for 1 minute every 10 minutes and with a minimum of 130% for 2 seconds every 1 minute. Overload ability shall be available at all times - not only at start.

U. The VFD shall be capable of sensing the loss of load (broken belt / broken coupling / dry pump) and signal the loss of load condition. The drive shall be possible to be programmed to signal this condition via a control panel warning, relay output and/or over the serial communications.

V. Relay outputs shall include programmable for on/off time delays that will allow for drive acceleration or deceleration to and from zero speed, without signaling a false underload condition.

W. It shall be possible to disconnect a motor running full speed by opening an optional contactor between motor and VFD without causing any damage to the VFD.

X. The VFD shall include a standard embedded functional safety feature Safe Torque Off, (STO), to make the motor mechanically safe.

Y. The VFD shall include an energy optimization circuit (flux optimization) that will automatically reduce applied motor voltage to the motor to reduce energy consumption by up to 10% and lower audible motor noise.

Z. The VFD shall be capable of starting into a spinning load (forward or reverse) up to full speed and accelerate or decelerate to a set-point (flying start) without tripping or component damage.

AA. The VFD shall restart after a power loss without the need to resend the start command. This feature shall be there regardless of the control source, control panel, I/O or fieldbus.

BB. Flux braking shall be available, where the VFD controls the motor to dissipate the extra rotary energy as heat whenever braking is required. It shall be possible to use this flux braking feature to decelerate the motor from one speed to another – not only for stopping the motor.

CC. Power-Loss-Ride-Through shall be programmable. If the incoming supply voltage is cut off, the VFD continues to operate using the kinetic energy of the rotating motor. The drive continues to be operational as long as the motor rotates and generates energy.

DD. The VFD shall include a switching frequency control function. This adjusts the switching or carrier frequency, based on actual VFD temperature and allows the highest carrier frequency without de-rating the VFD or operating at high carrier frequency only at low speeds (temperature fold-back). It shall be possible to set a minimum and a reference switching frequency.

EE. The VFD shall include a noise smoothing function, which distributes the acoustic motor noise over a range of frequencies instead of a single tonal frequency resulting in lower peak noise intensity.

FF. The VFD shall have three (3) programmable critical frequency or critical speed lockout ranges to prevent the VFD from operating the load continuously on an undesirable speed

range (skip frequencies)

GG. All I/O terminals shall be color coded to simplify wiring and troubleshooting, and shall have a special mode for testing I/O and the drive configuration without being connected to equipment. All I/O shall be accessible (monitor and control) for fieldbus protocols (pass-through I/O). It shall be possible to monitor status of the I/O from VFDs control panel.

HH. The VFD shall have at least two (2) programmable analog inputs. Both inputs shall accept current (0 to 20 mA or 4 to 20mA) or voltage (0 to 10 VDC) signals. The signal type selection, voltage or current, shall be made via VFD user interface. DIP-switches or jumpers are not allowed for input type programming. Analog Input shall have an inaccuracy of ≤1% of full scale in both current and voltage modes.

II. The analog inputs shall be programmable to be used as: speed reference, frequency reference, pressure monitor, PID loop controller's set-point reference or signal feedback, or other defined inputs.

JJ. If the analog input reference (4 to 20 mA or 2 to10 VDC) is lost, the VFD shall give the user the option of: (1) stopping and displaying a fault; (2) running at a programmable preset speed and displaying an alarm; (3) hold the VFD speed based on the last good reference received and displaying an alarm. The drive shall be programmable to signal this condition via a control panel warning, relay output and/or over the serial communication bus.

KK. The VFD shall have at least two (2) programmable analog outputs (0 to 20 mA or 4 to 20 mA) out of which one shall be software configurable to be either voltage (0 to 10 VDC) or current output. Analog Output shall have an inaccuracy of ≤1% of full scale in both current and voltage modes. The analog outputs shall be programmable to give an output signal proportional to frequency, motor speed, output voltage, output current, motor torque, motor power, DC bus voltage, active reference or other defined data.

LL. The VFD shall have at least six (6) programmable digital inputs (24 VAC and 12 to 24 VDC, PNP or 5 pcs NPN) to connect to external devices, as follows:
1. All inputs can be configurable for PTC sensors.
2. There shall be a programmable run permissive circuit.
3. Up to four (4) programmable free text interlock inputs shall be available.
4. The VFD shall have at least one digital input which can be configured to receive a pulse signal up to 16 kHz.

MM. The VFD shall have at least three (3) programmable digital Form-C relay (changeover) outputs. The relays shall include programmable on and off delay times and adjustable hysteresis.

NN. The VFD shall have an EIA-485 (RS-485) port for serial communications as standard. The VFD shall be equipped with built-in fieldbus communication of type Modbus RTU. EtherNet/IP, Modbus/TCP, DeviceNet, PROFIBUS-DP, PROFINET protocols shall be available as plug-in and inbuilt options.

OO. The VFD shall have an integral 5% impedance line reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from

dual (positive and negative DC buss) reactors, or 5% AC line reactors. VFDs with only one DC reactor shall add AC line reactors.

PP. All VFDs through 50 HP shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad.

THE VARIABLE FREQUENCY DRIVE UNITS SHALL BE ABB MODEL ACQ580-PD.

4.12 DRIVE FUSE PROTECTION

A. There shall be provided fuse protection in accordance with the drive manufacturer's installation guidelines and as required in UL61800-5-1.

4.13 ELECTRICAL APPARATUS - ADJUSTABLE FREQUENCY DRIVES (75 HP PUMP MOTOR)

A. This specification is to cover a complete Variable Frequency Drive (VFD aka: VSD, AFD, ASD, Inverter, AC Drive, et al) consisting of a pulse width modulated (PWM) inverter designed for use with a standard AC induction motor, synchronous reluctance (SynRM) and permanent magnet (PM) motors in water and wastewater applications. The VFD must provide a V/Hz or sensor-less vector mode of operation. VFD is packaged in Nema 1 Enclosure with a Harmonic Trap Filter and fused disconnect as a complete enclosed VFD solution for meeting IEEE519 Harmonic Mitigation requirements per IEEE519-2014.

B. The drive manufacturer shall supply the drive and all necessary options as specified. VFDs that are manufactured by a third party and "brand labeled" shall not be acceptable. All VFDs installed on this project shall be from the same manufacturer.

C. Functional Safety: The VFDs shall support 'Safe Torque Off' (STO) function capable for safety related applications up to SIL 3, SILCL 3 and PL e.

D. The VFD shall be solid state, with a Pulse Width Modulated (PWM) output. The VFD shall be a Sensor-less Vector AC to AC converter utilizing the latest Insulated Gate Bipolar Transistor (IGBT) technology. The VFD shall employ a Sensor-less Vector inner loop torque control strategy that mathematically determines motor torque and flux. The VFD must also provide an optional operational mode for V/Hz Operation.

E. The VFD shall be rated to operate from 3-phase power at one of the following voltage ranges. (208-240), (380-480), (500-600) VAC +10%/-15%, 48Hz to 63Hz. The VFD shall employ a full wave rectifier to prevent input line notching and operate at a fundamental (displacement) input power factor of 0.98 at all speeds and nominal load. The ACQ580 standard VFD efficiency shall be 98% or better at full speed and load.

F. VFDs (208-240Vac) 1-100 Hp, (380-480Vac) 1-350 Hp, (500-600Vac) 2-250 Hp shall have internal chokes (reactors) to reduce input current harmonic content, provide protection from power line transients such as utility power factor correction capacitor switching transients and reduce RFI emissions.

G. The VFD shall be furnished in a UL Type 1 (NEMA 1) listed enclosure rated as specified for operation at ambient temperatures between -15oC and 40oC at an altitude not exceeding 3300 feet, with relative humidity less than 95% and no condensation allowed.

H. The printed circuit boards (PCB) shall be conformal coated to protect from atmospheric contamination by Chemical gasses and Solid particles per IEC 60721-3-3; Chemical gasses Class 3C2 and Solid particles Class 3S2.

I. It shall be possible to disconnect a motor running full speed by opening an optional contactor between motor and VFD without causing any damage to the VFD. The VFD shall include a standard embedded functional safety feature Safe Torque Off, (STO), to make the motor mechanically safe. The VFD shall be capable of starting into a spinning load (forward or reverse) up to full speed and accelerate or decelerate to a set-point (flying start) without tripping or component damage.

J. All VFD I/O terminals shall be color coded to simplify wiring and troubleshooting and shall have a special mode for testing I/O and the drive configuration without being connected to equipment. All I/O shall be accessible (monitor and control) for fieldbus protocols (pass-through I/O). It shall be possible to monitor status of the I/O from VFDs control panel.

K. The VFD shall have at least two (2) programmable analog outputs (0 to 20 mA or 4 to 20 mA) out of which one shall be software configurable to be either voltage (0 to 10 VDC) or current output. The VFD shall have at least six (6) programmable digital inputs (24 VAC and 12 to 24 VDC, PNP or 5 pcs NPN) to connect to external devices. Up to four (4) programmable free text interlock inputs shall be available. The VFD shall have at least three (3) programmable digital Form-C relay (changeover) outputs. The relays shall include programmable on and off delay times and adjustable hysteresis.

L. The VFD shall have specific pump control functionality to control up to six pumps with one VFD to allow distribution of pump usage in a multiple pump system. The VFD shall have multi-pump functionality with an intelligent master/follower configuration for controlling up to eight parallel pumps equipped with own VFD without additional devices:
    1. The VFD shall have a parameter synchronization feature to broadcast PID, Multi-pump and Analog Input parameters to ensure system parametrization is equal in the parallel VFDs
    2. The VFD shall have specific functionality to start and stop the pumps based on the required pumping capacity. In order to balance the operating time of the pumps, the VFD shall have the capability to change the order in which the pumps are started and stopped.
    3. The VFD shall have the capability to give priorities for parallel pumps in the system to enable the most efficient pumps to be operated the most.
    4. The VFD shall have the capability to set a maximum stationary time to ensure all pumps get exercised regularly, regardless of their priorities.
    5. The VFD shall have the capability to control across-the-line pumps instead of parallel VFDs, in order to resolve the system demand.

M. The VFD shall have a level control function with operation modes for optimal tank filling or

emptying supporting up to eight parallel pumps.

1. User–programmable start level shall indicate the point at which the pump will start.
2. The pump(s) shall operate in user-programmable “efficient speed”.
3. If the level keeps raising, more pumps will be started based on unique start levels.
4. There shall be a possibility to connect high- and low- level limit switches, which will trigger either full speed pumping or pump stop, depending if the application is for filling or emptying a tank
5.

N. The VFD shall have the ability to calculate the flow based on the measured pressure difference (using pressure sensors) or the power curve of the pump (sensor-less).
   1. There shall be a multiplier parameter to enable correction for the calculation.
   2. There shall be a specific energy parameter to measure actual flow per input power ratio. The motor speed can be adjusted to locate the most economical pumping point.
   3. The VFD shall have two additional ramps for quick acceleration and two additional for deceleration in order to reduce wear of the mechanical parts in submersible pumps.
   4. The VFD shall have soft pipe filling function with flexible user parameter settings to protect the system. There shall be a configurable pipe fill time to ensure the setpoint is reached within a desired time.
   5. The VFD shall have a specific “Pump cleaning” functionality, based on a series of rapid reverse and forward rotation of the impeller, to prevent pump and pipe clogging.
   6. The VFD shall have the cleaning cycle counter and user-programmable cleaning count time to give a warning and indicate the need for manual inspection.
   7. The cleaning function shall consist of forced stopping, reverse and forward rotations to allow debris to be removed from the impeller.
   8. There shall be a cleaning cycle status visible on the control panel screen when the cleaning function is active for monitoring the cleaning progress.
   9. The VFD shall resume normal operation after the cleaning cycle is complete.
   10. The VFD shall have a programmable Sleep functionality for PID control in pumping systems to stop the pump during low demand.
   11. The VFD shall have a specific “Sleep Boost” functionality to minimize the amount of unnecessary pump starts and stops during periods of low demand. The sleep boost function is used to boost the pressure or water level up before the pump shuts down in order to extend the pumps sleeping time.

O. The VFD shall support a torque boost function for applications where boosting of the torque is required for initial starting of the pump.

P. The VFD shall have a minimum of two independent process PID controllers as standard, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed loop control.
   1. The VFD shall have 250 mA of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by other suppliers.
   2. The loop controller setpoint shall be adjustable from the VFDs control panel, analog inputs, or over the serial communications bus.
   3. The VFD shall have a minimum of four constant setpoints available for each loop

controller.

4. The setpoint shall be possible to be set and displayed in engineering units. Using only percentage as setting and display unit is not acceptable.
5. There shall be two parameter sets for the first PID loop controller. Switching between the sets shall be possible via digital inputs, timed function, and serial communications or from the control panel.

Q. All setpoints, process variables, etc. shall be accessible from the serial communication bus. The VFD shall have the ability to calculate air or water flow from pressure difference. There shall be the possibility to use a differential pressure transducer or two separate pressure transducers. The control panel shall be able to display the flow in engineering units. PID controller shall be standard in the VFD, allowing an analog input signals to be connected to the VFD for the closed loop control. The VFD shall have 250 mA of 24 VDC power to power an external transmitter supplied by others. The loop controller set-point shall be adjustable from the VFD control panel, analog inputs, or over field bus. The set-point shall be set and displayed in engineering units.

R. The VFD shall provide a PLC-like programming capability as standard. It shall be possible to use different kinds of arithmetic, logical, selection, comparison, and operation function blocks to monitor and control the VFD, functions, inputs, outputs, and variables. There shall be a possibility to run different kinds of function block programs in different states and to set the criteria, when to change the state.

S. Fault Logger: A fault logger shall accommodate seven diagnostic values together with a date and time stamp.

T. The following protection functions shall be available:
   1. Dry pump Protection (prevents the pump from running dry, protecting the pumps bearings and shaft seal from damage when there is no water in the pump)
   2. Overvoltage and under-voltage controller
   3. Ground Fault (Earth-leakage) supervision
   4. Motor short-circuit protection
   5. Output and input switch supervision
   6. Overcurrent protection
   7. Phase-loss detection (both motor & line)
      i. The VFD shall have the capability to continue running at a reduced output current when an input phase-loss is detected.
      ii. The VFD shall have the capability to detect an open circuit on the output of the VFD without the requirement to have the VFD modulating.
   8. Underload and overload supervision
   9. Freely configurable supervisions for any parameter or signal to trigger an action.
   10. Communication loss functionality to ensure uninterrupted operation. The VFD shall have the capability to change the control location from PLC to another external location identified by user, e.g. VFDs embedded PID/loop controller and change back when communication is recovered.
   11. The VFD shall have pump protection functions for flow and pressure to avoid damages of the pump and for leakage detection.

i. Inlet protection for avoid dry run, cavitation, and blocked pipe.
ii. Outlet protection for avoid high pressure and leakages.
iii. Stall protection for avoid running locked pump.

12. The VFD shall have the capability to detect cavitation within the pump without need for external devices
    i. There shall be a possibility to enunciate a warning only, fault the VFD, or control the output frequency of the VFD to try and eliminate the cavitation.
    ii. There shall be user-programmable values for the cavitation control feature, to allow application specific response when controlling the output frequency.

U. The user interface shall have the following features:
1. Detachable Control Panel
2. The control panel shall include a backlit LCD.
3. The control panel shall have a real-time clock with battery backup for adding time stamps to events, as well as for use with timer functions.
4. The control panel shall provide a clear, interactive, context sensitive menu-based user interface to make it easy to adjust the settings of the VFD.
5. The display shall be in complete words, in a language selectable by the user, for programming and fault diagnostics (alphanumeric fault codes are not acceptable).
6. The control panel shall provide interactive assistants (wizards) to help to commission and use the VFD.
7. A dedicated "Help" button shall be available on the control panel. The Help button shall provide context sensitive assistance for programming and troubleshooting.
8. The control panel shall include Hand-Off-Auto selections and manual speed control.
9. The VFD shall have the capability to change the output phase rotation sequence by use of a parameter. This parameter must be independent from, and not affecting, any speed reference or direction input to the VFD.
10. A listing of changed parameters shall be readily available in order to assist with commissioning and troubleshooting.
11. The control panel shall have the capability to copy VFD settings from one VFD to another VFD, regardless of the VFD power, voltage, or enclosure rating.
12. The control panel shall have an editable "Contact info" that shows up in case of a fault.
13. The user shall be able to connect a PC tool with a standard USB cable to the control panel in order to set up and control the VFD. It shall be possible to connect the USB cable without using any tools.

PANEL SOLUTIONS / ENCLOSURE / PACKAGED DRIVE

V. Enclosure shall be UL (NEMA) Type 1 with Fans to exhaust hot air from the enclosure. Flange mounted VFDs are not allowed, VFD must be mounted to the backplate of the enclosure for ease of maintenance and exchange.
1. Enclosure shall not require side clearance and shall have the ability to be mounted side by side or back to back with 1" clearance.
2. Enclosures shall be no less than 14AWG.
3. Cabling to enclosure shall support *Bottom Entry / Bottom Exit, and Top Entry / Top Exist, Top Entry / Bottom Exit* for all enclosures up to 350HP without any

modifications to the standard enclosure design. Enclosures shall be wall-mounted only, floor standing enclosures are not allowed.

4. Non-thermostatically Controlled enclosure fans – UL Type 1 shall be utilized and powered from internally mounted control transformer.
5. Enclosure design shall be similar for power range 40-350 Hp @ 480V, for consistency of esthetics

W. Main Disconnect means shall be fused Disconnect.
   1. Rotary disconnect handle shall be pad-lockable in the off position, and support Lockout Tagout by having built in padlock mounting.
   2. Fused Disconnect / Disconnect with Fuses
      a. Shall be from the same manufacturer as VFD and provide a UL SCCR rating of 100kAIC.

X. Pilot Devices Packages
   1. Shall be 30 mm devices. H/O/A selector switch shall be mounted on the enclosure door.
      a. In Auto position, control wiring shall be prewired with customer interface terminal blocks to easily connect in a contact closure from DCS or Over-riding PLC control system to allow external controllers to Start/Stop the VFD.
      b. In Hand position, the VFD shall be issued a Run Command directly from the Hand contact.
   2. Indicating lights shall be 30mm devices and mounted on the front of the enclosure. These shall include:
      a. Power On Light – White in color
      b. VFD Running Light – Green in color
      c. VFD Fault Light – Red in color
   3. Red, Mushroom Head, twist to release style Emergency stop push button shall be provided as standard. This Emergency Stop push button shall be wired to the Safe Torque Off (STO) terminals of the VFD. The E-Stop button will consist of parallel contacts, both making/breaking simultaneously for control of parallel input signals on the VFD's STO.

Y. Customer Interface terminal blocks shall be integrated into the enclosure electrical design to allow for easy installation of field wiring
   1. Customer interface terminal blocks shall be prewired to internally mounted control relays which will support 120VAC control power for field signals.
      a. Control Relays shall have manual coil activation levers to allow for testing and troubleshooting
      b. Control Relays will have indication flags that display the status of the relay coil again for easy troubleshooting.
   2. Four predefined field signals common to pumping applications shall be prewired to customer interface terminal blocks and configured in the VFD as standard protections. Each input protection must be individually annunciated on the VFD's control keypad when activated to allow for ease of troubleshooting. Annunciation must be in clean descriptive terminology for the protection it serves. These four protections shall be:
      a. Motor Thermal Protection
      b. Low Flow Protection

c. Low Inlet Suction Pressure
d. High Discharge Pressure

3. There shall also be customer interface terminal blocks prewired to provide operating status of the VFD back to the DCS or Over-riding PLC control system. These signals shall be prewired to the dedicated terminal blocks and clearly identified in the electrical schematic drawings provided in submittals. The required status feedback signals that are prewired to the customer interfacing terminal blocks are:
   a. Motor Thermal indication
   b. Low Flow indication
   c. Low Suction Pressure indication
   d. High Discharge Pressure indication
   e. VFD Running Status
   f. VFD Fault Status
   g.

Z. Elapse time meter: Shall either be installed on the enclosure front door as a stand alone unit or provided by functionality built into the door mounted VFD keypad controller.

AA. Input Filters: Standard VFD must have 5% equivalent impedance built into the VFD module to reduce harmonics and protect VFD from transient voltages.
   1. VFD enclosure must be equipped with a passive harmonic trap filter mounted integral to the VFD enclosure. Externally, separate mounted trap filters are not acceptable.
   2. Passive harmonic trap filter shall be capable of meeting IEEE519-2014 harmonic mitigation levels for harmonic current and voltage distortion mitigation.
   3. Passive harmonic trap filter shall include a contactor which is controlled by the VFD's relay output and switched on at a user definable speed to help prevent leading power factor from occurring at low pump loads. Contactor manufacturer shall be same manufacturer as VFD.
   4. Separate Active Harmonic Filter technology is not allowed. Each VFD package must contain an integral Passive Harmonic Trap Filter to eliminate single point of failure concerns within the pumping control system.

BB. Control panel shall be mounted on front of the enclosure and maintain the integrity of the enclosure. Control panel holder shall be Non-Corrosive.

CC. Packaged VFD Solution shall be UL508A Rated

THE VARIABLE FREQUENCY DRIVE UNITS SHALL BE BASED ON AN ABB MODEL ACQ580.

4.14 ELECTRICAL POWER TRANSFORMER

A. Balanced 115/230 single phase power for the auxiliary circuits within the scope of each booster station shall be obtained by use of a 15 KVA dry, step down transformer. The transformer shall be wall mounting type, in a NEMA 3R non-ventilated weatherproof enclosure. Transformer shall operate with noise levels equal to or less than ANSI and NEMA standards. Transformer insulation shall be Class 180c.

B. The transformer shall meet the most recent standards for efficiency.

C. The unit shall be "UL" approved for indoor/outdoor application.

4.15 TELEMETRY CONTROL INTERFACE PANEL

A. It will be the responsibility of the station manufacturer to provide the following as an adjunct to the supplied telemetry equipment.

1. 1" telemetry entrance conduit complete to telemetry panel.
2. Size 12" x 12" NEMA 1 telemetry interface panel.
3. Separate 120 volt single phase power circuit in conduit to the telemetry interface panel.
4. Telemetry control circuits made up and in conduit from main control panel to telemetry interface panel terminal strip.
5. Metal framing channel to mount telemetry equipment.

4.16 ALARMS CONDITION AND OUTPUTS

A. The following alarms/status points shall be included within the booster pump station and wired back to the interface panel:

1. Provide indication as to the AUTO position of the HAND-OFF-AUTOMATIC selector switches on the pumps.

2. Water Within Station - The water alarm shall be a 120 volt AC circuit driven by a float switch wall-mounted within the equipment building. The float switch shall be of the magnetic float type with the float moving up and down a guide tube. One half (1/2) inch of float movement shall actuate the SPST reed type switch inside the guide tube. The switch shall be so mounted that when water reaches a point one (1) inch above the floor switch will activate the alarm.

3. Unauthorized entry alarms on hatches and doors - The unauthorized entry alarm shall be driven by a door-mounted limit switch. The limit switch shall be the adjustable arm, roller contactor type which makes an internal SPST micro switch. The switch will be so mounted as to active anytime the entrance man way door is opened.

4. Pump Motor Starter Failure – There shall be logic provided for detection, indication and alarm of the failure of the motor starter/controller.

5. Phase fail/power status alarm – The phase fail alarm shall be provided by 120 volt AC relay.

6. Low Suction Pressure alarm – The low suction pressure alarm shall be provided by the logic with input from the suction pressure transmitter.

7. High Discharge Pressure alarm – The high discharge pressure alarm shall be provided by the logic with input from the discharge pressure transmitter.

8. Fire/Smoke alarm – The fire/smoke alarm shall be provided by a fire/smoke detector in the station as an input to the logic.

9. High Station Temperature Alarm – The station high temperature alarm shall be provided by a thermostat in the station.

10. Low Temperature Alarm – The station low temperature alarm shall be provided by a thermostat in the station.

11. Generator On/Off – Generator status shall be provided by generator panel as described elsewhere in these specifications.

12. Generator Alarm Condition – Indication of any alarm condition transmitted from the alarm control.

13. Automatic Transfer Switch (ATS) Status – Indication of the position of the ATS shall be provided. Utility or Emergency.

4.17 PUMP MOTOR RUN TIME METER

A. The control panel shall contain one running time meter supplied for each pump to show the cumulative number of hours of operation.

B. The meter shall be enclosed in a dust and moisture proof molded plastic case, suitable for flush mounting on the main control panel.

C. The meter dial shall register in hours and tenths of hours up to 99999.9 hours before repeating.

D. The meter shall be suitable for operation from a 115 volt, 60 cycle supply.

4.18 ELECTRICAL PHASE MONITOR

A. A phase monitor shall be supplied to protect three-phase equipment against phase loss, undervoltage and phase reversal conditions.

B. When a fault is sensed, the monitor output relay opens within two seconds or less to turn the equipment off and/or cause an audio or visual alarm. Both Delta and Wye systems may be monitored. The monitor shall have an automatic reset and shall also include an adjustable voltage delay.

C. The monitor shall have an indicator LED (glows when all conditions are normal and shall monitor phase sequence: ABC operate (will not operate CBA). The phase monitor shall be UL approved and CSA certified.

4.19 SURGE PROTECTION DEVICE

A. A secondary surge arrester shall be provided. Housing shall be Noryl and be ultrasonically sealed. Valve blocks shall be metal oxide with an insulating ceramic collar. Gap design shall be annular. The lead wire shall be permanently crimped to the upper electrode forming part of the gap structure.

B. Arresters shall be UL and CSA listed Lightning Protective Devices.

4.20 ELECTRICAL CONDUIT AND WIRING

A. All service entrance conduits power and signal, shall be rigid steel conduit, individually sized to accept the inbound service conductors and telemetry/telephone/radio cables.

B. These service entrance conduits are installed by the installing contractor through the provided conduit cutout in the building floor. The exterior conduit cutouts shall be capped or plugged for shipment.

C. All wiring within the equipment enclosure and outside of the panel enclosures shall be run in conduit except where watertight flexible conduit is properly used to connect pump motors, fan motors, transformers, solenoid valves, limit switches, etc., where flexible connections are best utilized.

D. Devices and appliances where furnished by the original manufacturer and being equipped with a UL approved rubber cord and plug, may be plugged into a receptacle.

E. Equipment enclosure conduits shall be Schedule 80 PVC with solvent weld moisture-proof connections, in minimum size 3/4" or larger, sized to handle the type, number and size of equipment conductors to be carried.

F. The conduiting shall be in compliance with Article 347 of the National Electrical Code and NEMA TC-2, Federal WC-1094A and UL-651 Underwriters Laboratory Specifications.

G. Where flexible conduit connections are necessary, the conduit used shall be Liquid-tight, flexible, totally nonmetallic, corrosion resistant, nonconductive, U.L. listed conduit sized to handle the type, number and size of equipment conductors to be carried - in compliance with Article 351 of the National Electrical Code.

H. Motor circuit conductors shall be sized for load. All branch circuit conductors supplying a single motor of one (1) horsepower or more shall have an ampacity of not less than 125 percent of the motor full load current rating, dual rated type THHN/THWN, as set forth in Article 310 and 430-B of the National Electrical Code, Schedule 310-13 for flame retardant, heat resistant thermoplastic, copper conductors in a nylon or equivalent outer covering.

I. Control and accessory wiring shall be sized for load, type MTW/AWM (Machine tool wire/appliance wiring material) as set forth in Article 310 and 670 of the National Electrical Code, Schedule 310-13 and NFPA Standard 79 for flame retardant, moisture, heat and oil

resistant thermoplastic, copper conductors in compliance with NTMA and as listed by Underwriters Laboratories (AWM), except where accessories are furnished with a manufacturer supplied UL approved rubber cord and plug.

4.21 GAUGE PRESSURE TRANSMITTERS

A. Pressure transmitters shall be supplied to measure pump station suction and discharge pressure. The transmitters shall sense gauge pressure and transmit a 4-20 mA dc signal. The instruments shall measure pressure of a predetermined span. Range is to be fixed at 0-600 PSI. The accuracy shall be ≤±0.05% of span.

B. Each transmitter shall provide an analog output and include a standard LCD with touch control and bluetooth to provide Intelligent transmitter. The one-line digital indicator shall display the measurement in any selected units.

C. All process-wetted parts of each instrument shall be Type 316L stainless steel. The transmitter shall be protected by a gasketed, weatherproof IP66 and IP68 enclosure.

D. The transmitter shall have 1/4 inch NPT female threaded tapping ports.

E. Gauge Pressure Transmitter manufacturer: Endress Hauser PMP71B.

4.22 ELECTRICAL DEVICES

A. Multi-position switches including Hand-Off-Automatic switches shall be oil tight, 3-position maintained and be located on the main control panel door.

B. Indicating lights shall be oil tight, with a full voltage, LED pilot light.

C. Nameplates shall be furnished on all panel front mounted switches and lights.

D. Switches, lights and pushbuttons shall be Schneider Electric, Series XB, 22 mm, Die Cast Chrome plated devices. Pilot lights shall be with protected LED's for 120 Vac operation as XB4BVG,pushbuttons shall be non-illuminated, momentary contact, extended lens as ZB4BL and the switches shall be 2 position maintained, 2 position right-to-left, 3 position maintained, 3 position momentary-to-center, 3 position momentary from left to center, and 3 position momentary from right to center with standard black lever as ZB4BD.

Switches

1. Pump #1 Hand-Off-Auto, 3-position;
2. Pump #2 Hand-Off-Auto, 3-position;
3. Pump #3 Hand-Off-Auto, 3-position;

Lights

1. Red – Low Suction Pressure;
2. Red – High Discharge Pressure;
3. Green – Pump #1 in Operation;

4. Green – Pump #2 in Operation;
5. Green – Pump #3 in Operation;
6. Red – Pump #1 Failure;
7. Red – Pump #2 Failure;
8. Red – Pump #3 Failure.

E. The control panel door shall be complete on the interior with a stick-on transparency containing an "as-built" reproduction of the electrical control panel schematic. The wiring diagram shall be a corrected "as-built" copy & contain individual wire numbers, circuit breaker numbers, switch designation & control function explanations.

PART 5 – INSTRUMENTS - PROGRAMMABLE LOGIC CONTROLLER (PLC) BASED EQUIPMENT CONTROL SYSTEM

5.1 SCOPE

A. Provide one (1) complete Programmable Logic Controller (PLC) based control system as described herein. The system shall employ industry standard Programmable Logic Controllers as described herein. The system shall be completely factory integrated and tested in the factory and field run-in with factory personnel.

5.2 BASIS-OF-DESIGN PLC EQUIPMENT

A. This equipment specification and related documents represent a design based on the Allen-Bradley Micrologix 1400 Series Programmable Logic Controllers. Communications, interface, input/output and other peripheral devices have been proven to be 100% compatible with the Allen-Bradley equipment.

B. No other PLC equipment is acceptable unless the Engineer-of-Record provides notification of alternate system approval by addendum prior to the bid date.

5.3 GENERAL PLC SYSTEM REQUIREMENTS – COMPLETE SYSTEM RESPONSIBILITY

A. The Station manufacturer shall be the System Integrator and as such will assume full and complete responsibility for the Station PLC. Control System and related control functions and the telemetric communication for the full scope of supply.

B. This assumption of full responsibility shall include identifying all electrical, mechanical and plumbing schematics and wiring inter-connect diagrams, providing instrument installation details, preparing input/output listings, writing software, performing software and hardware integration, installation in the station at the factory, debugging, calibrating and tuning the various components and subsystems and providing training and warranty services.

5.4 UL LISTING REQUIREMENT

A. The system integrator shall produce panels that fully comply with Underwriters Laboratory Standard for Industrial Control Panels #508A.

B. All panels shall be cUL 508A listed. The cUL 508A "sticker" shall be clearly displayed in the appropriate location within the panel. The cUL 508A listing shall be in the name of the equipment manufacturer.

5.5 SYSTEM INTEGRATOR FACILITY & STAFF

A. The station manufacturer shall have on staff Control System Engineers who are dedicated to the development of PLC programs, SCADA software, Instrumentation configuration and control logic development. The system integrator shall have electrical engineers on staff dedicated to the development of panel wiring diagrams, panel layouts and general electrical design.

B. The system Integrator shall have a field service department fully equipped, trained and competent field service technicians able to work on any and all devices provided with this system. The system integrator shall have been in the business of providing telemetry, control and SCADA systems to the water production and water distribution market for no less than 20 years.

5.6 CONTROL PANEL - DESIGN, ASSEMBLY & TEST

A. The PLC panel design, assembly, the integration of component parts and startup will be the responsibility of the manufacturer of record for the factory-built water distribution equipment. That manufacturer shall maintain at its regular place of business a complete PLC design, assembly and test facility to assure continuity of control design with equipment application.

5.7 GENERAL EQUIPMENT SPECIFICATIONS FOR PLC CONTROL SYSTEMS

A. Enclosures:

1. Enclosures shall be NEMA 1 for indoor and NEMA 4 for outdoor locations. Enclosure shall be fabricated from a minimum of 14-gauge cold rolled steel with a baked enamel finish in the manufacturer's standard color. Units shall include a single gasket front door. Hinges, locking hasp and door clamping hardware shall be included.

B. Incoming Power Requirements & UPS:

1. Controls shall operate from a source of 120 volts, 1 phase, 60 Hz. Each panel shall be accompanied with an uninterruptible power supply (UPS). The UPS shall condition the power as well as provide 500 VA of power during outages. A 6-amp control power circuit breaker shall be employed as both a method of equipment protection and as a means of power disconnection. The circuit breaker shall be a single pole, thermal, magnetic type with a 10,000 Amp Interrupt Current rating. The circuit breaker shall be

UL listed.

C. Power Supplies:

1. All DC power supplies required for operation shall be provided. Units shall provide sufficient voltage regulation and ripple control to assure powered components can operate within their required tolerances.

D. Wiring Requirements:

1. All wiring shall be in complete conformance with the National Electrical Code, state, local and NEMA electrical standards. All incoming and outgoing wires shall be connected to numbered terminal blocks and all wiring neatly tied and fastened to chassis as required.

5.8 PROGRAMMABLE LOGIC CONTROLLER (PLC) - MICROLOGIX 1400:

A. Provide microprocessor-based Programmable Logic Controllers (PLC) as detailed in this specification and on the applicable plan sheets. The PLC shall be capable of use in a stand-alone configuration and also be capable of being networked into a larger system. It shall be specifically suitable for use in a telemetry system as an intelligent remote telemetry unit. The PLC shall be programmable in standard ladder logic.

B. The PLC shall have a processor and thirty-two (32) embedded discrete I/O. The I/O shall be expandable with the use of expansion I/O. The expansion I/O shall not require a "rack" in which to be mounted.

C. The program shall be stored on non-volatile Electrically Erasable Programmable Read Only Memory (EEPROM) modules. The CPU shall have 10,000 bytes (10K) user memory and perform 32 bit signed math functions. The CPU shall have integral to it, two communications ports capable of RS-232 DF-1 half, and full duplex serial communications as well as MODBUS RTU Slave protocol, and DF- 1 radio modem. The CPU also shall have a third port integral to it a communications port capable Ethernet communications. The CPU shall have on-line programming feature without interrupting the program running at the time.

D. The PLC shall be powered from 85/265 VAC 60 Hz line power.

E. The PLC shall be U.L. listed, C-U.L. listed, CE compliant and suitable for use in Class 1, Division 2, Groups A, B, C and D environments.

F. The PLC shall be equipped with the following embedded discrete I/O:
   1. 20 - 120 VAC inputs.
   2. 12 - relay outputs.

G. The CPU shall have a LCD display integral to the unit for display of status and selectable information.

H. The PLC shall have expansion I/O capabilities as follows:

1. Discrete Input Modules:

   Discrete input modules shall be available in 8 channel configurations. The modules shall accept 20-48 VDC, 100-240 VAC signals. Modules shall have a removable terminal strip.

2. Relay Output Modules:

   Relay output modules shall be available in 8 channel versions. Modules shall be rated for 5-265 VAC and 5-125 VDC voltages.

3. Analog Input / Output Module:

   Analog input modules shall be available in 4 channel configurations, 2 inputs and 2 outputs. The modules shall be rated for input signals between 4 mA and 20 mA., or 0 – 10 VDC. The module shall employ a 12 bit analog to digital conversion chip. Outputs shall be either 0-10 VDC or 0-20 mA DC. The output digital to analog converter shall have 12 bit resolution.

I. The PLC shall be manufactured by Allen-Bradley Co. a division of Rockwell International being Model Micrologix 1400, series 1766.

5.9 OPERATOR INTERFACE EQUIPMENT – 7” COLOR

A. The PLC control system shall include a 7” High-Definition front panel mounted touch screen display for operator interface. The display shall have a screen with 800 x 480 pixel resolution using 16.7M-color TFT LCD. The screen shall have no touch cells and utilize analog resistive technology. Unit shall have 128mb of operating RAM, 128mb flash, and a high-speed 600MHz processor. Unit shall have a real time clock chip as a standard option. Operator interface shall have integrated Ethernet port and shall support the Allen-Bradley Ethernet/IP protocol.

B. The color touch screen operator interface shall be manufactured by Weintek USA Inc. Kenmore, WA 98028, Model #MT8071iE, iE Series. All required communication modules, cables, and accessories shall be provided for a complete and operational system.

5.10 PROGRAMMING SOFTWARE

A. All PLC equipment supplied on this project shall be programmable in standard ladder logic and/or function blocks. The logic development and configuration software shall be the same for all PLC's listed in this specification. Equipment requiring separate program development and configuration software for each product is not acceptable.

B. The software program shall be Windows based and be Microsoft certified for use with Windows 10.

C. The software shall be able to develop the ladder logic programs, provide equipment configurations, diagnostics for both equipment and software, upload programs, download programs, and edit programs "on-line" where applicable.

D. The software shall be as manufactured by Rockwell Software, a division of Rockwell Automation, Model RS-LOGIX.

5.11 ETHERNET SWITCH

A. Ethernet switch to have 5 TP RJ45 ports minimum. Switch shall be an unmanaged switch with auto-negotiation, auto-crossing and store and forward switching mode. Data transmission speed shall be 10/100 Mbps. The switch supply volage range shall be 9-32VDC.

B. Ethernet switch shall be Phoenix Contact p/n 1085039, or equal.

5.12 OPERATION DESCRIPTION FOR PLC BASED and VFD CONTROLLED PUMPING SYSTEM

A. There shall be control algorithms programmed into the Programmable Logic Controller (PLC) to operate the system based on an operator adjustable discharge pressure target setpoint.

B. The system shall control pump starting and stopping, the cascading of pumps and pump speed through the variable frequency drives based upon station flow with safety cutouts based upon suction pressure and discharge pressure and pump speed. The PLC shall be programmed by personnel who are an employee of the station manufacture to insure a single source of responsibility and maintenance.

C. If the station discharge pressure drops below the Lead pump call, the PLC shall start a pump. Once the pump is started, the PLC-VFD system shall operate automatically to adjust the output of the selected pump in order to maintain an adjustable discharge target pressure setpoint for the operation of the station.

D. Pump output shall be adjusted by varying the speed at which it operates. The speed shall be controlled by a variable frequency drive (VFD) and the calculation of needed pump speed shall be performed by a programmable logic controller (PLC).

E. The PLC shall employ a standard Proportional Integral and Derivative (PID) algorithm to calculate the 4-20mA speed reference output to the drives needed to maintain the station setpoint. Initially, the VFD's shall provide ramping speed control on start and stop. When the percentage VFD speed is equal to or less than the minimum off percentage setpoint a pump stop call shall start ramping down the VFD's.

F. The pumps shall be brought on and offline in a cascading sequence as controlled by the pump selection/alternation portion of the control algorithm. Pump speed, with two or more

pumps online, shall be the same for all pumps. When a pump comes online, its speed shall increase from the minimum speed while the online pump(s) speed continues to adjust to try and maintain discharge target pressure.

G. Pumps going offline shall be done in the opposite manner to avoid pressure surges in the system.

H. Pump speeds shall be set at the minimum allowed for the proper motor cooling. These minimum speeds shall be set into the VFD program parameters.

I. Manual speed control can be accomplished through the use of a speed adjustment feature on the VFD unit or HMI screen.

PART 6 –FACILITIES EQUIPMENT

6.1 MAJOR EQUIPMENT AT THIS SITE:

A. Allen-Bradley Micrologix 1400 PLC;
B. NEMA enclosure;
C. Pressure transmitters (2);
D. Complete configuration & programming;
E. Operator Interface Unit;
F. Other devices as needed to provide a complete and operable installation.

6.2 STATION EXTERIOR LIGHTING

A. An exterior light shall be provided as located on the drawing. The light shall be 20 watt LED, 5K color, and 1532 lumens. Housing shall be one piece, injection molded, bronze polycarbonate. A button type photo control shall be provided

6.3 STATION INTERIOR LIGHTING

A. There shall be one or more forty eight (48) inch minimum length LED light fixtures installed within the equipment enclosure, as shown on the plan for this item. The fixture shall be 120/277VAC, 6000 lumens minimum with a medium distribution lens, 4K color temp, and be UL Listed for a wet environment. The light switch shall be of the night glow type and be located conveniently adjacent to the door.

B. Open fixtures will not be accepted.

6.4 HEATING/COOLING/EXHAUST UNIT

A. The unit shall be one-piece, wall-mounted, factory-assembled, pre-charged, prewired, tested and ready-to-operate. The unit shall have a limited warranty of 5-years on parts and 1-year on compressor. Capacity and EER certified in accordance with ANSI/ARI Standard390-2003.

1. One (1) each exterior wall mounted, hard-wired as shown;
2. Enclosed weatherproof casing constructed of 20 gauge galvanized steel, finished with baked-on polyester enamel paint;
3. One (1) washable filter;
4. Remote adjustable thermostat;
5. Refrigerant: 410A (HFC);
6. Minimum EER Rating: 9.00

Cooling Capacity	BTUH	Breaker size	CFM @ 0.2" ESP, (Max/Min)	Heater	Bard Manufacturing Part Number
2.5 Ton	29,600	30	1285/885	15 KW	W30A1-C15BW

6.5 DEHUMIDIFIERS

A. One (1) each, installed as shown.
B. Capacity 30 pints per 24 hours.
C. Compressor rated 115 volts, 60 Hz, 4.3 operating amps.
D. 106 CFM fan, 2 fan speed.
E. Humidity range 35 to 80% RH, ambient temperature range of 41 to 95 F, Type R410A refrigerant.
F. Washable filter.
G. Condensate piped direct to drain.
H. UL listed rubber cord.

6.6 ENGINE GENERATOR SET - STATION DIESEL GENERATOR SET

A. The station manufacturer will provide a generator set and automatic transfer switch with the booster pump station of sufficient size to run the total connected load. The generator set will be shipped separately and pad mounted at the jobsite.

B. The installing contractor is responsible for providing an appropriate lifting device to unload the generator when delivered.

C. The installing contractor shall be responsible for setting the engine-generator, securing it to the pad, and connecting it into the transfer switch.

D. STATION PROJECT CONDITIONS

Engine generator system shall withstand; -10° F. to 104° F. [-23° C. to 40° C.] ambient temperature and at an altitude of 1000 feet, without degradation of performance capability.

E. WARRANTY

Manufacturer shall provide warranty coverage on the material and workmanship of the generator set for a minimum of 24 months from registered commissioning and start-up.

6.7 ENGINE-GENERATOR SET

A. Emergency/Standby Power engine-generator set, compliant with UL 2200, IBC Seismic, 4-cycle, 1800 RPM, diesel engine, brushless generator, torque-matched excitation, digital automatic voltage regulator, digital set-mounted control panel, set mounted high ambient 122° F. [50° C.] cooling system.

B. The generator set ratings shall be a minimum of 150 kW, 180 kVA at .8 PF, Standby rating with system voltage of 277/480 volts AC, 3 phase, 4 wire, 60 hertz.

C. Prototype Tests and Evaluations shall have been done on a complete and functional unit, component level type tests will not substitute for this requirement.

D. Steady-State voltage regulation shall be 1 percent of rated voltage for any constant load between no load and rated load.

E. Transient Voltage Performance shall be not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state regulation band within 4 seconds.

F. Steady-State frequency regulation shall be isochronous from steady state no load to steady state rated load.

G. Transient Frequency Performance shall be not more than 6 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 5 seconds.

H. The diesel engine-generator set shall be capable of single step load pick up of 100% nameplate kW at rated power factor, less applicable derating factors, with the engine-generator set at operating temperature and recover to stable voltage and frequency within 10 seconds.

I. Motor starting capability shall be a minimum of 540 *S*kVA at 20 percent voltage dip as tested per IEEE Standard 115.

J. Sustained Short-Circuit Current: For a PMG Excitation, 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds without damage to generator system components. For a 1-phase, bolted short circuit at system output terminals, system shall regulate both voltage and current to prevent over-voltage conditions on the non-faulted phases.

K. ENGINE:

1. The engine shall be 4 cycle, 1800 RPM, direct injection diesel. Minimum engine displacement shall be 415 cubic inches [6.8 Liters], with 6 cylinders and shall meet the current EPA Tier Level at the time of production.

2. The engine shall have an isochronous electronic governor with speed sensing. Fuel rate

shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous states.

3. The engine shall be cooled by an open unit-mounted closed loop radiator system rated for full rated load operation in 122°F (50°C) ambient condition with the ambient temperature as measured at the generator air inlet. Generator sets installed indoors shall be provided with a flexible radiator duct adapter flange. The cooling system shall be filled with 50/50 ethylene glycol/water mixture by the equipment supplier. Rotating parts shall be guarded against accidental contact.

4. The engine shall include the following accessories; an electric starter capable of three complete cranking attempts without overheating, positive displacement lubrication oil pump, full flow replaceable spin-on canister lubrication oil filters, positive displacement fuel pump, replaceable spin-on canister, primary water separator, fuel filter, replaceable dry element air cleaner with restriction indicator, flexible supply and return fuel lines, and engine mounted battery charging alternator.

6.7 BASE:

A. The engine-generator set shall be mounted on a heavy duty steel base to maintain alignment between components. The base shall incorporate a battery tray with battery hold down clamps within the rails. Provisions for stub up of electrical conduits shall be within the footprint of the set. Vibration isolators shall be integral between generator set and base or base and base tank.

6.8 AC GENERATOR:

A. The AC generator shall be synchronous, four pole, and revolving field, drip proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 standard temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 125° C. The broad range (12 lead) generator shall be capable of delivering rated output (KVA) at rated frequency and power factor.

B. Subtransient Reactance of the generator shall not be in excess of 12 percent, based on the rating of the engine generator set.

C. A PMG excitation system shall provide a separate power source from the main generator output to the automatic voltage regulator. The automatic voltage regulator shall be Solid State type, providing performance as specified. The voltage regulation system shall be microprocessor-controlled, full wave rectified, provide a pulse-width modulated signal to the exciter, and include an under- frequency protection function.

D. The automatic voltage regulator shall control buildup of AC generator voltage to provide a linear rise and limit voltage overshoot. The regulator shall include an under frequency roll-off volts per hertz characteristic, which shall reduce output voltage in proportion to

frequency below an adjustable threshold.

6.9 ENGINE-GENERATOR SET CONTROL:

A. The control shall be microprocessor based and provide automatic starting, monitoring, protection and control functions.

B. Provide cycle cranking of 15 SEC (ON)/15 SEC (OFF) for three attempts (75 SEC). If engine fails to start, lockout the engine and indicate overcrank on alarm status panel.

C. Automatic Starting System Sequence of Operation: When mode-selector on the control is in the AUTOMATIC position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector is switched to the ON position, generator set starts. The OFF position of same selector initiates generator-set shutdown. (Selectors with different configurations but equal functions are acceptable.) When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

D. Manual Starting System Sequence of Operation: Switching ON-OFF selector on the generator control panel to the ON position starts generator set. The OFF position of same selector initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

E. Operating and safety indications, protective devices, system controls, engine gauge display and associated equipment shall be grouped in a common control and monitoring panel. Mounting method shall isolate the control panel from generator-set vibration.

F. The control shall include indicating and protective devices and controls as required by NFPA 110 for Level 1 system, AC voltmeter, AC ammeter, AC frequency meter displays, Fault Reset Switch, DC voltmeter, Engine-coolant temperature gauge, Engine lubricating-oil pressure gauge, Running-time meter displays, fuel tank derangement alarm, and Emergency Stop Switch with lock-out/tag-out provisions.

G. The control shall include generator-voltage digital raise/lower switch. The control adjustment of these parameters in a range of plus or minus 5% of the voltage operating set point.

H. The control's AC system protection shall include over/under voltage, loss of voltage reference, and over excitation shut down protection. There shall be an overload warning, and overcurrent warning alarm. Status LED indicating lamps to indicate, existing shutdown condition, existing alarm condition, and not in auto.\

I. The control system shall include a Digital display panel, with appropriate navigation devices,

shall be provided to view all information noted above, as well as all engine status and alarm/shutdown.

J. The control system shall log the latest 1000 individual alarm and shut down conditions, the total number of times each alarm or shutdown has occurred, and the date and time the latest of these shutdown and fault conditions occurred.

K. The control system shall continuously monitor DC power supply to the control, and annunciate low or high voltage conditions.

6.10 GENERATOR SET AUXILIARY EQUIPMENT AND ACCESSORIES:

A. Generator Main Circuit Breaker: Set-mounted and wired, UL listed, molded case thermal-magnetic type, rated at 250 amps, 3 pole, 480 volts.

B. Coolant Heater: Engine mounted, thermostatically controlled, water jacket heater(s) for each engine. The heater(s) shall be sized as recommended by the equipment supplier. Installed with isolation valves to isolate the heater for replacement of the element without draining the engine cooling system or significant coolant loss. Heater voltage and wattage shall be as recommended by the manufacturer.

C. Starting and Control Batteries: Starting batteries, lead acid type, 12 or 24 volt DC, sized as recommended by the engine manufacturer. Battery cables and connectors as recommended by the engine manufacturer for cable length as required.

D. Battery Charger: A 6 Amp, UL Listed, voltage regulated battery charger shall be provided for each engine-generator set. Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with automatic float, taper and equalize charge settings. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps @ 120 VAC, 2 amps @ 30 VDC for remote indication of:

1. Battery charger fault - yellow light
2. Low battery voltage - yellow light
3. High battery voltage - yellow light
4. Power ON - green light (no relay contact).

E. Muffler/Silencer: Selected with performance as required to meet sound requirements of the application, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. For generator sets with outdoor enclosures the silencer shall be inside the enclosure.

F. Sub-Base Fuel Storage Tank: Provide a UL listed dual wall sub-base fuel storage tank with 298 gallons capacity. Comply with NFPA 30 and NFPA 37. The tank shall be made of corrosion resistant steel. Tank shall include a fuel level gauge. The station manufacturer or generator set supplier is not responsible for the initial fuel supply.

G. Enclosure: Outdoor weather-protective, Level 1 sound attenuating, enclosure shall be

provided as factory-assembled to the generator set base and radiator cowling. Housing shall provide ample airflow for generator set operation. The housing shall have hinged side-access doors and rear control door. All doors shall be lockable. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color. Reduce the sound level of the engine generator while operating at full rated load to a maximum of 75 dBA measured at any location 23 feet [7m] from the engine generator in a free field environment.

H. Remote Emergency-Stop Switch: wall mounted, unless otherwise indicated; and labeled "Generator Emergency Stop". Push button shall be protected from accidental operation and contain a lockable feature (per NEC 2017).

I. The generator set shall be Kohler Power Systems, Model 150REOZJF.

6.11 AUTOMATIC TRANSFER SWITCH

A. Complete factory assembled service entrance rated transfer equipment with electronic control designed for power transfer, voltage sensors on both sources, single-solenoid mechanism, manual handle provided for maintenance purposes, positive mechanical and electrical interlocking and mechanically held contacts. Transfer switches must be specifically intended for service entrance applications, and labeled "Suitable for service entrance use only". Molded case circuit breaker must be UL 489 listed.

B. Entire transfer switch including enclosure must be listed and labeled to UL 1008; switches with only the mechanism listed are not acceptable.

C. Manufacturer shall provide warranty coverage on the material and workmanship of the automatic transfer switch for a minimum of 24 months from registered commissioning and start-up.

D. Ratings: Comply with requirements for NFPA 110, Level 1 equipment. Refer to the Project drawings for confirmation on the size(s) and type(s) of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.

Type	Automatic Transfer Switch
Current Rating	400 A
System Voltage	480 VAC, 3-Phase / 4-Wire
Number of switched phases	3
Switched neutral	No
WCR @ V	35,000 A @ 480 VAC
Enclosure	NEMA 1, Indoor
IBC seismic certification	

Main contacts shall be rated for 600 Volts AC minimum.

E. Transfer switches shall be rated to carry 100 percent of rated current continuously in the enclosure. Circuit breaker type transfer switches do not meet this specification.

F. Transfer switches shall be continuously rated in ambient temperatures of -30°C. to +60°C (-22°F. to +140°F), relative humidity up to 95% (non-condensing) and altitudes up to 10,000 feet.

G. Transfer switch equipment shall have a withstand and closing rating (WCR) in RMS symmetrical amperes greater than the available fault currents shown on the drawings.

H. Construction:

1. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in both positions.

2. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishment. Arc chutes shall have insulating covers to prevent interphase flashover.

3. Provide two sets of auxiliary contacts on both sources, operated by transfer switch position, rated 10 amps 250 VAC.

4. Enclosures shall be UL listed. The enclosure shall provide NEC wire bend space. The cabinet door shall be key-locking. Provide switch position indicator lamps and power available lamps for both sources (four total) on the outside cabinet door.

5. Transfer switches shall be mounted in enclosures as designated on the drawings. Separate enclosures shall be the NEMA type specified. Manual operating handles shall be accessible to authorized personnel only by opening the key-locking cabinet door.

I. Automatic Controls:

1. Control shall be solid-state and designed for a high level of immunity to power line surges and transients. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs and relays on all outputs. Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEC 61000-4-5.

2. Solid state undervoltage sensors shall simultaneously monitor all phases on the normal source and single phase on generator source. Pick-up and drop-out settings shall be adjustable. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage. Provide adjustable underfrequency sensing on generator source.

3. Automatic controls shall signal the engine-generator set to start upon signal from normal source sensors. Solid-state time delay start, adjustable from 0 to 5 seconds (factory set at 2 seconds) shall avoid nuisance start-ups. Battery voltage starting contacts shall be dry type contacts factory wired to a field wiring terminal block.

4. The switch shall transfer when the emergency source reaches the set point voltage and frequency. Provide a solid-state time delay on transfer, adjustable from 0 to 60 minutes.

5. The switch shall retransfer the load to the normal source after a time delay retransfer, adjustable from 0 to 9 hours 59 minutes 59 seconds. Retransfer time delay shall be immediately bypassed if the emergency power source fails. A generator stabilization time delay shall be provided after transfer to emergency adjustable 0 to 4 seconds.

6. Controls shall signal the engine-generator set to stop after a time delay, adjustable from 0 to 60 minutes 59 seconds, beginning on return to the normal source.

7. Power for transfer operation shall be from the source to which the load is being transferred.

8. The control shall include provisions for remote test, transfer inhibit, and retransfer inhibit.

9. A variable window inphase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer.

10. Provide devices mounted on cabinet front consisting of push button selector switches to provide the following positions and functions:
11. Test - Simulates normal power loss to control for testing of generator set. Controls shall provide for a test with or without load transfer.

12. Override - Override programmed delays, and immediately go to the next operation.

13. The indicator panel LEDs shall display; which source the load is connected to (normal source or generator source), which source or sources are available, when switch is not set for automatic operation or the control is disabled, when the switch is in test/exercise mode.

J. Accessory Items:

1. Transfer switches as shown on the drawings shall be equipped with accessories as follows:

a. Exerciser Clock: Provide solid state exerciser clock to set the day, time, and duration of generator set exercise/test period. Provide a with/without load selector switch for the exercise period.
b. The automatic transfer switch shall be ASCO Model 300.

6.12 SERVICE ENTRANCE MAIN BREAKER

A. Upstream of the automatic transfer switch, shall be a factory installed service entrance rated main breaker. The main breaker shall be rated for 277/480V, 3PH, 4W, 400A service and 35kAIC fault current. The enclosure shall be NEMA 1 and the entire assembly mounted inside the pump station.

WARRANTY STATEMENT

The warranty for the booster pumping system is the sole responsibility of the booster pumping system manufacturer and includes the following:

1. The warranty shall be for a period of two (2) years commencing upon station startup.

2. The two (2) year warranty period shall be inviolate regardless of any component manufacturer's warranty for equipment and components within the station.

3. The warranty shall cover all equipment, components and controls, provided under this contract by the booster pumping system manufacturer, exclusive of those components supplied by and/or installed by others independent of the control of the booster pumping system manufacturer.

4. The booster pumping system manufacturer shall bear the full cost of labor and materials for replacement and/or repair of faulty or defective components, or controls, supplied by the booster pumping system manufacturer on site as required so there shall be no cost incurred by the Owner for this work during the warranty period.

5. No assumption of contingent liabilities for any component failure during warranty is made.

This warranty is provided by the booster pumping system manufacturer as the single party responsible for warranting all components included with the booster pumping system on site and all aspects of performance as specified. The booster pumping system manufacturer does not utilize "Second Party" or "pass through" warranties. All warranty service will be provided by factory direct booster pumping system manufacturer employees.

Dated: _____

_____
Company Name

State of _____

County of _____

_____
Company Officer’s Signature

The above WARRANTY STATEMENT was signed and acknowledged before me on this ___ day of _____, 20___ by _____(Officer), acting in the aforesaid capacity for _____(Company).

_____
Notary Public

CERTIFIED WELDING AND STEEL STATEMENT

All capsule, skid, structural, transmission piping, pipe and equipment supports, and restraint, welding; shall only be performed by certified welders.

All transmission piping or pressure vessel welding shall be performed by individuals certified to weld carbon steel pipe under ASME CODE SECTION IX.

All other welding shall be performed by individuals certified under ASME CODE SECTION IX or by the American Welding Society (AWS) Structural Welding Code, Section 9.10.

Prior to welding all structural supports, transmission piping, pipe and equipment supports, and restraints, shall be grit blasted to near while blast cleaning (SSPC-SP10).

All steel used for fabrication of the booster pumping system shall be domestic. This includes, but is not limited to, all steel used in fabricating the capsules, skids, all structural steel, all supports and bracing, and all transmission piping, flanges, and fittings.

Dated: _____

_____
Company Name

State of _____

County of _____

_____
Company Officer's Signature

The above CERTIFIED WELDING AND STEEL was signed and acknowledged before me on this ___ day of _____, 20___ by _____(Officer), acting in the aforesaid capacity for _____(Company).

_____
Notary Public

CORROSION PROTECTION STATEMENT

Detailed in this submittal is a complete manufacturing methodology for corrosion protection to be utilized by the booster pumping system manufacturer. Key components of that manufacturing methodology are listed below.

SURFACE PREPARATION AND EXTERIOR COATING

All surfaces of the entire structure including the entire skid and base plate shall be grit blasted equal to near white blast cleaning (SSPC-SP10).

Following blasting and directly before full painting, all weldments will be hand primed with a covering primer coating.

The protective coating shall take place immediately after surface preparation. The protective coating shall consist of a two component, high solids, amide-cured epoxy system formulated for high build application having excellent chemical and corrosion resistant properties. The epoxy system shall be self-priming and require no intermediate coatings. The protective coating shall provide in two (2) applications a total dry mil thickness of 8.0 mils minimum, 11 mils maximum.

FUSION BONDED EPOXY INTERNAL PIPE COATING

The internal surfaces of piping to be fusion bonded coated shall be grit blasted to an SP-10 finish with the finish profile required by the coating material manufacturer.

The internal, wetted surfaces of the steel transmission piping shall have applied to it a Fusion Bonded Epoxy Coating on the interior pipe surface. The coating shall be applied and meet the testing requirements of Table 1 and Table 2 with the exception of Table 2 section 7 per AWWA C-213.

The powder coating product shall be National Sanitation Foundation (NSF) Standard 61 certified material.

The epoxy powder coating shall be Powdura NSF-61 ELS8-80003 from Sherwin WIlliams.

Prior to shipment of the station, the station manufacturer shall provide in writing to the Engineer certification that the fusion bonded epoxy coating has been applied to all internal surfaces of the steel piping using the proper method. Said certification shall show under the station manufacturer's letterhead:

- Date of application;
- Material manufacturer and product designation including a product data sheet for the coating;
- Applier of the fusion bonded coating, name, address and phone number;
- Notarized signature of an officer of the station manufacturing company stating the fusion bonded epoxy coating was applied to AWWA Standard C213-91 or the latest revision.

PIPING

Piping shall be steel and conform to material specification ASTM A-53 (CW) for nominal pipe size four (4) inch and smaller and ASTM A-53 (ERW) Grade B for nominal pipe size five (5) inches and larger. Steel butt-welding fittings shall conform to material specification ASTM A-234 Grade WPB and to the dimensions and tolerances of ANSI Standards B1.9 and B16.28 respectively.

Forged steel flanges shall conform to material specification ASTM A-105 Class 60 and/or ASTM A-181 for carbon steel forgings and to the dimensions and tolerances of ANSI Standards B16.5 as amended in 1992 for Class 150 and Class 300 flanges.

The piping sizes shall be as shown on the drawing.
Size 10 inch and below - Schedule 40
Size 12 inch and above - Standard weight (.375" wall)

All pipe welds shall be performed by certified welders employed by the booster pumping system manufacturer. As part of the equipment submittal, the pumping system manufacturer shall provide copies of the welding certificates of the employees who are to perform the pipe welds.

All piping surfaces shall be prepared by sandblasting, or other abrasive blasting, prior to any welds taking place. Piping or 5" diameter and smaller may be cut by saw. Piping of 6" diameter and larger shall be bevel cut, and Oxyfuel or Plasma-arc cutting techniques shall be used to assure and facilitate bevel pipe cuts. No saw cuts or other form of abrasive cut-offs are allowed on 6" and larger diameter pipe.

In all cases, short circuit transfer, spray transfer or pulse-arc transfer modes of the gas metal arc welding process shall be applied semi-automatically. When utilizing the short circuit mode, shielding gas shall be used. When utilizing the short circuit mode, shielding gas consisting of 50% carbon dioxide and 50% argon gas shall be used. When utilizing the spray or pulse-arc transfer modes, a shielding gas consisting of 5% carbon dioxide and 95% argon shall be used. In all cases, welding wire with a minimum tensile strength of 70,000 psi shall be employed. All tensile strength of 60,000 psi shall be employed. All flange welds and butt welds of equal size pipe shall be a single continuous nonstop weld around the complete circumference of the pipe. Whenever possible, vertical up weld passes will be applied to all pipe welds. No vertical down weld passes will be allowed. Completed welding assemblies shall create no internal obstruction, restriction or create any unintended sources of water deflection.

Piping of six (6) inch diameter and larger shall require a minimum of two (2) weld passes to complete each weld. The first pass, or root pass, shall be applied at the bottom of the bevel cut using the short circuit transfer welding mode, and the second pass, or cap pass, shall be applied over the root pass using the spray or pulse arc transfer welding modes to insure that at a minimum the total weld thickness shall be equal to thinnest of the two (2) pieces being welded together.

Dated: _____

_____
Company Name

State of _____

County of _____

_____
Company Officer's Signature

The above CORROSION PROTECTION SYSTEM STATEMENT was signed and acknowledged before me on this ___ day of _____, 20___ by _____(Officer), acting in the aforesaid capacity for _____(Company).

_____
Notary Public

FACTORY START-UP AND SERVICE STATEMENT

Start-up and warranty service shall be performed by the booster pumping system manufacturer factory direct employees. No representative, contract service organization or third party of any sort shall be directed to perform such services by the booster pumping system manufacturer.

1. Start-up and warranty service technicians shall be regular factory direct employees.

2. At least one of the following factory direct employees will perform all services and warranty work as required on the booster pump station:

EMPLOYEE NAME	POSITION	YEAR OF SERVICE
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

3. One (1) or more of the Service Technicians listed above will perform the required start-up and warranty service on the booster pumping system.
4. A total of one (1) day for start-up and training on site shall be provided.
5. Start-up service to include two (2) bound O&M Manuals for the booster pumping system.
6. All start-up or service reports shall be attested to by start-up technician and representatives of Owner or Engineer.
7. Service reports shall be distributed to:
   a. Manufacturer's File
   b. Engineer's File
   c. Contractor's File
   d. Owner's File

Dated: _____

_____
Company Name

State of _____

County of _____

_____
Company Officer’s Signature

The above FACTORY START-UP AND SERVICE STATEMENT was signed and acknowledged before me on this ___ day of _____, 20___ by _____(Officer), acting in the aforesaid capacity for _____(Company).

_____
Notary Public

APPLICABLE STANDARDS AND LISTINGS

This booster pumping system will be manufactured to pertinent sections of the following standards and listings:

1. Underwriters Laboratories, Inc. (UL) ULQCZJ, UL508, UL508SE, UL58,
2. National Electric Code (NEC) Compliance
3. American Water Works Association
4. Electrical Testing Laboratory (ETL)
5. American National Standards Institute (ANSI)
6. American Society for Testing and Materials (ASTM)
7. American Welding Society (AWS)
8. American Society of Mechanical Engineers (ASME)
9. Society For Protective Coatings (SSPC) (formally Steel Structures Painting Council)
10. National Sanitation Foundation (NSF)
11. Ten States Standard

Dated: _____

_____
Company Name

State of _____

County of _____

_____
Company Officer's Signature

The above APPLICABLE STANDARDS AND LISTING STATEMENT was signed and acknowledged before me on this ___ day of _____, 20___ by _____(Officer), acting in the aforesaid capacity for _____(Company).

_____
Notary Public

CERTIFICATION OF COMPLIANCE

We the undersigned booster pumping system manufacturer have reviewed the plans and specifications and herein certify we will bid the project as specified without exception or deviation.

We the undersigned booster pumping system manufacturer understand conditional proposals will not be accepted and submission of a proposal by a booster pumping system manufacturer, will constitute an incontrovertible representation by the booster pumping system manufacturer that without exception the proposal is premised upon all work as required by these plans and specifications and will be completed fully as specified.

We the undersigned booster pumping system manufacturer understand the Contract Documents are the final authority for acceptance of the work provided. We understand the booster pumping system manufacturer is required to provide the required design with bid submittals.

We the undersigned booster pumping system manufacturer understand the Engineer and Owner shall be considered the sole judge of the merits of the manufacturers design with bid submittal.

We the undersigned booster pumping system manufacturer understand we are eligible to offer equipment proposals for this work provided no exceptions of deviations are taken to the plan design and product specifications and provided we strictly abides by the requirements set forth in the complete design with bid submittal.

We the undersigned booster pumping system manufacturer, understand award of the contract for this work will not be based solely on price. Overall booster pumping system design, price, qualification of the bidder, qualification(s) of subcontractors, and the demonstrated intent by the bidder to adhere to all aspects of these performance plans and specifications will all be factors in determining the award.

We the undersigned booster pumping system manufacturer understand this is a performance specification format. Liability for the design and performance of the booster pumping system, telemetry, and SCADA controls as specified herein will remain with the booster system manufacturer. It is the responsibility of the booster system manufacturer to fully understand the application as specified herein and to design and manufacture, the booster pumping system and telemetry / SCADA controls to the specified quality standard, to perform as required by the Engineer and Owner.

Dated: _____ _____

Company Name

State of _____

County of _____ _____

Company Officer's Signature

The above Certification of Compliance was signed and acknowledged before me on this ___ day of _____, 20___ by _____(Officer), acting in the aforesaid capacity for _____(Company).

_____

Notary Public

REQUEST FOR APPROVAL AS ALTERNATE BOOSTER STATION MANUFACTURER

We the undersigned booster station manufacturer do hereby formally request approval as an alternate booster pumping station manufacturer.

We the undersigned booster station manufacturer have reviewed the plans and specifications and herein certify we will bid the project as specified without exception or deviation.

We the undersigned booster station manufacturer understand conditional proposals will not be accepted and submission of a proposal by a pre-approved booster station manufacturer, will constitute an incontrovertible representation by the booster station manufacturer that without exception the bid is premised upon all work as required by this specification and will be completed fully as specified.

We the undersigned booster station manufacturer understand approval as an alternate does not exempt the booster pumping station manufacturer from meeting all requirements of the Contract Documents nor does it give any prior acceptance of any equipment, software or services. The Contract Documents are the final authority for acceptance of the work provided. The response to the pre-bid information requirement does not exempt the booster station manufacturer from providing the required design submittals.

We the undersigned booster station manufacturer, recognize the Engineer and Owners decision as to those manufacturers pre-approved to bid shall be final. The Engineer and Owner shall be considered the sole judge of the merits of the manufacturers to bid.

We the undersigned booster station manufacturer understand if approved to bid we are eligible to offer equipment proposals for this work provided no exceptions of deviations are taken to the plan design and product specifications and provided we strictly abides by the requirements set forth in the following sections for the pre-bid information requirement and the complete design submittal.

We the undersigned booster station manufacturer, understand award of the contract for this work will not be based solely on price. Overall booster pump station design, price, qualification of the bidder, qualification(s) of subcontractors, and the demonstrated intent by the bidder to adhere to all aspects of these design/ build plans and specifications will all be factors in determining the award.

We have attached to this request four (4) sets of the pre-bid information requirement, as specified, including five (5) design build references, the complete bill of material listing as specified, engineering cut sheets for any alternate materials submitted for pre-bid approval consideration, and the list of subcontractors to be utilized for the professional engineering and site construction aspects for the this turn key design build project.

Dated: _____ _____

Company Name

State of _____

County of _____

_____
Company Officer's Signature

The above REQUEST FOR APPROVAL TO BID STATEMENT was signed and acknowledged before me on this ___ day of _____, 20___ by _____(Officer), acting in the aforesaid capacity for _____(Company).

_____
Notary Public

SECTION 400567.16 - DOUBLE CHECK VALVE ASSEMBLY BACKFLOW PREVENTERS FOR PROCESS SERVICE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Double check valve backflow preventers.

1.2 DEFINITIONS

A. Outside Screw and Yoke (OS&Y) Valve: A valve in which the operating screw is driven by a threaded nut that is built into the handle.

1.3 COORDINATION

A. Coordinate Work of this Section with installation of process piping.

1.4 SUBMITTALS

A. Product Data: Double check valve backflow preventers.

B. Field Quality-Control Reports: For double check valve backflow preventers.

C. Qualifications Statement: For manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of double check valve backflow preventers.

1.6 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified to NSF Standards 61 and 372.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.
3. Provide additional protection according to manufacturer instructions.

1.8 WARRANTY

A. Furnish five-year manufacturer's warranty for double check valve backflow preventers.

PART 2 - PRODUCTS

2.1 DOUBLE CHECK VALVE BACKFLOW PREVENTERS

A. Description:

1. Comply with AWWA C510.
2. Configuration: Two independently operating check valves with intermediate atmospheric vent.
3. Materials:

    a. Body: Bronze, ASTM B584.
    b. Internal Components: Stainless Steel Type 304.
    c. Springs: Stainless steel.
    d. Elastomers: Silicone.

4. Connections: Threaded, ASME B1.20.1
5. End Valves: OS&Y.
6. Furnish assembly with strainer and three test cocks.
7. Size:

    a. 2 inches (50 mm).

8. Working Temperature:

    a. Minimum: 33 degrees F (1 degrees C).
    b. Maximum: 140 degrees F (60 degrees C).

9. Maximum Operating Pressure: 150 psi

B. Accessories:

1. Relief valve.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field dimensions are as indicated on Drawings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Thoroughly clean end connections before installation.

B. Close pipe and equipment openings with caps or plugs during installation.

C. Cleaning: Clean surfaces to remove foreign substances.

3.3 INSTALLATION

A. According to manufacturer instructions and local code requirements.

B. Repair damaged coatings with material equal to original coating.

C. Do not install in vertical position.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. After installation, inspect for proper supports and interferences.

C. Repair damaged coatings with material equal to original coating.

3.5 CLEANING

A. Keep interior of backflow preventers clean as installation progresses.

3.6 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 400567.16