

CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
ENGINEERING DIVISION
PROJECT SPECIFICATIONS
FOR
CITY OF ELYRIA
WWPCP ACTIVATED SLUDGE AERATION TANK
IMPROVEMENTS

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Safety-Service Director

Kathy McKillips, P.E.
City Engineer

Signature:



Date: 10/28/2025

SUBMITTED BY AECOM



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INVITATION TO BID

Sealed bids for a unit price contract will be received by the City of Elyria, Ohio, until **2:00 PM** local time on **Tuesday, November 25, 2025** for the project known as:

WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS

The bids are to be delivered to the **Office of the Engineer, Elyria City Hall, 131 Court Street, Elyria, Ohio 44035**. All bids received will then be opened and read at a public bid-opening meeting.

DESCRIPTION OF WORK: The Contractor shall furnish all labor, equipment, supplies, and supervision of labors necessary to complete the work. The project includes the modification to the Elyria WWPCP aeration tanks from a 2-pass conventional activated sludge treatment process to a 3-pass BNR configuration with internal mixed liquor recycle to increase the wet-weather secondary treatment capacity to 40 MGD to comply with the Consent Decree. Secondary treatment modifications include replacement of process mechanical equipment, electrical, instrumentation and controls upgrades. The project also includes installation of 1,100 linear feet (LF) of 36-inch sewer to divert flow from the east detritus tank to the two Wet Weather Holding Tanks during wet weather event

BIDDING DOCUMENTS: The plans, specifications, and all bidding forms may be examined at the City of Elyria Website, <http://www.cityofelyria.org/bids-requests/>, go to "Current Bids". Bidders SHALL request the electronic copy of the bid package by sending their request to kmckillips@cityofelyria.org in order to be placed on the Planholders List.

PRE-BID MEETING: A mandatory pre-bid meeting will be held at 10:00 AM local time, on Thursday, November 6, 2025, at the Elyria Water Reclamation Plant, 1194 Gulf Road, Elyria, Ohio 44035. If this meeting cannot be attended, the Contractor is required to contact Shayne Stewart, Superintendent (440-366-2211 ext. 5100) at the WWPCP prior to the Pre-Bid Meeting to schedule a site visit to review the project site conditions at an alternate time.

PROJECT RELATED QUESTIONS: Questions related to the project will be accepted until 5:00 P.M. on Monday, November 17, 2025.

BID SECURITY: The bid must be accompanied by a bid guaranty. The bid guaranty must meet all requirements of Section 153.54 of the ORC and the Instructions to Bidders.

BUY OHIO: All contractors and subcontractors involved with the project will, to the extent practicable, use Ohio products, materials, services, and labor in the implementation of this project.

COMPLETION TIME: The contractor will have 365 days from the date of the Notice to Commence Work to complete all work. All Work shall be completed by December 31, 2026.

PREVAILING WAGES: The contractor and any subcontractor must comply with the prevailing wage rate requirements on public improvements as determined by the Secretary of Labor in accordance with Federal-Aid requirements. Wage rates are set forth in the U.S. Department of Labor wage decision No. OH20250001 dated September 26, 2025 and can be found at website <http://www.wdol.gov/dba.aspx>. Please note it is the Contractor's responsibility to be aware of current wage rates for public improvements in Lorain County.

COMPLIANCE WITH ALL LAWS: All work shall be carried out in compliance with all federal, state and local laws, rules and regulations that apply to the work. Any project specification item in conflict with a federal, state, or local law, rule or regulation, shall be void.

AFFIRMATIVE ACTION: All bidders must comply with the provisions of Chapter 167 of the Elyria Codified Ordinances as amended. Bidders must be pre-certified or submit an acceptable Affirmative Action Plan with the bid submission. No contract will be awarded unless an acceptable Affirmative Action Plan is reviewed by the EEO Office, approved and incorporated into the contract. Each bidder must complete and sign the Elyria Equal Opportunity Clause, which is included with the specifications.

PROPOSAL FORMS: No proposal will be considered unless it is made on the blanks furnished by the City. No bidder shall take any exception to any requirement of the specifications. Each proposal must contain the full name of the party or parties submitting the proposal and all persons interested therein.

AWARD OF CONTRACT: The City reserves the right to waive any technicalities or informalities, to reject any or all bids received, and to accept any bid with any combination of alternates which is deemed most favorable to the City of Elyria, Ohio at the time and under the conditions stipulated in the project documents.

Published by order of:
Mayor Kevin Brubaker

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INSTRUCTIONS TO BIDDERS

1. ORDINANCE

- 1.1 The bids for this project are being taken in accordance with Ordinance No. 2025-131 passed by the Elyria City Council on September 2, 2025.

2. DEFINED TERMS

- 2.1 Except as given in Section 2.2 herein, the terms used in these Instructions to Bidders which are defined in the General Conditions and have the meanings assigned to them in Section 1.01 of the noted General Conditions.
- 2.2 Additional terms used in these Instructions to Bidders are defined as follows:

SUCCESSFUL BIDDER - the lowest and best, responsible, and responsive bidder to whom the City (on the basis of the City's evaluation as hereinafter provided) makes an award.

UNDERGROUND FACILITIES - All pipes, conduits, ducts, cables, fiber optic cables, wires, service connections, manholes, closeouts, valves, vaults, pull boxes, tanks, tunnels, culverts or other such facilities or attachments, and encasements containing such facilities privately or publicly owned which have been installed underground to furnish any of the following services or materials: electricity, gas, steam, liquid petroleum products, street lighting, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems, or water.

WORK - The entire completed construction or the various separately identifiable parts thereof required to be furnished under the contract documents. Work includes and is the result of performing or furnishing labor and furnishing and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the contract documents.

3. COPIES OF BIDDING DOCUMENTS

- 3.1 Complete sets of the bidding documents may be purchased as described in the Invitation to Bid. No refund will be made for returned documents.
- 3.2 Complete sets of bidding documents must be used in preparing bids; the City does not assume any responsibility for errors or misinterpretations resulting from the use of an incomplete set of bidding documents.
- 3.3 The City in making copies of the bidding documents available on the above terms does so only for the purpose of obtaining bids for the work and does not confer a license or grant permission for any other use of the bidding documents.

4. QUALIFICATIONS OF BIDDERS

- 4.1 To demonstrate qualifications to perform the work, each bidder must be prepared to submit within five (5) days after the bid opening, upon the City's request, detailed written evidence

such as financial data, previous experience, present commitments and other such data as may be needed to demonstrate the bidder's qualifications.

- 4.2 Each bidder must be qualified to do business in the State of Ohio, or must obtain such qualification prior to award of the contract by the City.

5. EXAMINATION OF CONTRACT DOCUMENTS AND SITE

- 5.1 It is the responsibility of each bidder before submitting a bid:

5.1.1 To examine thoroughly the contract documents and other related data identified in the bidding documents. Documents are available for review in the City of Elyria Engineering Department;

5.1.2 To visit the site to become familiar with and satisfy bidder as to the general, local and site conditions that may affect cost, progress, performance or the furnishing of the work;

5.1.3 To consider federal, state and local laws and regulations that may affect cost, progress, performance, or the furnishing of the work;

5.1.4 To study and carefully correlate bidders knowledge and observations with the contract documents, and other related data;

5.1.5 To promptly notify the Engineer of all conflicts, errors, ambiguities or discrepancies which bidder has discovered in or between the contract documents and other related documents or observations.

5.1.6 To evaluate the condition, layout and nature of the project site and surrounding area;

5.1.7 To consider the availability and cost of labor;

5.1.8 To consider the availability and cost of materials, supplies and equipment;

5.1.9 To consider the cost of temporary utilities required in the bid;

5.1.10 To consider the cost of any permit or license required by a local or regional authority having jurisdiction over the project;

5.1.11 To consider the generally prevailing climatic conditions; and

5.1.12 To evaluate conditions bearing upon transportation, disposal, handling, and storage of materials.

5.2 All notices of conflicts, errors, ambiguities or discrepancies submitted by a bidder to the Engineer must be in writing and should be given at least seven (7) days prior to the bid opening. The Engineer will respond to such notices received in time, by sending an addendum to all holders of the plans and specifications.

5.3 Any reports of exploration and tests of subsurface conditions at or contiguous to the site which have been utilized by the Engineer in preparation of the contract documents are

identified in the Supplementary Conditions. The bidder may rely upon the general accuracy of the "technical data" contained in such report but not upon other data, interpretations, opinions or information contained in such reports or otherwise related to the subsurface conditions at the site, nor upon the completeness thereof for the purpose of bidding or constructing the project, but the City is not responsible for the accuracy thereof.

- 5.4 The City may have record drawings of previous projects constructed in the past, in part or the entire site where this project is to be constructed. The bidder may examine these drawings, if available.
- 5.5 The bidder may purchase copies of the reports noted in Section 5.3 and of the drawings noted in Section 5.4 for the cost of reproduction as established by City Ordinance or by the firm printing the bid documents. Those reports and drawings are not part of the contract documents. The bidder is responsible for any interpretation or conclusion drawn from any technical data, opinions or other information contained in or developed from such reports or drawings.
- 5.6 Before submitting a bid each bidder will be responsible to obtain such additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and underground facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance, or furnishing the work, or which relates to any aspect of the means, methods, techniques, sequences, or procedure of construction to be selected and employed by bidder and all safety precautions and programs incidental thereto or which bidder deems necessary to determine its bid for the performing and furnishing the work in accordance with time, price, and other terms and conditions of the contract documents.
- 5.7 On request, the City will grant permission to each potential bidder, access to the site (by issuing a no fee excavation permit, except a fee will be required if pavement is to be cut) to conduct such examination, investigation, exploration, tests and studies as each bidder deems necessary for submission of a bid. Bidders must fill all test holes and clean up and restore the site to its former condition upon completion of such explorations, investigation, tests and studies.
- 5.8 The general nature of any work scheduled to be performed at the project site by the City, or by another prime contractor working for the City, and by any utility (if known by the City) that relates to the work for which a bid is to be submitted, is included as information in the Supplementary Conditions.
- 5.9 The submission of a bid will constitute an incontrovertible representation by bidder that bidder has complied with every requirement of this Article 5, and that without exception the bid is premised upon performing and furnishing the work required by the contract documents and applying the specific means, methods, techniques, sequences or procedures of construction selected by the bidder to complete the project as expressly required by the contract documents, that the bidder has given the Engineer written notice of all conflicts, errors, ambiguities and discrepancies that bidder has discovered (if any) in the contract documents in time for an addenda to be issued to all plan holders, and that the written resolutions thereof issued by the Engineer as an addenda is acceptable to the bidder, and that the contract documents are generally sufficient to indicate and convey understanding of all

terms and conditions for performing and furnishing the work.

6. AVAILABILITY OF LAND FOR WORK

- 6.1 The lands upon which the work is to be performed, the right-of-way and easements, and access thereto and other lands designated for use by the contractor in performing the work are identified in the contract documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the work are to be obtained and paid for by the contractor.
- 6.2 All easements and/or right-of-way for permanent structures or permanent changes in existing facilities have been obtained and paid for by the City unless otherwise provided in the Supplementary Conditions.
- 6.3 Any special condition set forth in easements obtained by the City, which may affect the performance or furnishing the work, if any, are identified in the Supplementary Conditions.

7. INTERPRETATIONS AND ADDENDA

- 7.1 All questions about the true meaning or intent of the bidding documents are to be directed to the Engineer in writing. Interpretations or clarifications considered necessary by the Engineer in response to such questions will be issued by addenda, either mailed, faxed, emailed or hand delivered to all parties recorded by the Engineer as having received the bidding documents or attended the pre-bid meeting.
- 7.2 An addendum may also be issued by the Engineer to modify the bidding documents as deemed advisable by the City.
- 7.3 A bidder may not rely upon any interpretation of the bidding documents by any means other than a written addendum.

8. BID SECURITY

- 8.1 Each bid must be accompanied by a bid guarantee. The bid guarantee may be a **Bid/Contract Bond**, a **Certified Check**, a **Cashier's Check** or a **Letter of Credit**. The bid guarantee shall meet all requirements of Section 153.54 of the Ohio Revised Code and any additional requirements stated herein.
- 8.2 Any bond shall be furnished by a surety company licensed to conduct business in the State of Ohio. Any check used as bid security shall be drawn on a solvent bank.
- 8.3 Any **Bid/Contract Bond** submitted shall be for the full amount of the base bid plus the highest combination of additive alternates, if any. The form of the **Bid/Contract Bond** shall be of substantially the same form as provided in Section 153.571 of the Ohio Revised Code and it shall serve as both a bid bond and a contract bond. If stated, the amount of the **Bid/Contract Bond** shall be specified in figures. Specifying the amount of the bond as a percentage or one hundred percent (100%) is **not** acceptable.
- 8.4 Section 3905.41, Ohio Revised Code, may require that a **Bid/Contract Bond** be

countersigned by an Ohio resident agent. It is the bidder's responsibility to determine the applicability of Section 3905.41, Ohio Revised Code.

- 8.5 Any **Certified Check, Cashier's Check** or a **Letter of Credit** submitted shall be made payable to the City of Elyria, Ohio, and shall be for an amount of not less than ten percent (10%) of the sum of the base bid plus the highest combination of additive alternates, if any. The amount shall be stated in figures. Any **Certified Check, Cashier's Check** or a **Letter of Credit** submitted shall be accompanied by an executed Consent of Surety form. Any letter of credit shall be revocable only by the City. If the successful bidder used a certified check, cashier's check or letter of credit, it will be returned upon provision of the **Contract Bond** required by Section 153.54, Ohio Revised Code.
- 8.6 In case a bidder, to whom a contract is awarded, fails to execute the contract within ten (10) days after notice of award is delivered in writing to the bidder, or in case a bidder fails to secure the contract with an acceptable performance bond and payments bond (each in the full amount of the contract) and execute the contract within ten (10) days after notice of the award is delivered in writing to the bidder, the bidder shall be considered as refusing the contract and shall forfeit their bid security in accordance with provisions of Section 153.54 of the Ohio Revised Code.
- 8.7 The bid security from each bidder may be held by the City for up to sixty (60) days. The bid security will be returned to the unsuccessful bidders after the contract has been signed and secured as provided herein above by the successful bidder.

9. **CONTRACT TIME**

- 9.1 The number of days within which, or the date by which, the work is to be substantially completed and also completed and ready for a pre-final payment, are set forth in the Invitation to Bidders and will be set forth in the Agreement Form.

10. **LIQUIDATED DAMAGES**

- 10.1 Provisions for liquidated damages, if any are set forth in the Agreement Form.

11. **SUBSTITUTE AND "OR-EQUAL" ITEMS**

- 11.1 The drawings or specifications may make a reference to a specific manufacturer's make or model identification for a material or item of equipment. The materials and equipment described in this way, by a manufacturer's brand name, establishes a standard of required type, function, quality, and expected life to be met by any proposed substitute or "or-equal" item. Such reference to a name shall be considered as requiring the contractor to furnish either that product or a substitute proposed by the contractor and approved by the Engineer as an approved equal.
- 11.2 An application for acceptance will not be considered by the Engineer until after the effective date of the Agreement.
- 11.3 Each submission by the contractor for review of a substitute shall include the name of the material or equipment for which it is to be substituted and a complete description of the

proposed item including drawings, cuts, performance and test data, and any other information necessary for an evaluation.

- 11.4 The Engineer's review of the substitution will consider the City's normal inventory of repair parts for the specified equipment and the possibility of increased down time for repairs to equipment of a type that repair parts are not in the City's inventory.

12. BID FORM

- 12.1 The Bid Form is included with the bidding documents. This form shall be used by the bidder to submit its bid.
- 12.2 All blanks on the Bid Form (except the signature line) must be completed by printing in ink or by typewriter.
- 12.3 Discrepancies between the sum of the labor bid price and the material bid price for an item will be resolved by using the total bid price stated by the bidder expressed in numbers. The Bid Price shall be the sum of the total for the extension of the unit prices times the estimated quantity. Discrepancies between the multiplication of the estimated quantity of an item on the proposal and the total unit price stated by the bidder will be resolved by using the total unit price stated by the bidder and the estimated quantity.
- 12.4 Bids by entities must be executed by an authorized officer, member, partner, or the equivalent and accompanied by evidence of authority to sign.
- 12.5 Bids by a partnership must be executed in the partnership name and signed by a partner, whose title must be shown below the signature.
- 12.6 The bid shall contain an acknowledgment of receipt of all addenda.
- 12.7 The address, telephone number and email address for communication regarding the bid must be shown.
- 12.8 An out-of-state entity must provide evidence of authority to conduct business in the State of Ohio.
- 12.9 The bid price stated in the bid form shall be the full price for completion of the work which price shall include all payments by the City to the contractor for all labor, material, equipment, supervision, and overhead required to complete the work.
- 12.10 The cost of completing all work specified in the drawings and in the specifications, in accordance with the contract documents, shall be included by the bidder in the pay items listed on the Bid Form.

13. SUBMISSION OF BIDS

- 13.1 Bids shall be submitted at the time and place indicated in the Invitation to Bidders and shall be bound with the other bidding documents, and enclosed in an opaque sealed envelope marked "**BID ENCLOSED**" for project (by name) plus the name and address of the bidder.

- 13.2 If the bid is sent through the mail or delivered by another delivery system, the sealed bid envelope shall be enclosed in a separate envelope with the notation **"BID ENCLOSED"** on the face of the delivery envelope. Bids received, if any, after the deadline for delivery of bids, will be returned unopened.

14. NO MODIFICATION OF BIDS

- 14.1 After submission of a bid to the City, no modification of the bid may be made by the bidder.

15. WITHDRAWAL OF BIDS

- 15.1 After submission of a bid to the City, and at any time before the deadline for bid submission, the bidder may withdraw its bid by giving a duly signed written notice requesting to withdraw the bid to the City. Thereafter, that bidder will be disqualified from further bidding on the work, including any re-bid held by the City.

16. OPENING OF BIDS

- 16.1 All bids received will be opened and (unless obviously non-responsive) read aloud publicly at the place where the bids are to be submitted. A summary of the prices bid will be mailed to all bidders after a tabulation of the bids is completed by the Engineer.

17. BIDS TO REMAIN SUBJECT TO ACCEPTANCE

- 17.1 All bids will remain subject to acceptance for sixty (60) days after the day of the bid opening, but the City may, in its sole discretion, release the bid and return the bid security prior to the end of the sixty (60) day period.

18. AWARD OF CONTRACT

- 18.1 The City reserves the right to reject any or all bids, including without limitation, the rights to reject any or all nonconforming, non-responsive, unbalanced or conditional bids, and to reject the bid of any bidder if the City believes that it would not be in the best interest of the City to make an award to that bidder, whether because the bid is not responsive or the bidder is unqualified or of doubtful financial ability or fail to meet any other pertinent standard or criteria established by the City.
- 18.2 In evaluating the bids to determine the lowest and best bid, the City will consider the qualification of the bidders, whether or not the bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may have been submitted with the bid or as may be requested per the contract documents before the award is made by the City.
- 18.3 The City may consider the qualifications and experience of the subcontractors, suppliers, and other persons and organizations proposed for those portions of the work as to which the identity of subcontractors, suppliers, and other persons and organizations must be submitted as provided in the Supplementary Conditions. The City may consider also the operating cost, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in the work when such data is required to be submitted

prior to the award of the work.

- 18.4 The City may conduct such investigations as the City deems necessary to assist in the evaluation of any bid and to establish the responsibility, qualifications and financial ability of the bidders, proposed subcontractors, suppliers, and other persons and organizations to perform and furnish the work in accordance with the contract documents to the City's satisfaction within the prescribed time.
- 18.5 If the contract is to be awarded, it will be awarded to the bidder whose evaluation by the City indicates to the City that the award will be in the best interest of the City.
- 18.6 If the contract is to be awarded, the City will give the successful bidder a Notice of Award within sixty (60) days after the day of the bid opening, unless the bidder grants a time extension to the City.

19. SIGNING OF AGREEMENT

- 19.1 When the City gives a written Notice of Award to the successful bidder, it will be accompanied by the required number of the unsigned counterparts of the Agreement. Within ten (10) days thereafter the contractor shall sign the Agreement and deliver all copies to the City Engineer. The City will then execute the Agreement, and the City Auditor's Certification of Funds, and will deliver one (1) fully executed Agreement to the contractor with the Notice to Commence Work. One copy of the Agreement and attached documents will be sent to the local agent of the contractor's surety.

20. CONTRACT SECURITY

- 20.1 When the successful bidder delivers the executed Agreement to the City, it must be accompanied by the required performance and payment bonds, unless the bond submitted with the bid was a **Bid/Contract Bond**, which will serve as the required contract security.

21. SALES TAXES

- 21.1 The City is exempt from Ohio State sales and use taxes on the materials and equipment to be incorporated into the work. Said taxes shall not be included in the bid price. The contractor shall contact the City Auditor's Office at 440-326-1530 for completion of the tax-exempt forms required for the project.

22. PROGRESS PAYMENTS AND RETAINER

- 22.1 Progress payments may be made to a Contractor before the work is completed. Progress payments so paid to a Contractor shall be based on actual measurements of labor and materials furnished, including materials delivered, under the contract to the date of estimate. The amount of a progress payment shall be determined by subtracting from the value of the portion of the work completed and materials furnished to the date of the estimate a retainer of ten percent (10%) and the sum of all previous progress payments.
- 22.2 Thirty (30) days after substantial completion of the work under the contract, and upon approval of the work by the Engineer, the ten percent (10%) retainage may be reduced to five

percent (5%).

- 22.3 After completion of all punch list items, the five percent (5%) retainage may be released. The Contractor shall be responsible for full guarantee of all work for one full year from the date of final completion of the contract. No retainer shall be subject to interest payments to the Contractor nor required to be deposited with an escrow agent who will pay interest to the Contractor.

23. EQUAL EMPLOYMENT OPPORTUNITY

- 23.1 In addition to the City of Elyria, Ohio, Codified Ordinance Chapter 167, the contractor shall, and all subcontractors working on the project shall, comply with the equal employment requirements for the utilization of minorities and females pursuant to Chapter 123 of the Ohio Administrative Code, the Governor's Executive Order of 1972, and the Governor's Executive Order 84-9.

24. CONTRACTOR LICENSES AND/OR PERMITS

- 24.1 The Contractor and all Subcontractors shall obtain, maintain and renew the necessary licenses and/or permits as required by the City of Elyria Building Department to complete the Work. The Contractor shall secure all credentials and pay for all necessary fees associated with obtaining these licenses and/or permits. Fees shall be included in the price of the contract and no additional payment will be made to the Contractor for reimbursement of fees. Licenses and/or permits shall be obtained prior to initiating any construction activity associated with that particular license.

25. WARRANTY OF WORKMANSHIP AND MATERIALS

- 25.1 The Successful Bidder shall warrant that all labor furnished under this project shall be competent to perform the tasks undertaken, that the product of such labor shall yield only first-class results, that all material and equipment provided shall be new and of high quality, that the completed work will be complete, of high quality, without defects, and that all work complies with the requirements of this project.
- 25.2 The duration of the Bidders warranty, including equipment and labor, shall be one (1) year from the date of Substantial Completion or upon written acceptance notice date by the City for individual pieces of equipment.

26. STORMWATER BEST MANAGEMENT PRACTICES

- 26.1 The Contractor and all Subcontractors shall consider and implement any and all storm water best management practices (BMPs) as per City of Elyria Codified Ordinance Chapter 960 "Storm Water Management" and as per the Ohio Department of Natural Resources in the most recent version of the Rainwater and Land Development manual for construction site runoff and post-construction site runoff as required to minimize, reduce and/or eliminate the discharge of contaminated or sediment-laden storm water from the construction site. All existing and proposed outlets and drainage courses shall be protected.

The Contractor shall develop and submit a plan for approval if the construction site is over

one acre. Weekly site inspections, including all inspections within 24 hours after a rain event, shall be the responsibility of the contractor. Completed and signed inspection forms shall be submitted to the Engineer within 48 working hours after the completion of the inspection. Maintenance of all BMPs shall be the responsibility of the contractor. The contractor and all of its subcontractors shall comply with all other storm water best requirements as specified in the specifications, documents, Storm Water Pollution Prevention Plans and/or drawings for this project. Cost for this work shall be included in 1) the individual unit price bid for Storm Water Pollution Prevention Plan (SWPPP), 2) the separate line items as applicable, or 3) the total lump sum base bid for the project, whichever is applicable and detailed in the bid form.

27. SUBCONTRACTOR QUALIFICATIONS

- 27.1 Within five (5) days after the bid opening and prior to Award of Contract, the Successful Bidder shall supply to the City a list of subcontractors that it intends to use for the project, if not included with the original bid submittal. The City, at its sole discretion, may request that a subcontractor be replaced or not used. If the Successful Bidder refuses to replace this subcontractor, the City reserves the right to award the contract to the next lowest and best bidder deemed most qualified to perform the Work. The City may request references for any subcontractor. If the Successful Bidder proposes to change a subcontractor at any time after submittal of the original list of subcontractors, including during construction, the new subcontractor shall be approved by the City prior to that subcontractor performing any work on the project.

AGREEMENT FORM

**AGREEMENT
BY AND BETWEEN
THE CITY OF ELYRIA
AND**

CONTRACT NO. ____-____

This Agreement is made and entered into, effective upon full execution by all parties, by and between the City of Elyria, Ohio, an Ohio municipal corporation with offices located at 131 Court St., Elyria, Ohio 44035 (the “City”) and _____, an Ohio entity with offices located at _____, Ohio 44____ (the “Contractor”). The Contractor and the City shall be collectively referred to as the “Parties” and individually as the “Party.”

WHEREAS, this Agreement was authorized by Ordinance No. 2025-131, which was passed by the Elyria City Council on September 2, 2025; and

WHEREAS, the City desires to enter into an agreement for _____ services (the “Agreement” or “Contract”); and

WHEREAS, the Contractor has submitted a bid in response to the City’s request for bid proposals; and

WHEREAS, the City has determined that the Contractor has the experience and resources to complete the work as contemplated by this Agreement.

NOW, THEREFORE, in consideration of the mutual covenants contained herein and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the City and the Contractor agree as follows:

ARTICLE 1 – WORK

The Contractor shall furnish all labor, equipment, supplies, and supervision of labors necessary to complete the work, which is the subject of this Agreement (the “Work”). The Contractor shall furnish all labor, equipment, supplies, and supervision of labors necessary to complete the work. The Contractor shall furnish all labor, equipment, supplies, and supervision of labors necessary to complete the work. The project includes the modification to the Elyria WWPCP aeration tanks from a 2-pass conventional activated sludge treatment process to a 3-pass BNR configuration with internal mixed liquor recycle to increase the wet-weather secondary treatment capacity to 40 MGD to comply with the Consent Decree. Secondary treatment modifications include replacement of process mechanical equipment, electrical, instrumentation and controls upgrades. The project also includes installation of 1,100 linear feet (LF) of 36-inch sewer to divert flow from the east detritus tank to the two Wet Weather Holding Tanks during wet weather events. The project is located in the city of Elyria, Ohio. Construction documents were prepared by AECOM Technical Services, Inc. and the Office of the Elyria City Engineer.

The City’s request for bid proposals (attached as Exhibit “A”) and Contractor’s proposal (attached as

Exhibit “B”) are incorporated by reference as if fully rewritten herein. In the event that a discrepancy exists between the terms of Exhibits A and B, the terms of Exhibit A will be controlling and binding. In the event that a discrepancy exists between the terms of the Exhibits and this Agreement, the terms of this Agreement will be controlling and binding.

ARTICLE 2 - ENGINEER TO BE CITY'S REPRESENTATIVE

The services of the Contractor shall be carried out under the authority for contract administration of the Mayor and Safety-Service Director of the City, who is designating the City Engineer as the person who, as the City’s representative, will administer the contract, undertake and assume all duties and responsibilities, and will have the authority and rights assigned to the Engineer under the specifications for this work.

ARTICLE 3 - CONTRACT PERFORMANCE

COMPLETION TIME: Construction of this project shall begin at the discretion of the contractor, but all work must be completed no later than December 31st, 2026.

ARTICLE 4 - LIQUIDATED DAMAGES

The City and the Contractor recognize that time is of the essence in this agreement, and that the City will suffer financial loss (including but not limited to incidental and consequential damages) if the Work is not carried out within the time specified in Article 3 herein. Both the City and the Contractor recognize the impossibility of calculating the actual loss suffered by the City if the Work is not substantially completed within the specified time. Accordingly, instead of requiring any such proof, the City and the Contractor agree that as liquidated damages for delay (but not as a penalty) the Contractor shall pay the City the following sums for each calendar day that expires after the Completion Time for Consent Decree related work and all other work specified in Article 3 herein for completing the work assigned, unless the City grants a time extension for good reason not under the control of the Contractor.

<u>Amount Per Day</u>	<u>Calendar Day after Completion Time</u>
\$500	1 st through 30 th Day
\$750	31 st through 60 th Day
\$1,500	61 st Day and beyond

In addition to the foregoing, Contractor agrees to pay for the cost of any additional inspection services that the City requires as a result of delays.

ARTICLE 5 - CONTRACT AMOUNT

The City shall pay the Contractor for performance of the Work, in accordance with the contract documents, a total amount of, which shall not exceed, _____ Dollars and _____ Cents (\$_____).

The Contractor agrees that no extra work will require any extra or additional payments by the City, unless the extra work is authorized in writing by the City’s Mayor before the extra work is performed.

ARTICLE 6 - PAYMENT PROCEDURES

The Contractor agrees to promptly (by the 5th of each month), but not more frequently than once every thirty (30) days, submit an original invoice with one (1) copy and the required estimate computations with required certifications to the Engineer. The City will make progress payments on or about the 26th day of each month.

Prior to substantial completion, progress payments will be in an amount equal to ninety percent (90%) of the Work completed and ninety percent (90%) of the materials and equipment delivered to the project site, but not yet incorporated into the Work, less in each case, the aggregate of all payments previously made. No retainer shall be subject to interest payments to the Contractor nor required to be deposited with an escrow agent who will pay interest to the Contractor.

Acceptance of the Work, Pre-Final Payment and Final Payment: Upon final completion and acceptance of the work by the City in accordance with E.C.O. 143.06, the City shall pay the Contractor all funds due the Contractor, except for the five percent (5%) retainer per Section 22 of the Instructions to Bidders. The five percent (5%) retainer shall be paid by the City to the Contractor, after completion of all work and all punch list items. If defects in the Work are found during the one (1) year period after final completion, the defects are to be corrected by the Contractor. The corrected work shall be guaranteed for a period of one (1) year by the Contractor. After satisfactory completion of all work and all punch list items, the five percent (5%) retainer or any payment withheld for other purpose may be released.

ARTICLE 7 - CONTRACTOR'S REPRESENTATIONS

The Contractor acknowledges that it has taken the steps reasonably necessary to ascertain the nature and the location of the Work to be performed, and that it has investigated and satisfied itself as to the general and local conditions which can affect the Work, its cost, including but not limited to (1) the cost of purchasing, transportation, handling and storage of materials and supplies, (2) the availability of labor and cost, (3) the uncertainties of weather or similar physical conditions, including the time of year the project is to be constructed, (4) all other physical conditions which can impact the cost of doing Work, (5) the character of the equipment and facilities needed to prepare to do the work and to carry out the work to be performed, considering the limited work area, and the access to the site, (6) the cost of the Contractor's overhead, (7) the cost of providing worker supervision and management, (8) the cost of providing insurance, bonds, and related expenses.

The Contractor also acknowledges that it has had sufficient time during the bidding of the project to review all contract documents, and to make all investigations necessary to reasonably ascertain the cost of doing the Work. Further, the Contractor has correlated the results of observations, examination, investigations, and review of local labor conditions with the terms and conditions of all of the contract documents, including the addenda listed on the Contractor's Bid Form, in determining the price bid for the Work. The Contractor acknowledges that the City assumes no responsibility for any understanding reached or representations made concerning conditions which can affect the Work, by any of its officers, employees, or agents before execution of this Agreement, unless that understanding or representation is expressly stated in the contract documents which are a part of the Agreement.

ARTICLE 8 – INDEMNIFICATION

Contractor shall indemnify, defend and hold harmless the City, its elected officials, employees, representatives and agents (the “Indemnified Parties”) from and against any and all loss, cost, expense, damage, injury, liability, claim, demand, penalty or cause of action (including attorneys' fees) directly or indirectly arising out of, resulting from or related to (in whole or in part), (1) the Work performed hereunder, (2) the contract or (3) an act or omission of Contractor, a Subcontractor or any individual partnership or joint venture or corporation (a) directly or indirectly employed by Contractor or a Subcontractor or (b) for whose acts or omissions Contractor or a Subcontractor may be liable. Contractor shall promptly advise the City in writing of any action, administrative or legal proceeding or investigation as to which this indemnification may apply, and Contractor, at Contractor's expense shall assume on behalf of the City, and conduct with due diligence and in good faith, the defense with counsel satisfactory to the City, provided, that the City shall have the right to be represented therein by advisory counsel of its own selection and at its own expense; and provided further, that if the defendants in any such action include both Contractor and the City, and the City shall have reasonably concluded that there may be legal defenses available to the City which are different from or additional to, or inconsistent with those available to Contractor, the City shall have the right to select separate counsel to participate in a defense of such action on its own behalf at Contractor's expense. In the event of failure by Contractor to fully perform in accordance with this indemnification, the City, at its option, and without relieving Contractor of its obligations hereunder may so perform, but all costs and expenses so incurred by the City in that event shall be reimbursed by Contractor to the City, together with interest on the same from the day any such expense was paid by the City until reimbursed by Contractor at the rate of interest provided to be paid on judgments, by the law of the State of Ohio. The obligations of Contractor under this Section shall survive the expiration of the Contract.

In claims against any of the Indemnified Parties by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts or omissions they may be liable, the indemnification obligation under this Section shall not be limited by a limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or Subcontractor under workers' compensations acts, disability benefits acts, or other employee benefit acts.

The Contractor acknowledges that, as a political subdivision of the State of Ohio, the City does not indemnify any person or entity. The Contractor agrees that no provision of this Agreement or any other agreement between the Contractor and the City may be interpreted to obligate the City to indemnify or defend the Contractor or any other party.

ARTICLE 9 - CONTRACT DOCUMENTS

This Agreement and accompanying documents, including the Bid Form, Unit Price Schedule, Instructions to Bidders, Invitation to Bid, all Addenda listed on the Contractors Bid Form, the General Conditions, State Prevailing Wages and Technical Specifications as prepared by the City Engineer's Office, and all attachments submitted by the Contractor with its Bid Form, are made a part of the Agreement hereto as if the contents of those contract documents were fully rewritten herein. The City and the Contractor agree that there are no oral or written representations, understandings or agreements relating to this Agreement which are not fully expressed herein. No modification, change or amendment hereof shall be valid unless such is in writing and signed by the authorized representative of the party against which such modification, change or amendment is

sought to be enforced.

ARTICLE 10 - INSURANCE

10.1 Insurance Coverage Requirements. Contractor agrees to procure and maintain during the term of this Agreement insurance in the types and amounts shown below.

- a) Worker's Compensation in full compliance with the requirements of the State of Ohio.
- b) SEE REQUEST FOR BID PROPOSALS FOR SPECIFIC INSURANCE REQUIREMENTS.

All insurance shall be exclusive of defense costs whenever possible.

10.2 Insurance Coverage Terms and Conditions.

- a) The insurance policies of the Contractor, required for this Agreement, shall:
 - (i) Name the "City of Elyria, Ohio" as an Additional Insured. This does not apply to Worker's Compensation and Professional Liability.
 - (ii) Contain a waiver of subrogation provision wherein the insurer(s) waives all rights of recovery against the City; and
 - (iii) Be primary and not in excess or contingent on any other basis; and
- b) The insurance required for this Agreement shall be provided by insurance carrier(s) licensed to transact business and write insurance in the state(s) where operations are performed and shall carry a minimum A.M. Best's rating of A- VII or above.
- c) The terms of this Agreement shall be controlling and shall not be limited by any insurance policy provision.
- d) High-risk activities may require higher insurance limits.
- e) These insurance provisions shall not affect or limit the liability of the Contractor stated elsewhere in this Agreement or as provided by law.
- f) The Contractor shall require any and all of its subcontractors to procure, maintain, and pay premiums for the insurance coverages and limits of liability outlined above with respect to products, services, work and/or operations performed in connection with this Agreement.
- g) The City reserves the right to require insurance coverages in various amounts or to modify or waive insurance requirements on a case-by-case basis whenever it is determined to be in the best interest of the City.
- h) If the Bid/Proposal specifies the need for higher limits of liability for any applicable insurance provision, the Bid/Proposal specifications shall govern.
- i) Where coverages are made on a claims-made basis, the claims-made retroactive date on the policy shall be prior to the commencement of professional activity related to this Agreement.

j) The Contractor shall furnish a Worker's Compensation Certificate and Certificate of Insurance evidencing that the insurance coverages required herein are in full force and effect. Acceptance of a non-conforming certificate of insurance by the City shall not constitute a waiver of any rights of the parties under this Agreement.

k) The Certificate(s) of Insurance evidencing these coverages shall contain the following additional insured and waiver of subrogation language where applicable:

(i) "City of Elyria, Ohio is an additional insured for purposes of commercial general liability and automobile liability": and/or

(ii) "Waiver of subrogation in favor of the City of Elyria."

l) Any additional insured shall receive at least thirty (30) days' notice of any cancellation, change reducing the coverage, or refusal to renew, which is adverse to the interest of any additional insured to be affected. The City shall be provided with any notice of non-renewal, regardless of the cost. The same terms apply to any subcontractors to the extent practical.

10.3 Certificate of Insurance. This Agreement is contingent upon, and not valid or binding upon City, until such times as City receives said Certificate of Insurance.

ARTICLE 11 - TERMINATION

11.1 Termination for Default. Either party may terminate this Agreement, in whole or in part, whenever such party determines that the other has failed to satisfactorily fulfill its material obligations and responsibilities hereunder and is unable to cure such failure within a reasonable period of time, not to exceed thirty (30) calendar days. Such termination shall be referred to as "Termination for Default." If the defaulting party is unable to cure the failure within the specified time period, the party seeking to terminate may, by giving written notice thereof to the defaulting party, terminate this Agreement, in full or in part, as of the date specified in the notice of termination. The Contractor, however, shall be paid for all services and/or materials provided on or prior to the date of termination. Any fees paid in advance shall be returned to the City at a prorated amount.

11.2 Termination for Financial Instability. In the event that the Contractor becomes financially unstable to the point of (i) ceasing to conduct business in the normal course, (ii) making a general assignment for the benefit of creditors, or (iii) suffering or permitting the appointment of a receiver for its business or its assets, or there is a filing by or against the Contractor of a meritorious petition in bankruptcy under any bankruptcy or debtor's law, the City may, at its option, terminate this Agreement under Section 11.1, the "Termination for Default" clause, by giving written notice thereof.

ARTICLE 12 – ASSIGNMENT

No assignment by a party hereto of any rights under or interests in the Agreement will be binding on another party hereto without the written consent of the party sought to be bound; and specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment. No assignment will release or discharge the assignor from any duty or responsibility under the contract documents.

ARTICLE 13 – SAFETY

The Contractor agrees to comply with Chapter 4121:1-3 of the Ohio Administrative Code entitled “Specific Safety Requirements of the Industrial Commission of Ohio relating to Construction,” effective November 1, 1979 and with the “Federal Occupational Safety and Health Act of 1970 and Code of Federal Regulation, Title 29, Chapter XVII, Part 1926,” and to also comply with all other requirements of law.

ARTICLE 14 – WARRANTY

THE CONTRACTOR HEREBY WARRANTS THAT THE SERVICES WILL NOT INFRINGE, MISAPPROPRIATE OR VIOLATE ANY INTELLECTUAL PROPERTY OR ANY OTHER RIGHT OF ANY PERSON OR ENTITY. THE SERVICES WILL BE PERFORMED IN A PROFESSIONAL AND WORKMANLIKE MANNER, CONSISTENT WITH INDUSTRY STANDARDS. THE SERVICES WILL BE PERFORMED IN STRICT ACCORDANCE WITH THE HIGHEST STANDARDS OF CARE, SKILL, DILIGENCE AND PROFESSIONAL COMPETENCE APPLICABLE TO SUPPLIERS/CONTRACTORS ENGAGED IN PROVIDING SIMILAR SERVICES IN THE LORAIN COUNTY AREA. THE CONTRACTOR HAS THE REQUISITE SKILL AND STAFF TO PERFORM THE SERVICES REQUIRED HEREUNDER FULLY, IN A TIMELY AND EFFICIENT MANNER. THE CONTRACTOR WILL PERFORM THE SERVICES IN ACCORDANCE WITH ALL APPLICABLE LAWS.

ARTICLE 15 - PREVAILING WAGE RATES

The Contractor agrees to pay wages equal to or exceeding the minimum wage rates as determined by the Ohio Department of Commerce (“ODOC”). The Contractor agrees to require all subcontractors, if any, to pay wages equal to or exceeding the minimum wage rates as determined by the ODOC.

ARTICLE 16 – SUCCESSORS

The City and the Contractor each bind themselves, their partners, successors, assigns and legal representatives in respect to all conveniences, agreements and obligations contained in the contract documents.

ARTICLE 17 - OTHER PROVISIONS

The Contractor agrees to comply with the requirements of Chapter 167 of the Elyria Codified Ordinances as amended, regarding Affirmative Action and Equal Employment Opportunity. All sections of Chapter 167 as amended on the first date of advertising this project, which are to be a part of any construction or service agreement executed by the City, are included in this Agreement by reference, as if repeated in full herein.

ARTICLE 18 – REVIEW BY COUNSEL

Each party and its counsel have reviewed and approved this Agreement and any ambiguities will not be resolved against the drafting party.

ARTICLE 19 – ENTIRE AGREEMENT

This Agreement sets forth the entire agreement between the parties and supersedes any prior agreements, negotiations or understandings of the parties.

ARTICLE 20 – GOVERNING LAW

This Agreement shall be governed by, and shall be construed and enforced in accordance with, the laws of the State of Ohio. The parties agree that any actions regarding this Agreement or the Work performed hereunder shall be brought in the Court of Common Pleas of Lorain County, Ohio. Each party consents to the exclusive jurisdiction of the Court of Common Pleas of Lorain County, Ohio, and hereby agrees not to challenge this Governing Law and Jurisdiction provision, and further agrees not to attempt to remove any legal action outside of Lorain County for any reason.

ARTICLE 21 – SEVERABILITY

If any term or provision of this Agreement is deemed by a court of law to be invalid or unenforceable, the remainder of this Agreement shall not be affected thereby, and each remaining term or provision of this Agreement shall be valid and enforceable to the fullest extent permitted by law.

ARTICLE 22 – SURVIVAL OF TERMS

Termination or expiration of this Contract for any reason shall not release either party from any liabilities or obligations set forth in this Contract which (i) the parties have expressly agreed shall survive any such termination or expiration, or (ii) remain to be performed or by their nature would be intended to be applicable following any such termination or expiration.

ARTICLE 23 – WAIVER

No delay or omission by either party in the exercise of any right or power shall impair any such right or power or be construed to be a waiver thereof. A waiver by either of the parties of any of the covenants, conditions or agreements to be performed by the other or any breach thereof shall not be construed to be a waiver of any succeeding breach thereof or of any other covenant, condition or agreement herein contained. No change, waiver or discharge hereof shall be valid unless in writing and signed by an authorized representative of the party against which such change, waiver, or discharge is sought to be enforced.

ARTICLE 24 – FORCE MAJEURE

Neither Party shall be in default if its failure to perform any obligation hereunder is caused solely by supervening conditions beyond that Party's reasonable control, including, without limitation, acts of God, civil commotion, strikes, labor disputes, or governmental demands or requirements.

ARTICLE 25 – INDEPENDENT CONTRACTOR

It is fully understood and agreed that the Contractor is an independent contractor and is not an agent, servant, or employee of the City. The Contractor declares that it is engaged as an independent business and has complied with all applicable federal, state, and local laws regarding business

permits and licenses of any kind, including but not limited to any insurance coverage, workers' compensation, or unemployment compensation that is required in the normal course of business and will assume all responsibility for any federal, state, municipal or other tax liabilities.

ARTICLE 26 - ANTI-DISCRIMINATION

Contractor agrees that in its employment of labor, skilled or unskilled, there shall be no discrimination exercised against any person because of race, color, religion, national origin, sex, gender, ancestry, age, disability, sexual orientation, sexual identity, genetic information, military status, or veteran status, and a violation of this term shall be deemed a material breach of this Contract.

ARTICLE 27 – HEADINGS

The section headings appearing in this Contract are inserted only as a matter of convenience and in no way define, limit, or describe the scope or extent of such section.

ARTICLE 28 - COUNTERPARTS

This Contract may be executed in separate original or facsimile counterparts, each of which shall be deemed an original, and all of which shall be deemed one and the same instrument.

ARTICLE 29 – OHIO REVISED CODE

Contractor shall comply with all applicable provisions of Sections 2909.21 to 2909.34 Ohio Revised Code (Ohio Patriot Act) and Sections 3517.13 Ohio Revised Code.

(THE REMAINDER OF THIS PAGE INTENTIONALLY LEFT BLANK)

(SIGNATURE PAGE TO FOLLOW)

CITY OF ELYRIA WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS

IN WITNESS WHEREOF, this Agreement has been executed in duplicate by the City and the Contractor on the dates below.

CONTRACTOR NAME

THE CITY OF ELYRIA, OHIO

Signature

Kevin Brubaker – Mayor Date

Print Name

APPROVED AS TO FORM:

Date

Amanda R. Deery, Law Director

Date

NOTICE TO COMMENCE WORK
and
NOTICE TO COMMENCEMENT OF A PUBLIC IMPROVEMENT
PURSUANT TO REVISED CODE SECTION 1311.252

State of Ohio

County of Lorain

I, Kevin Brubaker, being first duly sworn, say that:

1) Affiant is the Mayor of the City of Elyria, Ohio.

2) The City of Elyria, Ohio gives this Notice to Commence Work to the Contractor, for the public improvement identified as **WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS**

3) The following is the name, address and trade of the principal contractor working on this public improvement:

NAME:

ADDRESS:

TRADE:

DATE OF FIRST EXECUTED CONTRACT:

4) The following is the name and address of the surety for the principal contractor:

NAME OF SURETY:

ADDRESS OF SURETY:

5) For the purpose of serving an affidavit pursuant to Revised Code Section 1311.26, service may be made upon the following representative of the Public Authority:

Mayor Kevin Brubaker
CITY OF ELYRIA, OHIO
131 Court Street
Elyria, Ohio 44035

FURTHER AFFIANT SAYETH NAUGHT.

Signature: _____

SWORN TO BEFORE ME and subscribed in my presence this _____ day of _____, 2025.

(SEAL)

Notary Public: _____

FINANCE DIRECTOR'S CERTIFICATION OF FUNDS

I hereby certify that there is in the Treasury of the City of Elyria, State of Ohio, to the credit of the _____ Fund, not appropriated for any other purpose and/or in the process of collection, as required by law, the sum of _____ dollars and no cents (\$_____) to pay the cost of the attached contract for the **WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS** in Elyria, Ohio.

Executed this _____ day of _____ in the year of 2025.

Finance Director

Ordinance No.: 2025-131

Passed On: September 2, 2025

Account No.:

RESOLUTION OF DIRECTORS

Date _____

The Board of Directors of: _____ (Firm Name)

met on the ____ day of _____ of _____.

A motion was made, seconded and passed authorizing _____ (Name),

_____ (Title) to sign and submit a bid to the City of Elyria, Ohio, for

the: **WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS**

and authorizing the same person to enter into a contract with the City of Elyria, Ohio, if the City awards the work to the firm.

By: _____ Title: _____
(Signature)

ATTEST:

By: _____ Title: _____
(Signature)

(CORPORATION SEAL)

NOTE: A similar form with an original signature and a current date (within 12 months) may be used in place of this form. If the form submitted with the bid has photocopy signatures, the form must be replaced with one having original signatures, before the contract is signed.

BID FORM

UNIT PRICE CONTRACT

PROJECT: WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS

THIS BID IS SUBMITTED TO: Mayor Kevin Brubaker
Office of the Safety-Service Director
City of Elyria, Ohio
131 Court Street
Elyria, Ohio 44035

1. The undersigned **Bidder** proposes and agrees, if this **Bid** is accepted, to enter into an **Agreement** with the **City** in the form included in the **Contract Documents** to complete all **Work** as specified or indicated in the **Contract Documents** for the **Contract Price** and within the **Contract Time** indicated in this bid, and all in accordance with the **Contract Documents**.
2. **Bidder** accepts all of the terms and conditions of the **Instructions to Bidders**, including without limitation those dealing with the disposal of the **Bid Security**. This **Bid** will remain open for **sixty (60)** days after the day of **Bid Opening**. **Bidder** will sign the **Agreement** and submit the documents required by the **Contract Documents** within ten (10) days after the date of the **City's Notice of Award**.
3. In submitting this **Bid**, the **Bidder** represents, as more fully set forth in the **Agreement**, that:
 - (a) The **Bidder** has examined copies of the **Invitation to Bid**, the **Instructions to Bidders**, the **Specifications**, the **Supplementary Conditions** and all other **Contract Documents**, and also the following addenda:

Date

Number

Topics

the receipt of all of which is hereby acknowledged.

- (b) **Bidder** has examined the site and locality where the work is to be performed, the legal requirements (**Federal**, **State**, and **Local**, laws, ordinances, rules and regulations) and, conditions affecting cost, progress or performance of the **WORK**, and has made such independent investigations as **Bidder** deems necessary.
 - (c) This **Bid** is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; **Bidder** has not directly or indirectly induced or solicited any other bidder to submit a false or sham bid; **Bidder** has not solicited or induced any person, firm, or corporation to refrain from bidding; and **Bidder** has not sought by collusion to obtain for himself any advantage over any other bidder or over the **City**.
4. **Bidder** agrees that the **Work** on the project will be completed within 365 days from the date of the Notice to Commence Work.
5. **Bidder** will complete the **Work** in accordance with the Contract Documents for the following unit prices:

CITY OF ELYRIA WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS

BID FORM**WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS**

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	LABOR PRICE	MATERIAL PRICE	TOTAL UNIT PRICE	TOTAL COST
1	MOBILIZATION / DEMOBILIZATION (5.0% MAX)	1	LS	\$	\$	\$	\$
2	STORMWATER POLLUTION PREVENTION	1	LS	\$	\$	\$	\$
3	CONCRETE DEMOLITION	1	LS	\$	\$	\$	\$
4	CONCRETE WORK - DETRITUS TANK MODIFICATION	1	LS	\$	\$	\$	\$
5	DRILLED PIERS	500	VLF	\$	\$	\$	\$
6	CONCRETE WORK – NEW SPLITTER BOX	1	LS	\$	\$	\$	\$
7	CONCRETE WORK – AERATION TANKS	1	LS	\$	\$	\$	\$
8	CONCRETE WORK – EXISTING SPLITTER BOX	1	LS	\$	\$	\$	\$
9	ALUMINUM GRATING	140	SF	\$	\$	\$	\$

CITY OF ELYRIA WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	LABOR PRICE	MATERIAL PRICE	TOTAL UNIT PRICE	TOTAL COST
10	ALUMINUM LADDER	1	EA	\$	\$	\$	\$
11	GUARDRAILS	365	LF	\$	\$	\$	\$
12	MISC METALS	1,000	LBS	\$	\$	\$	\$
13	SLAB MOUNTED DAVIT CRANE	5	EA	\$	\$	\$	\$
14	WALL MOUNTED DAVIT CRANE	6	EA	\$	\$	\$	\$
15	AERATION TANK EXISTING EQUIPMENT REMOVAL	1	LS	\$	\$	\$	\$
16	8" GATE VALVE	1	EA	\$	\$	\$	\$
17	4' GATE VALVE	1	EA	\$	\$	\$	\$
18	3" GATE VALVE	1	EA	\$	\$	\$	\$
19	4" BUTTERFLY VALVE	12	EA	\$	\$	\$	\$

CITY OF ELYRIA WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	LABOR PRICE	MATERIAL PRICE	TOTAL UNIT PRICE	TOTAL COST
20	6" BUTTERFLY VALVE	12	EA	\$	\$	\$	\$
21	4" AIR FLOW VALVE	6	EA	\$	\$	\$	\$
22	6" AIR FLOW VALVE	6	EA	\$	\$	\$	\$
23	2' X 4' FLUSH GATE	1	EA	\$	\$	\$	\$
24	1' X 1' FLUSH GATE	6	EA	\$	\$	\$	\$
25	9'7.5" X 1' FLUSH GATE	2	EA	\$	\$	\$	\$
26	8'9" X 1' FLUSH GATE	4	EA	\$	\$	\$	\$
27	6'6" X 4' FLUSH GATE	1	EA	\$	\$	\$	\$
28	4'6"X4' FLUSH GATE	1	EA	\$	\$	\$	\$
29	3'X4'6" FLUSH GATE	3	EA	\$	\$	\$	\$
30	AERATION DIFFUSER SYSTEM INSTALLATION	1	LS	\$	\$	\$	\$

CITY OF ELYRIA WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	LABOR PRICE	MATERIAL PRICE	TOTAL UNIT PRICE	TOTAL COST
31	ELECTRIC DUCT INSTALLATION	551	LF	\$	\$	\$	\$
32	MISC ELECTRIC WORK	1	LS	\$	\$	\$	\$
33	COMMUNICATION WORK	1	LS	\$	\$	\$	\$
34	GRADING AT WET WEATHER HOLDING TANKS	1	LS	\$	\$	\$	\$
35	36-INCH FRPMP	1,080	LF	\$	\$	\$	\$
36	NEW MANHOLES <20' DEEP	4	EA	\$	\$	\$	\$
37	NEW DROP MANHOLES >20' DEEP	2	EA	\$	\$	\$	\$
38	WET WEATHER HOLDING TANK PENETRATIONS	3	EA	\$	\$	\$	\$
39	CONCRETE CURB REMOVE AND REPLACE	60	LF	\$	\$	\$	\$
40	FULL DEPTH ASPHALT PAVEMENT REMOVAL AND REPLACEMENT	1,000	SY	\$	\$	\$	\$
41	FULL DEPTH STONE PAVEMENT REMOVAL AND REPLACEMENT	600	SY	\$	\$	\$	\$

CITY OF ELYRIA WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	LABOR PRICE	MATERIAL PRICE	TOTAL UNIT PRICE	TOTAL COST
42	SITE WORK	1	LS	\$	\$	\$	\$
43	ADDITIONAL CONCRETE REPAIR ALLOWANCE – AS APPROVED BY ENGINEER	1	LS	\$	\$	\$	\$ 200,000.00
44	CONTINGENCY ALLOWANCE – AS APPROVED BY ENGINEER	1	LS	\$	\$	\$	\$ 1,000,000.00
	TOTAL BASE BID					\$	

ASSUMED QUANTITIES FOR CONCRETE REPAIRS INCLUDED IN BASE BID ITEMS
(identified on sheets S053, S054, S101, S103, S104, S105, S204, S308, S500, S502)

DESCRIPTION	UNIT	Assumed Base Bid Quantities
CONCRETE REPAIR TYPE A (see Sheet S054)	LF	
CONCRETE REPAIR TYPE B (see Sheet S054)	LF	
CONCRETE REPAIR TYPE C (see Sheet S054)	LF	
CONCRETE REPAIR TYPE D (see Sheet S054)	SF	
CONCRETE REPAIR TYPE E (see Sheet S054)	SF	

UNIT PRICES FOR BID ITEM 43 ADDITIONAL CONCRETE REPAIR ALLOWANCE
(SHALL APPLY TO TANK REPAIRS NOT SHOWN ON THE DRAWINGS AND TO REPAIRS SHOWN ON THE DRAWINGS
IN THE EVENT THAT THE ACTUAL QUANTITIES DIFFER FROM THE QUANTITIES ASSUMED ON THE BID FORM)

ITEM NO.	DESCRIPTION	UNIT	Unit Price
43.1	CONCRETE REPAIR TYPE A (see Sheet S054)	LF	
43.2	CONCRETE REPAIR TYPE B (see Sheet S054)	LF	
43.3	CONCRETE REPAIR TYPE C (see Sheet S054)	LF	
43.4	CONCRETE REPAIR TYPE D (see Sheet S054)	SF	
43.5	CONCRETE REPAIR TYPE E (see Sheet S054)	SF	

UNOFFICIAL TOTALS

BASE BID ITEMS (1) THROUGH (44) \$_____

The following documents are attached to and made a condition of this bid:

(a) BID SECURITY, in the form of _____.

(b) City EEO Form, and City Affirmative Action Form

(c) Bidder's Insurance Agent's Affidavit, signed by the agent (facsimile or electronic copy is acceptable at time of bidding, provided that the original is received by the City within five (5) days of bid submission.

(d) Tax Affidavit

(e) Bidder's Affidavit

The bidder is _____ (Insert Individual, Partnership, Corporation, Limited Liability Company, Limited Partnership, Limited Liability Partnership, or Joint Venture.)

This **Proposal** is signed on this _____ day of _____, in the year of 2025.

BIDDER: _____ (SEAL)
(Firm Name)

BY: _____ Title: _____
(Printed Name)

BY: _____ Attest: _____
(Authorized Signature)

BUSINESS ADDRESS: (Address to which all official notices are to be sent.)

Telephone Number: (_____) _____ - _____ FAX Number: (_____) _____ - _____

Email Address: _____

(NOTE: If **Bid** is by a partnership, a partner must sign; if the **Bid** is by a corporation, limited liability company an authorized officer must sign,; and if **Bid** is by a joint venture, an authorized officer or individual of all members of the joint venture must sign).

BID GUARANTY AND CONTRACT BOND

(OHIO REVISED CODE SECTION 153.571)

Bond Number _____

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned _____

(Bidder's Name and Address)

as principal and _____ (Name of Sureties) as sureties, are

hereby held and firmly bound unto the City of Elyria, Ohio, as obligee in the penal sum of the dollar amount of the bid submitted by the principal to the obligee on _____ (Date) to undertake the project known as _____

The penal sum referred to herein shall be the dollar amount of the principal's bid to the obligee, incorporating any additive or deductive alternate proposals made by the principal on the date referred to above to the obligee, which are accepted by the obligee. In no case shall the penal sum exceed the amount of \$ _____ (Dollars in Figures) _____

_____ (Dollars in Words). (If the amount in figures and the amount in words are different, the amount in words shall be used as the amount intended.) (If the foregoing blank is not filled in, the penal sum will be the full amount of the principal's bid, including alternates. Alternatively, if the blank is filled in, the amount stated must not be less than the full amount of the bid including alternates, in dollars and cents. A percentage is not acceptable.) For the payment of the penal sum well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH that whereas the above named principal has submitted a bid for:
WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS.

Now, therefore, if the obligee accepts the bid of the principal and the principal fails to enter into a proper contract in accordance with the bid, plans, details, specifications, and bills of material; and in the event the principal pays to the obligee the difference not to exceed ten percent (10%) of the penalty hereof between the amount specified in the bid and such larger amount for which the obligee may in good faith contract with the next lowest bidder to perform the work covered by the bid; or in the event the obligee does not award the contract to the next lowest bidder and resubmits the project for bidding, the principal pays to the obligee the difference not to exceed ten percent (10%) of the penalty hereof between the amount specified in the bid, or the costs, in connection, and printing and mailing notices to prospective bidders, whichever is less, then this obligation shall be null and void, otherwise to remain in full force and effect; if the obligee accepts the bid of the principal and the principal within ten (10) days after the awarding of the contract enters into a proper contract in accordance with the bid, plans, details, specifications, and bill of materials, which said contract is made a part of this bond the same as though set forth herein;

Now also, if the said principal shall well and faithfully do and perform the things agreed by obligee to be done and performed according to the terms of said contract; and shall pay all lawful claims of subcontractors, materialmen, and laborers, for labor performed and materials furnished in the carrying forward, performing, or completing of said contract; we agreeing and assenting that this undertaking shall be for the benefit of any materialman or laborer having a just claim, as well as for the obligee herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

The said surety hereby stipulates and agrees that no modifications, omissions, or additions, in or to the terms of the said contract or in or to the plans or specifications therefor shall in any wise affect the obligations of said surety on this bond.

Name of Bidder: _____ (SEAL)

By: _____ Title: _____
(Printed Name)By: _____ Attest: _____
(Signature) (Signature)

Name of Surety: _____ (SEAL)

Surety Mailing Address: _____

By: _____ Title: _____
(Printed Name)By: _____ (Attorney-in-Fact)
(Signature)

Surety Agent Mailing Address: _____

CONSENT OF SURETY

KNOW ALL MEN BY THESE PRESENTS, that we _____

(Name of Bidder) as principal and _____ (Name of Surety Company)

a corporation created and existing under the laws of the State of _____ and having its

principal office at _____
(Complete mailing address of Surety Company) are held firmly bound unto the **City of Elyria, Ohio**, hereby jointly and severally and binding our heirs, successors, administrators, executors, legal representatives and assigns by these presents.

THE CONDITION OF THIS OBLIGATION are such that whereas, the above named principal submits the herewith proposal for the **WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS** in the City of Elyria, Ohio, in conformance with the Invitation to Bid, and with the Instructions to Bidders. We, the above named surety, will meet all stipulations and will execute the Surety Bonds as hereinafter, to the above named principal in event he should be awarded a contract and in an amount of _____
(Amount in Words) which is an amount equaling or exceeding the amount of said principal's bid plus all additive alternates, and guaranteeing its performance in conformity with the plans and specifications, and a payment bond in the amount of _____
(Amount in Words) amount equaling or exceeding the amount of said principal's bid plus all additive alternates, as guaranteeing the payment of all laborers and suppliers of materials for the project, to the City of Elyria, Ohio.

WITNESS OUR SIGNATURES this _____ day of _____, 2025.

Name of Bidder: _____ (SEAL)

By: _____ Title: _____
(Printed Name)

By: _____ Attest: _____
(Signature) (Signature)

Name of Surety: _____ (SEAL)

By: _____ Title: _____
(Printed Name)

By: _____ Attest: _____
(Signature) (Signature)

Surety Agent Mailing Address: _____

BIDDER'S INSURANCE AGENT'S AFFIDAVIT

Project: **WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS**

I, _____, _____, first being duly sworn do state the following:
(Name) (Title)

- (a) that I am an Insurance Agent.
- (b) that I have reviewed the insurance requirements in the General Conditions, and have noted therein the requirements on insurance including the cancellation, and non-renewal provisions.
- (c) that I am familiar with the insurance that _____
(Bidder's Name)
has in force, and that its insurance meets the City requirements, or that it can be amended to meet the City requirements.
- (d) that if an award of contract is made by the City to the Bidder an insurance certificate will be issued within ten (10) days, which will include the **City of Elyria, Ohio, as Additional Insured.**

Further, Affiant sayeth naught.

(Agents Signature)

Sworn to and subscribed in my presence this _____ day of _____, 2025.

(Notary Public)

(SEAL)

(Attach Bidders Insurance Certificate to this page)

(The insurance certificate may be submitted after the bid opening date.)

TAX AFFIDAVIT

State of _____ SS
County of _____

I _____ (Name), _____ (Title), of the
_____ (Company Name), first being duly
sworn do depose and state that it has submitted a competitive bid for a contract, to be administered
and awarded by the City of Elyria, Ohio.

Further, Affiant says that it was not charged with any delinquent personal property taxes, penalties or
interest due or owing to the County of Lorain, State of Ohio, except as hereinafter stated:

(If none, state "NONE". If due, state "AMOUNT DUE", together with assessed interest and penalty.)

Further, Affiant says that a copy of this statement, affirmed under oath shall be made a part of its bid
and the contract to be awarded.

Further, Affiant sayeth naught.

Business Name: _____

By: _____ Title: _____

Sworn to and subscribed in my presence this _____ day of _____, 2025.

(SEAL)

(NOTARY PUBLIC)

My Commission Expires _____

BIDDER'S AFFIDAVIT

This affidavit is to be filled out and executed by the BIDDER; if the bid is made by a corporation, then by it's properly authorized agent.

STATE OF _____ SS
COUNTY OF _____

I, _____ being first duly sworn, deposes and says that he/she is
_____ (sole owner, a partner, officer of, etc.) of the
_____ (Name of Business) the party making the enclosed
bid; and says further that:
(Give the names of all persons, firms or corporations interested in the enclosed bid)

_____ and, that those listed are the only party or parties interested with
the profits of any contract which may result from the herein contained bid; that the said proposal is made without any
connection or interest in the profits thereof with any other person making any other bid or proposal for said work; that no
member of the City Council, the head of any department, division, or bureau or employee therein or any officer of the
City of Elyria, Ohio is directly or indirectly interested therein; that said bid is genuine and not collusion, or
communication or conference, with any person, to fix the bid price of Affiant or any other bidder, or to fix any overhead,
profit or cost element of said bid price, or that of any other bidder, or to secure any advantage against the City of Elyria,
Ohio, or any person interested in the proposed contract; and that all statements contained in said proposal or bid are true;
that such bidder has not, directly or indirectly submitted this bid, or contents thereof, or divulged information or data
relative thereto to any association, or to any member or agent thereof; and further says that all the statements made by him
in said proposal or bid are true.

AFFIANT

Sworn to and subscribed before me this _____ day of _____, 2025.

Notary Public in and for,
_____ County, Ohio
My Commission Expires: _____

PENALTY FOR FALSE CERTIFICATION

Section 35 of the Criminal Code, as amended, provides a penalty of not more than \$10,000.00 or imprisonment of not more than ten years, or both, for knowingly and willfully making or causing to be made, "any false or fraudulent statements --- or use or cause to be made or used and false ---account, claim, certification, affidavit, or deposition, knowing the same to contain any fraudulent or fictitious statement--"relating to any matter within the jurisdiction of any Governmental Department or Agency.

EQUAL EMPLOYMENT OPPORTUNITY CLAUSE

During the performance of this contract, the contractor agrees as follows:

1. The contractor shall not discriminate against any employee or applicant for employment because of race, religion, age, color, sex, national origin or handicap. The contractor shall take affirmative action to insure that applicants are employed and that employees are treated without regard to race, religion, color, sex, national origin or handicap during employment.

As used herein, the work "treated" shall mean and include without limitation, the following:

recruited: whether in the form of rates of pay or other forms of compensation

selected for training: including apprenticeship, promoted, upgraded, transferred, laid off and terminated

The contractor agrees to and shall post in conspicuous places available to employees and applicants for employment, notices to be provided by the contracting officers setting forth the provisions of the non-discrimination clause.

2. The contractor shall, in all solicitations or advertisement for employees placed by or on the behalf of the contractor; state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national origin or handicap.
3. The contractor shall submit to the City, in writing, an affirmative action plan and shall furnish all information and reports required by the City or its representatives pursuant to this chapter and permit access to the contractor's books, records, and accounts by the contracting agency and affirmative action officials for purposes of investigation to ascertain compliance with the Affirmative Action Program. The contractor may comply with the provisions of this section by doing one of the following:
 - (a) The contractor may submit its Affirmative Action Program in writing at the time of its submission of bid; or
 - (b) The contractor may submit its Affirmative Action Program in writing prior to its submission of bid for pre-certification.

The contractor's Affirmative Action Program may be pre-certified upon the filing and approval of its Affirmative Action Program with the City's OEO office not more than six months prior to its bid submission. Upon pre-certification, the contractor will be issued a pre-certification compliance number for its Affirmative Action Program, which may be used and referred to in any bid submission in the place of any other written requirement for Affirmative Action Program submission. It shall be the sole responsibility of the contractor to be re-certified upon the expiration of its pre-certification. Approved programs may be reviewed before any pre-certification expiration date.

4. The contractor shall send to each labor union or representatives of workers with which he/she has a collective bargaining agreement or other contract or understanding, a notice advising the labor union or workers' representative of the contractor's commitments under the Equal Employment Opportunity Clause of the City of Elyria and shall post copies of the notice in conspicuous places

available to employees and applicants for employment.

5. The contractor shall take such action with respect to any subcontractor as the City of Elyria may direct as a means of enforcing the provisions of the EEO Clause including penalties and sanctions for noncompliance. Provided, however; that in the event the contractor becomes involved in or is threatened with litigation as a result of such direction by the City, the City will enter into such litigation as is necessary to protect the interests of the City and to effectuate the City's Equal Opportunity Program and in the case of contracts receiving federal assistance, the contractor or the City may request the United States to enter into such litigation to protect the interests of the United States.
6. The contractor shall file and shall cause his/her subcontractors, if any, to file compliance reports with the City in the form and to the extent prescribed by the City or its representative. Compliance reports shall contain information as to the employment practices, policies, programs and statistics of the contract and subcontractor(s).
7. The contractor shall include the provisions of the Equal Employment Opportunity Clause in every subcontract or purchase order so that such provisions will be binding upon each subcontractor and/or vendor.
8. Refusal by the contractor or subcontractor to comply with any provision of this program as herein stated and described will subject the offending party to any or all of the following penalties:
 - (a) Withholding of all future payments under the involved public contracts to the contractor in violation until it is determined that the contractor or subcontractor is in compliance with the provision of this contract.
 - (b) Refusal of all future bids for any public contract with the City or any of its departments or divisions until such time as the contractor or subcontractor demonstrates that he/she has established and shall carry out the policies of the programs as herein outlined.
 - (c) Cancellation of the public contract and declaration of forfeiture of the performance bond.
 - (d) In cases in which there is substantial or material violation or the threat of substantial or material violation of the compliance procedure or as may be provided by contract, appropriate proceedings may be brought to enforce these provisions, including the enjoining within applicable laws of contractors, subcontractors or other organizations, individuals, or groups who prevent directly or indirectly or seek to prevent directly or indirectly compliance with the policy as herein outlined.

Name of Company Official

Title

Name of Company

Area Code/Telephone Number

Signature of Company Official

Date Signed

CONTRACTOR'S/VENDOR'S AFFIRMATIVE ACTION INFORMATION SHEET

This Affirmative Action Information Sheet is to be completed and returned with the Bid.

Bidder's EEO Officer's Name: _____

Bidder's EEO Officer's Title: _____

Bidder's Firm Name: _____

Address: _____

City/State/Zip Code _____

Telephone Number: (_____) _____ - _____ Fax Number: (_____) _____ - _____

Note: The bidder must comply with either #1 or #2 below. (Place a check mark in the correct item.)

#1 _____ Our firm has been pre-certified, by Elyria's EEO Officer.

Our pre-certification number is: _____

Our pre-certification expires on: _____

_____ A copy of our pre-certification letter from Elyria is attached.

#2 _____ We are enclosing our own Affirmative Action Plan (number of page(s) _____) with this bid.

(For City Office Use Only)

CITY OF ELYRIA SIGN-OFF:

Affirmative Action/Equal Opportunity Officer: _____

Comments:

CITY OF ELYRIA WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS

CONTRACTOR/SUPPLIER AFFIRMATIVE ACTION PROGRAM
TOTAL PRESENT WORKFORCE BREAKDOWN

TABLE 1

JOB CATEGORY	TOTAL MALES	MALE EMPLOYEES MINORITY GROUPS				TOTAL FEMALES	FEMALE EMPLOYEES MINORITY GROUPS				TOTAL ALL EMPLOYEES
		WHITE	BLACK	SPANISH	OTHER MINORITY		WHITE	BLACK	SPANISH	OTHER MINORITY	
OFFICIALS/ ADMINISTRATORS											
PROFESSIONALS											
TECHNICIANS											
PROTECTIVE SERVICE											
SALES											
PARAPROFESSIONALS											
OFFICE-CLERICAL											
SKILLED CRAFT SPECIFY											
JOURNEYMEN											
HELPERS											
APPRENTICES											
TRAINEES											
LABORERS											
SERVICE/CUSTODIAL											
OTHERS (SPECIFY)											
TOTALS											

SUPPLEMENTARY CONDITIONS

I. INSURANCE LIMITS:

LIABILITY, PROPERTY DAMAGE, VEHICLE AND BUILDER'S RISK INSURANCE: **Contractor** shall purchase and maintain such comprehensive general liability and other types of insurance as will provide protection from claims as set forth herein which may arise out of or result from **Contractor's** performance of the work and **Contractor's** other obligations under all contract documents, whether such performance is by **Contractor**, by any lower subcontractor, by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable.

The claims types for which insurance shall be provided shall include:

- a) Claims under workers compensation, disability benefits and others similar employee benefit acts;
- b) Claims for damage because of bodily injury, occupational sickness, sickness, disease, or death of any person;
- c) Claims for damages sustained by any person as a result of an employment practices offense directly or indirectly related to the employment of such person by the contractor or a subcontractor or by any other person for any other reason;
- d) Claims for damages, other than to the work itself, because of injury to or destruction of tangible property, including loss of the use resulting therefrom;
- e) Claims for damages because of bodily injury or death of any person or for property damage arising out of the ownership, leasing, renting, hires, loaned, or otherwise using, and the maintenance of any item of construction or equipment of any power tools by **Contractor** or a subcontractor;
- f) Claims for damages because of bodily injury or death of any person or for property damage arising out of the ownership, leasing renting or using maintenance of any motor vehicle, by **Contractor** or a subcontractor;
- g) Claims for damages to the work itself, and/or all existing **City** property located in the proximate area of the work, because of injury or destruction of the tangible property, including the loss of use resulting therefrom; and
- h) Claims for damages because of bodily injury or death of any person or property damage arising out of the use, transportation or storage of any type of explosives, explosive devices or dangerous ordnance use in doing work included in the Contract.

The insurance limits required by this section shall include the specific coverage as are applicable to the work, and shall be written for the specified limits stated herein, or for the specific limits as provided in any applicable supplementary specification, or as may be required by law, wherever is greater.

The Contractor shall have and maintain the type of insurance that provides the limits of coverage for each occurrence. If the Contractor's policy is not of the form providing coverage limits for each occurrence, then he shall obtain a rider providing coverage by occurrence for the work under this specification.

The insurance shall be written by a solvent and otherwise acceptable company(s) authorized to do business in the State of Ohio,

Evidence of insurance shall be provided by the Contractor to the City for review and acceptance by the City, before the issuance of the Notice to Commence.

Such evidence shall consist of the Contractors insurance agents "insurance affidavit" (when requested, on a form that is on file at the City Engineer's office) the Certificate of Insurance plus the Certificate of Compliance provided by the Ohio Department of Insurance for the Company(s) in question.

Failure to provide evidence of the maintenance of all of the required insurance shall suspend the City's obligation to pay for any and all work performed after the cessation of the required coverage for which evidence has previously been provided, and can be the basis of a non-compensable order to suspend work or for the termination of the contract for cause.

CITY OF ELYRIA WWPCP ACTIVATED SLUDGE AERATION TANK IMPROVEMENTS

The Contractor's policy shall provide and the Certificate of Insurance shall reflect the fact that the City is an additional insured and all (if any) other additional insured shall receive at least thirty (30) days notice of any cancellation, change reducing the coverage, or refusal to renew, which is adverse to the interests of the City and/or other additional insured to be effected. The City and other additional insured shall be provided with any notice on non-renewal, regardless of the cause.

The liability limits for the required coverage notes above shall be at least:

	EACH OCCURRENCE	AGGREGATE
Bodily Injury & Property Damage Combined	\$ 2,000,000.00	\$ 2,000,000.00
Vehicle Liability	\$ 1,000,000.00	\$ 1,000,000.00
Builders Risk/Installation Floater (if applicable,	(The amount of the contract)	

In the sole discretion of the City Engineer)

ANY AND ALL LIABILITY LIMITS SHALL BE EXCLUSIVE OF DEFENSE COSTS.

II. CONTROLLING LAW AND JURISDICTION:

This Agreement shall in all respects be interpreted and construed in accordance with and governed by the laws of the State of Ohio. This Agreement shall be subject to the jurisdiction of the Court of Common Pleas Lorain County, Ohio.

III. ENGINEER:

Unless otherwise provided, the **Engineer** shall be the City of Elyria Engineer.

IV. CONTINGENCY, IF ANY:

Any Extra Work performed or Extra Materials utilized as part of the Contingency line item, if included in the project, shall be approved in writing by the Engineer, and only the Engineer, prior to commencement of that activity and prior to payment for that activity. Final costs for the Extra Work incurred shall be approved by the Engineer. Approval of this activity shall be directly related to and necessary for the completion of the Scope of Work described in the bid documents, specifications or detailed plans with the construction project.

V. GEOTECHNICAL DATA REPORT

A Geotechnical Memorandum was prepared and utilized by the Engineer in preparation of the contract documents. The Geotechnical Memorandum is included with the bidding documents.

VI. POTENTIALLY CONFLICTING PROJECTS

None.

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly by



AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASSOCIATED GENERAL CONTRACTORS OF AMERICA

AMERICAN SOCIETY OF CIVIL ENGINEERS

PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
A Practice Division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed by



CONSTRUCTION SPECIFICATIONS INSTITUTE

These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor (EJCDC C-520 or C-525, 2007 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the Narrative Guide to the EJCDC Construction Documents (EJCDC C-001, 2007 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (EJCDC C-800, 2007 Edition).

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www.agc.org

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.
 3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Asbestos*—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
 5. *Bid*—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 6. *Bidder*—The individual or entity who submits a Bid directly to Owner.
 7. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).
 8. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.
 9. *Change Order*—A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
 10. *Claim*—A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.
 11. *Contract*—The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.
13. *Contract Price*—The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).
14. *Contract Times*—The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.
15. *Contractor*—The individual or entity with whom Owner has entered into the Agreement.
16. *Cost of the Work*—See Paragraph 11.01 for definition.
17. *Drawings*—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.
18. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
19. *Engineer*—The individual or entity named as such in the Agreement.
20. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.
21. *General Requirements*—Sections of Division 1 of the Specifications.
22. *Hazardous Environmental Condition*—The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.
23. *Hazardous Waste*—The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
24. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

25. *Liens*—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.
26. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.
27. *Notice of Award*—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.
28. *Notice to Proceed*—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.
29. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.
30. *PCBs*—Polychlorinated biphenyls.
31. *Petroleum*—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.
32. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.
33. *Project*—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.
34. *Project Manual*—The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.
35. *Radioactive Material*—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
36. *Resident Project Representative*—The authorized representative of Engineer who may be assigned to the Site or any part thereof.
37. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
38. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

39. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.
40. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
41. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.
42. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.
43. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.
44. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.
45. *Successful Bidder*—The Bidder submitting a responsive Bid to whom Owner makes an award.
46. *Supplementary Conditions*—That part of the Contract Documents which amends or supplements these General Conditions.
47. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.
48. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
49. *Unit Price Work*—Work to be paid for on the basis of unit prices.
50. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such

construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

51. *Work Change Directive*—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 Terminology

- A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day:*

1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents; or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

- c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide:*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
 3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.
- F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

- A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the

Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 *Starting the Work*

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

- A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:
 - 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;
 - 2. a preliminary Schedule of Submittals; and
 - 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.07 *Initial Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.
- C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

- A. Standards, Specifications, Codes, Laws, and Regulations
 1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
 2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Contractor's Review of Contract Documents Before Starting Work:* Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.
2. *Contractor's Review of Contract Documents During Performance of Work:* If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:
 - a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.
- B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:
 1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or
3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

- A. Contractor and any Subcontractor or Supplier shall not:
 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or
 2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

- A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
- B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.
- C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must

comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings:* The Supplementary Conditions identify:

- 1. those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and
- 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

- 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
- 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
- 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

- 1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review:* After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. *Possible Price and Times Adjustments:*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and
 - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:
 - a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or
 - b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph 4.03.A.
3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any

of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and
2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all such information and data;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents;
 - c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and
 - d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have

been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

- A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.
- B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
 - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
 - 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
 - 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.
- D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall

immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

- E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.
- F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.
- G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H

shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

- I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.
- B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.
- C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

- A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

- A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.

- B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.
- C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.
- D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.
- E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor's Insurance*

- A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:
 - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;
 - 2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;
 - 3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;
 - 4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:
 - a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or
 - b. by any other person for any other reason;
 - 5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
 - 6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.
- B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;
2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;
3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;
4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);
5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and
6. include completed operations coverage:
 - a. Such insurance shall remain in effect for two years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

5.05 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 *Property Insurance*

- A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;
 2. be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions.
 3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
 4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;
 5. allow for partial utilization of the Work by Owner;
 6. include testing and startup; and
 7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued.
- B. Owner shall purchase and maintain such equipment breakdown insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee.
- C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.
- D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes

property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

- E. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under this Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

5.07 *Waiver of Rights*

- A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:
 - 1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
 - 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of

recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

- A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the loss payees, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order.
- B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

- A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

- A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 – CONTRACTOR’S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

6.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner’s written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.
- B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.
1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.
 2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and “Or-Equals”*

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or “or-equal” item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.
1. “Or-Equal” Items: If in Engineer’s sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an “or-equal” item, in which case review and approval of the proposed item may, in Engineer’s sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that:
 - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
 - 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and
 - 3) it has a proven record of performance and availability of responsive service.
 - b. Contractor certifies that, if approved and incorporated into the Work:
 - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items:*

- a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.
- b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.
- c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.
- d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - 1) shall certify that the proposed substitute item will:
 - a) perform adequately the functions and achieve the results called for by the general design,
 - b) be similar in substance to that specified, and
 - c) be suited to the same use as that specified;
 - 2) will state:
 - a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,
 - b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and
 - c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;
 - 3) will identify:
 - a) all variations of the proposed substitute item from that specified, and
 - b) available engineering, sales, maintenance, repair, and replacement services; and

- 4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.
- B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.
- C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.
- D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- E. *Engineer's Cost Reimbursement:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- F. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.
- B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable

objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

- C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:
 - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor
 - 2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.
- D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.
- E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.
- F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

- A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not

limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

- C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 *Taxes*

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 *Use of Site and Other Areas*

A. Limitation on Use of Site and Other Areas:

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.
2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.
3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

- B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

- C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

6.13 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
 - 1. all persons on the Site or who may be affected by the Work;
 - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 - 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.
- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

- D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 *Emergencies*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 *Shop Drawings and Samples*

- A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

- a. Submit number of copies specified in the General Requirements.
- b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples:*

- a. Submit number of Samples specified in the Specifications.
- b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Submittal Procedures:*

1. Before submitting each Shop Drawing or Sample, Contractor shall have:

- a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
- b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
- c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
- d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop

Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. Engineer's Review:

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. Resubmittal Procedures:

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

- A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
1. observations by Engineer;
 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 4. use or occupancy of the Work or any part thereof by Owner;
 5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;
 6. any inspection, test, or approval by others; or
 7. any correction of defective Work by Owner.

6.20 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .
- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor,

Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

- C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
 - 1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.
- B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

- A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:
1. written notice thereof will be given to Contractor prior to starting any such other work; and
 2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.
- B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.
- C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:
1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;
 2. the specific matters to be covered by such authority and responsibility will be itemized; and
 3. the extent of such authority and responsibilities will be provided.

- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

- A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.
- B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.
- C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

8.02 *Replacement of Engineer*

- A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

8.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

- A. Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

8.06 *Insurance*

- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

- A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

8.12 *Compliance with Safety Program*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

9.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make

exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

- A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work*

- A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

- A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

- A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.
- B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.
- C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.
- D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.
- B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.
- C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.
- D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of

any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.10 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).
- B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract

Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

10.03 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:
1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;
 2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and
 3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 *Claims*

- A. *Engineer's Decision Required:* All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.
- B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions

of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

- C. *Engineer's Action:* Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:
1. deny the Claim in whole or in part;
 2. approve the Claim; or
 3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.
- D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.
- E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.
- F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

- A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:
1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall

include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
 - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

- e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
- f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.
- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.
- i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

- 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.
- 2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
- 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
- 4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
- 5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

- C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.
- D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.
- B. *Cash Allowances:*
 - 1. Contractor agrees that:
 - a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 - b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.
- C. *Contingency Allowance:*
 - 1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.

- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:
 - 1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
 - 2. there is no corresponding adjustment with respect to any other item of Work; and
 - 3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:
 - 1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or
 - 2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or
 - 3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).
- C. *Contractor's Fee:* The Contractor's fee for overhead and profit shall be determined as follows:
 - 1. a mutually acceptable fixed fee; or
 - 2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;

- b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;
- c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;
- d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;
- e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
- f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

- A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.
- B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

- C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.
- D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.
- E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

- A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

- A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
- B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:
 - 1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;
 - 2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and

3. as otherwise specifically provided in the Contract Documents.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
 - D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.
 - E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.
 - F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

- A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.
- B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.
- C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.
- D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

- A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).
- B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. repair such defective land or areas; or
 - 2. correct such defective Work; or
 - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other

dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored

elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

- C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

- A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments:*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. Review of Applications:

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

- c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:
- a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or
 - d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. Payment Becomes Due:

- 1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. Reduction in Payment:

- 1. Owner may refuse to make payment of the full amount recommended by Engineer because:
 - a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;
 - b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
 - c. there are other items entitling Owner to a set-off against the amount recommended; or
 - d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.
3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.

14.03 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion,

Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

- E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

14.05 *Partial Utilization*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
 - 1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.
 - 2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
 - 4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment*

A. Application for Payment:

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;
 - b. consent of the surety, if any, to final payment;
 - c. a list of all Claims against Owner that Contractor believes are unsettled; and
 - d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. Engineer's Review of Application and Acceptance:

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. Payment Becomes Due:

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

- A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 *Waiver of Claims*

- A. The making and acceptance of final payment will constitute:
 1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and
 2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);
 2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;
 3. Contractor's repeated disregard of the authority of Engineer; or
 4. Contractor's violation in any substantial way of any provisions of the Contract Documents.
- B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:
1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);
 2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and
 3. complete the Work as Owner may deem expedient.
- C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.
- D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.
- E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

- F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

15.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;
 3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and
 4. reasonable expenses directly attributable to termination.
- B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

- A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.
- B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.
- C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:
 - 1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or
 - 2. agrees with the other party to submit the Claim to another dispute resolution process; or
 - 3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
 - 1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or
 - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

- A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

Equal Employment Opportunity (EEO) Requirements
(Required Contract Provision)

The Contractor's EEO Certification Form provided on the following page must be:

- (1) included in the contract documents and
- (2) referenced in the Instructions to Bidders, informing bidders that the form must be completed and submitted with their bid.

NOTE: If the loan applicant has its own EEO requirements, local procedures and forms may be substituted for the EPA form.

/

Contractor Equal Employment Opportunity Certification

During the performance of this contract, the undersigned agrees as follows:

1. The undersigned will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The undersigned will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The undersigned agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this equal opportunity (federally assisted construction) clause.
2. The undersigned will, in all solicitations or advertisements for employees placed by or on behalf of the undersigned, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.
3. The undersigned will send to each labor union or representative of workers, with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representative of the undersigned's commitment under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
4. The undersigned will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
5. The undersigned will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and relevant orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records and accounts by the administering agency of the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
6. In the event of the undersigned's non-compliance with the equal opportunity (federally assisted construction) clause of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated or suspended in whole or in part, and the undersigned may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rules, regulations, or order of the Secretary of Labor, or as provided by law.
7. The undersigned will include this equal opportunity (federally assisted construction) clause in every subcontract or purchase order unless exempted by the rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order No. 11246 of September 24, 1965, so that such provision will be binding upon each subcontract or vendor. The undersigned will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for non compliance: Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor, as a result of such direction by the administering agency the undersigned may request the United States to enter into such litigation to protect the interest of the United States.

(Signature)

(Date)

(Name and Title of Signer, Please type)

(Firm Name)

Debarment Requirements

(Required Contract Provision)

The Certification Regarding Debarment, Suspension, and Other Responsibility Matters form included on the following page must be:

- (1) included in the contract documents and
- (2) referenced in the Instructions to Bidders, informing bidders that the form must be completed and submitted with their bid.

Certification Regarding Debarment, Suspension, and Other Responsibility Matters

INSTRUCTIONS

Under Executive Order 12549 an individual or organization debarred or excluded from participation in Federal assistance or benefit programs may not receive any assistance award under a Federal program or a subagreement thereunder for \$25,000 or more.

Accordingly, each prospective recipient of an EPA grant, loan, or cooperative agreement and any contract or subagreement participant thereunder must complete the attached certification provide an explanation why they cannot. For further details, see the regulation 40 CFR 32.510, Participants' responsibilities.

Go to <https://sam.gov/content/exclusions> to search for excluded parties. The record includes information regarding entities debarred, suspended, proposed for debarment, excluded or disqualified under the nonprocurement common rule, or otherwise declared ineligible from receiving Federal contracts, certain subcontracts, and certain Federal assistance and benefits. This information may include names, addresses, DUNS numbers, Social Security Numbers, Employer Identification Numbers or other Taxpayer Identification Numbers, if available and deemed appropriate and permissible to publish by the agency taking the action.

Where To Submit

The prospective EPA grant, loan, or cooperative agreement recipient must return the signed certification or explanation with its application to Ohio EPA.

A prospective prime contractor must submit a complete certification or explanation to the individual or organization awarding the contract.

Each prospective subcontractor must submit a complete certification or explanation to the prime contractor for the project.

Applicants may reproduce these materials as needed and provide them to their prospective prime contractor, who, in turn, may reproduce and provide them to prospective subcontractors.

Additional copies / assistance may be requested from:

Ohio EPA
Division of Environmental and Financial Assistance
P.O. Box 1049
Columbus, Ohio 43216-1049
(614) 644-2798
www.epa.ohio.gov/defa/

Certification Regarding Debarment, Suspension, and Other Responsibility Matters

The prospective participant certifies to the best of its knowledge and belief that it and its principals:

- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- (b) Have not within a three year period preceding this proposal been convicted of or had a civil judgement rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- (c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (b) of this certification;
- (d) Have not within a three year period preceding this application / proposal had one or more public transactions (Federal, State, or local) terminated for cause or default; and
- (e) Will not utilize a subcontractor or supplier who is unable to certify (a) through (d) above.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award. In addition, under 18 USC Sec. 1001, a false statement may result in a fine of up to \$10,000 or imprisonment for up to 5 years, or both.

Type Name & Title of Authorized Representative

Signature of Authorized Representative

Date

☐ I am unable to certify to the above statements. My explanation is attached.

Disadvantaged Business Enterprises (DBE) Utilization

(Required Contract Provision)

USEPA has a program to encourage the participation of disadvantaged businesses in the construction activities funded by the Clean Water and Drinking Water SRF's. "DBE" is an all-inclusive term that includes Minority Business Enterprises (MBE), Women Business Enterprises (WBE), Small Business Enterprises (SBE), Small Business in Rural Areas (SBRA), HUBZone Small Business, Labor Surplus Area Firms (LSAF), and other entities defined as socially and/or economically disadvantaged. While the WPCLF and WSRLA strongly encourage participation by all disadvantaged groups, specific participation goals are negotiated with USEPA only for Minority Business Enterprises and Women's Business Enterprises.

Goals

As a condition of receiving capitalization grants from U.S. EPA for the Water Pollution Control Loan Fund (WPCLF) and the Water Supply Revolving Loan Account (WSRLA), the Ohio EPA negotiates "fair share" Disadvantaged Business Enterprises (DBE) objectives with U.S. EPA. **The current negotiated goal for construction related activities is 5.4% (the total goal is based on 3.1% of MBEs and 2.3% of WBEs participation).**

DBE Certification

Under the DBE program, qualified DBE's are those that have been certified as an MBE or WBE. Certifications can be obtained from a federal agency such as the Small Business Administration or the Department of Transportation or by an approved State agency. The Unified Certification Program (UCP) administered by the Ohio Department of Transportation (ODOT) can provide the necessary DBE certifications. Information on the UCP can be found at www.ohioucp.org as well as the ODOT website <https://www.transportation.ohio.gov/programs/business-economic-opportunity/dbe>. The Department of Development operates the Encouraging Diversity Growth and Equity Program (EDGE), the other state approved DBE certification program. Information on EDGE can be found at <https://development.ohio.gov/business/minority-business/business-certifications/encouraging-diversity-growth-and-equity-program>.

DBE Qualifications

To qualify for MBE certification, businesses must be 51 percent owned and controlled by a U.S. citizen and Ohio resident belonging to an African American, Native American, Hispanic, or Asian American ethnic group. In addition, the business must be in operation for at least one year prior to submitting an application. For DBE status, a business must be at least 51 percent owned by a socially and economically disadvantaged person who participates in the daily operations of the business. This person must be a woman or of African-American, Hispanic, Native American, Asian American ethnicity.

Program Requirements

To comply with DBE program requirements the WPCLF/WSRLA loan recipient must do the following:

1. Create and maintain a bidder's list (see description below)

2. Include contract conditions applicable to the DBE program in all procurement contracts entered into by the Borrower for all WPCLF and WSRLA projects. These conditions are listed below.
3. Follow, document, and maintain documentation of good faith efforts on the part of prime contractors to ensure that Disadvantaged Business Enterprises (DBEs) have the opportunity to participate in the project.
4. Review the Form 6100-3 and 6100-4 submittals provided by bidders on the project for completeness and obtain any additional information necessary to verify the certification status of all proposed subcontractors.
5. Obtain documentation of the good faith efforts of the prime contractor if the prime contractor does not meet the MBE or WBE goal.
6. Obtain a written confirmation from any prime contractor states that they will not meet the MBE and WBE goals because they will not be entering into any agreements for goods or services with any company, firm, joint venture, or individual.
7. Submit the following to the Ohio EPA/DEFA as part of the bid package upon which the WPCLF/WSRLA loan amount is determined:
 - Form 6100-3 from each subcontractor
 - Form 6100-4 from each prime contractor
 - a copy of the Good Faith Efforts documentation from any prime contractors that will not meet the MBE and WBE goals,
 - if any of the prime contractors will not meet the MBE and WBE goals because they will not be entering into any agreements for goods or services with any company, firm, joint venture, or individual, a copy of the written confirmation from that prime contractor
8. Report MBE/WBE accomplishments on Form 5700-52A annually (within 15 days after October 1st).

NOTE: It is up to the WPCLF/WSRLA loan recipient whether or not to require completion and submission of Forms 6100-3 and 6100-4 from all bidders with the bid proposal or to accept completion and submission from the successful bidder(s) only at some time after bids are received. Regardless of whether the forms are completed and submitted with the bids or at some later time once the successful bidders are identified, completed forms are to be submitted to Ohio EPA with the bid package.

To comply with DBE program requirements all prime contractors must do the following:

1. Follow, document, and maintain documentation of their good faith efforts.
2. Complete and submit **Form 6100-4 DBE Subcontractor Utilization Summary** as part of the bid proposal package to the loan recipient.
3. Have its Disadvantaged Business Enterprise subcontractors complete **Form 6100-3 DBE Subcontractor Proposed Performance Form** and submit those as part of the bid proposal package to the loan recipient.
4. Provide **Form 6100-2 DBE Subcontractor Actual Participation Form** to all of its Disadvantaged Business Enterprise subcontractors for completion at the end of the work.
5. During construction, provide the data necessary so that the loan recipient can report MBE/WBE accomplishments on Form 5700-52A annually (within 15 days after October 1st).

Bidders List

The Borrower must create, maintain, and use a bidders list for purposes of soliciting both MBE/WBEs and non-MBE/WBEs during procurement of construction, equipment, supplies, and services. This list shall include:

1. Entity's name with point of contact;
2. Entity's mailing address, telephone number, and e-mail address;
3. The procurement on which the entity bid or quoted, and when; and
4. Entity's status as an MBE/WBE or non-MBE/WBE.

Borrowers that receive less than \$250,000 or less in any one fiscal year can be exempt from maintaining a Bidders List.

The Bidders List shall be maintained until the project period has expired and the Borrower is no longer receiving EPA funding. The Bidders List must include all firms that bid on the prime contracts, or bid or gave a quote on subcontracts, including both MBE/WBEs and non-MBE/WBEs.

Required Contract Conditions

The DBE Specification language and instructions to the bidders and Forms 6100-2, 6100-3 and 6100-4 must be included in the contract documents and referenced in the Instructions to Bidders, informing bidders that the forms must be completed and submitted with their bid for all WPCLF and WSRLA projects:

1. The prime contractor must pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the owner.
2. The prime contractor must notify the owner in writing prior to the termination of any Disadvantage Business Enterprise subcontractor for convenience by the prime contractor.
3. If a Disadvantage Business Enterprise contractor fails to complete work under the subcontract for any reason, the prime contractor must employ the six Good Faith Efforts (listed below) if soliciting a replacement contractor.
4. The prime contractor must employ the six Good Faith Efforts even if the prime contractor has achieved its fair share objectives.
5. An owner must ensure that each procurement contract it awards contains the following terms and conditions:

The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies.

Good Faith Efforts

Borrowers and their prime contractors must follow, document, and maintain documentation of their good faith efforts as listed below to ensure that Disadvantaged Business Enterprises (DBEs) have the opportunity to participate in the project by increasing DBE awareness of procurement efforts and outreach.

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities; including DBEs on solicitation lists and soliciting them whenever they are potential sources.
2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.
3. Consider in the contracting process whether firms competing for large contracts could be subcontracted with DBEs. This will include dividing total requirements when economically feasible into smaller tasks or quantities to permit participation by DBEs in the competitive process.
4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
5. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce.
6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in numbers 1 through 5 above.

DBE Forms

Form 6100-3 – Each prime contractor must have its DBE subcontractors complete **Form 6100-3 DBE Subcontractor Proposed Performance Form**. This form gives the DBE subcontractor the opportunity to report the scope and cost of the subcontract and it should be forwarded to the Prime Contractor along with the DBE's quote. Each subcontractor completes one Form 6100-3. The Borrower must submit all Form 6100-3 forms to the Ohio EPA/DEFA as part of the bid package upon which the WPCLF/WSRLA loan amount is determined.

Form 6100-4 – Each prime contractor must complete and submit **Form 6100-4 DBE Subcontractor Utilization Summary** as part of the prime contractor's bid proposal package to the Borrower. This form summarizes the Prime Contractor's intended use of identified DBE(s) and the estimated dollar amount of each subcontract. Only one Form 6100-4 form is required from each Prime Contractor. The Borrower must submit this form to the Ohio EPA/DEFA as part of the bid package upon which the WPCLF/WSRLA loan amount is determined.

Form 6100-2 - The prime contractor must provide **Form 6100-2 DBE Subcontractor Actual Participation Form** to all of its Disadvantaged Business Enterprise subcontractors.

This form gives the DBE subcontractor the opportunity to describe the work the DBE received from the Prime Contractor, how much the DBE was paid and any other concerns the DBE might have. Disadvantaged Business Enterprise subcontractors must send completed Form 6100-2 directly to the Region 5 DBE Coordinator after the work by the subcontractor is done and is NOT submitted with the bid package to Ohio EPA.

Region 5 MBE/WBE Coordinator
USEPA, Acquisition and Assistance Branch
77 West Jackson Boulevard (MC-10J)
Chicago, IL 60604

Reporting During Construction – Form 5700-52A

The purpose of MBE/WBE reporting is to monitor the grant recipient's accomplishments in utilizing MBEs and WBEs; and adherence to the good faith efforts (i.e., outreach to MBEs, WBEs, and other DBEs); and progress in achieving MBE and WBE Goals. During the progress of the construction project, the loan recipient must complete & submit Form 5700-52A annually (**within 15 days after October 1st**). If there were no MBEs or WBEs utilized, or no procurement expenditures of any kind were made during the reporting period, a "negative report" is still required.

Reports are to be sent to:

Florel Fraser, Ohio EPA – DEFA
P.O. Box 1049
Columbus, OH 43216-1049
E-mail address: Florel.Fraser@epa.ohio.gov
Phone: (614) 644-3636

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form**

This form is intended to capture the DBE¹ subcontractor's² description of work to be performed and the price of the work submitted to the prime contractor. An EPA Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractors bid or proposal package.

Subcontractor Name		Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Prime Contractor Name		Issuing/Funding Entity:	

Contract Item Number	Description of Work Submitted to the Prime Contractor Involving Construction, Services , Equipment or Supplies	Price of Work Submitted to the Prime Contractor
DBE Certified By: ☐ ODOT ☐ DAS/EDGE ☐ Other: _____ Meets/ exceeds EPA certification standards? ☐ YES ☐ NO ☐ Unknown		

¹ A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

² Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 I.

Prime Contractor Signature	Print Name
Title	Date

Subcontractor Signature	Print Name
Title	Date

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form**

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE¹ subcontractors² and the estimated dollar amount of each subcontract. An EPA Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name		Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Issuing/Funding Entity:			

I have identified potential DBE certified subcontractors	☐ YES ☐ NO		
If yes, please complete the table below. If no, please explain:			
Subcontractor Name/ Company Name	Company Address/ Phone/ Email	Est. Dollar Amt.	Currently DBE Certified?

Continue on back if needed

¹ A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

² Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form**

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 I.

Prime Contractor Signature	Print Name
Title	Date

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form**

An EPA Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE¹ subcontractor² the opportunity to describe work received and/or report any concerns regarding the EPA-funded project (e.g., in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the EPA DBE Coordinator at any time during the project period of performance.

Subcontractor Name		Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Prime Contractor Name		Issuing/Funding Entity:	

Contract Item Number	Description of Work Received from the Prime Contractor Involving Construction, Services , Equipment or Supplies	Amount Received by Prime Contractor

¹ A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

² Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form**

Please use the space below to report any concerns regarding the above EPA-funded project:

Subcontractor Signature	Print Name
Title	Date

ALERT

“Total Procurement” fields and “MBE/WBE Combined Procurement” fields located in section 4B of this form should include Federal funds provided under the assistance agreement, recipient matching funds, and funds from other sources that are included in the assistance agreement.

Due to process time of Paperwork Reduction Act procedures, EPA is not able to update the [EPA Form 5700-52A](#) immediately to reflect this clarification.

If EPA grant recipients have questions about [EPA Form 5700-52A](#), please work with your respective Grants Specialist or [DBE Coordinator](#).



U.S. ENVIRONMENTAL PROTECTION AGENCY MBE/WBE UTILIZATION UNDER FEDERAL GRANTS AND COOPERATIVE AGREEMENTS

This collection of information is approved by OMB under the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. (OMB Control No. 2030-0020). Responses to this collection of information are required to obtain an assistance agreement (40 CFR Part 30, 40 CFR Part 31, and 40 CFR Part 33 for awards made prior to December 26, 2014, and 2 CFR 200, 2 CFR 1500, and 40 CFR Part 33 for awards made after December 26, 2014). An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The public reporting and recordkeeping burden for this collection of information is estimated to be 1 hour per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates and any suggested methods for minimizing respondent burden to the Regulatory Support Division Director, U.S. Environmental Protection Agency (2821T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

1A. REPORTING PERIOD October 1, — September 30,				1B. REPORT TYPE ☐ Annual ☐ Final Report (Project completed)	
1C: Revision of a Prior Year Report? ☐ No ☐ Yes If yes, what reporting period is being revised and briefly describe the changes made. Note: The revised report will replace the associated original report in its entirety.					
2A. RECIPIENT UNIQUE ENTITY IDENTIFIER					
2B. RECIPIENT REPORTING CONTACT Name: Email: Phone:					
3. FEDERAL AWARD IDENTIFICATION NUMBER (FAIN) (For SRF state recipients, please include all numbers for all open assistance agreements being reported on this form.)					
4A. If NO procurements were made this reporting period (by the recipient, sub-recipient(s), loan recipient(s), and prime contractor(s)), CHECK and SKIP to Block No. 6. (Procurements are all expenditures through contract, order, purchase, lease or barter of supplies, equipment, construction, or services needed to complete Federal assistance programs.) ☐					
4B. Total Procurements & MBE/WBE Accomplishments This Reporting Period (in dollars)					
	Construction	Non-Construction	Total		
Total Procurement:	\$ _____	\$ _____	\$ _____		
MBE/WBE Combined Procurement:	\$ _____	\$ _____	\$ _____		
5A. Good Faith Efforts: If procurements were made, indicate whether your organization has followed the six Good Faith efforts found in 40 CFR Part 33, Subpart C, 40 CFR 33.501 and 2 CFR 200.321. ☐ Yes, my organization has implemented and documented each of the six Good Faith Efforts on the procurements made during this reporting period. ☐ No, my organization has not implemented and documented each of the six Good Faith Efforts on the procurements made during this reporting period.			5B. If procurements were made, but no MBE/WBE procurements are being reported, then check the applicable box(es) for the reason(s) why no MBE/WBE procurements were made. ☐ No MBE/WBE(s) applied ☐ No MBE/WBE(s) were qualified ☐ Other:		
6. NAME OF RECIPIENT'S AUTHORIZED REPRESENTATIVE			TITLE		
7. SIGNATURE OF RECIPIENT'S AUTHORIZED REPRESENTATIVE			DATE		

Instructions:

A. General Instructions:

MBE/WBE utilization is based on 40 CFR Part 33 and 2 CFR Parts 200 and 1500. The reporting requirement reflects the change in the reporting threshold described in Recipient/ Applicant Information Notice-2018-G04 issued by EPA's Office of Grants and Debarment on September 7, 2018 (<https://www.epa.gov/grants/rain-2018-g04>). EPA Form 5700-52A must be completed annually by recipients of financial assistance agreements where the combined total of funds budgeted for procuring supplies, equipment, construction and services exceeds the current Simplified Acquisition Threshold as set by the Federal Acquisition Regulation at 48 CFR Subpart 2.1. This reporting requirement applies to all new and existing awards and voids all previous reporting requirements.

In determining whether the threshold is exceeded for a particular assistance agreement, the analysis must focus on funds budgeted for procurement under the supplies, equipment, construction, services or "other" categories, and include funds budgeted for procurement under sub- awards or loans.

Reporting will also be required in cases where the details of the budgets of sub-awards/loans are not clear at the time of the grant awards and the combined total of the procurement and sub-awards and/or loans exceeds the Simplified Acquisition Threshold.

For example, if the Simplified Acquisition Threshold is \$250,000, then if a recipient has \$300,000 budgeted under procurement, then completion of this report is required.

When reporting is required, all procurement actions are reportable, not just the portion which exceeds the Simplified Acquisition Threshold.

If at the time of award the budgeted funds exceed the Simplified Acquisition Threshold but actual expenditures fall below, a report is still required.

If at the time of award, the combined total of funds budgeted for procurements in any category is less than or equal to the Simplified Acquisition Threshold and is

maintained below the threshold, no DBE report is required to be submitted.

Recipients are required to report 30 days after the end of each federal fiscal year (i.e. October 30th), per the terms and conditions of the financial assistance agreement.

Final reports are due October 30th or 120 days after the end of the project period, whichever comes first.

MBE/WBE program requirements, including reporting, are material terms and conditions of the financial assistance agreement. Failure to comply may lead to termination of the financial assistance agreement which is then reported to the OMB-designated integrity and performance system accessible through SAM (currently FAPIIS) pursuant to 2 CFR 200.339(b).

B. Submission:

Recipients must submit completed forms to the point of contact associated with the awarding office for the applicable assistance agreement.

Information on specific points of contact for EPA's Headquarters and ten Regional Offices is located at:

<https://www.epa.gov/grants/frequently-asked-questions-disadvantaged-business-enterprises>

Questions regarding the completion of this form should be directed to the DBE Coordinator associated with the awarding office for the applicable assistance agreement. A list of the DBE Coordinators for each awarding office can be located here:

<https://www.epa.gov/grants/epa-dbe-program-coordinators>

c. Instructions:

1A. Specify Federal fiscal year this report covers. The Federal fiscal year runs from October 1st through September 30th (**e.g. November 29, 2020 falls within Federal fiscal year 2021**)

1B. Specify report type. Check the annual reporting box if this is an annual report. If it is a final report, check the final report box to indicate if the project is completed.

1C. Indicate if this is a revision to a previous year and provide a brief description of the revision you are making including what reporting period is being revised. The revised report will replace the associated original report in its entirety.

2A. Provide your organization's Unique Entity Identifier. More information about Unique Entity Identifier, including its meaning, can be found in 2 CFR Part 25.

2B. Identify the name and contact information for the person located within the recipient organization that can be contacted if questions arise from this report.

3. Provide the Federal Award Identification Number (FAIN) assigned by EPA. A separate report must be submitted for each Assistance Agreement.

***For SRF recipients:** In box 3 list numbers for ALL OPEN Assistance Agreements being reported on this form.

4A. Self-explanatory. **Note:** Procurement means expenditures under the supplies, equipment, construction, services or "other" categories, and include funds expended for procurement under sub-awards or loans.

4B. Provide the total dollar amount (in dollars) of **ALL** procurements awarded this reporting period by construction, non-construction, and grand total by the recipient, sub-recipients, and SRF loan recipients, **including** MBE/WBE expenditures, not just the portion which exceeds the threshold. For example: Actual dollars for procurement from the procuring office; actual contracts let from the contracts office; actual goods, services, supplies, etc., from other sources including the central purchasing/ procurement centers).

Provide the total dollar amount (in dollars) of MBE/WBE procurements **ONLY** awarded this reporting period by construction, non-construction, and grand total by the recipient, sub-recipients, SRF loan recipients, and prime contractors not just the portion which exceeds the threshold.

***For SRF recipients only:** In 4B, please enter the total annual procurement amount under all of your SRF Assistance Agreements. The figure reported in this section is **not** directly tied to an individual Assistance Agreement identification number. **(SRF state recipients report state procurements in this section)**

5A. Self-explanatory.

5B. If procurements were made during this reporting period, but no procurements with MBE(s) or WBE(s) are being reported, then select the reason why. If "Other" is chosen, please fill in with the reason.

6. Self-explanatory.

7. Self-explanatory.

****This data is requested to comply with provisions mandated by: statute or regulations (40 CFR Part 33 and/or 2 CFR Parts 200 and 1500); OMB Circulars; or added by EPA to ensure sound and effective assistance management. Accurate, complete data are required to obtain funding, while no pledge of confidentiality is provided.**

Davis-Bacon Wage Rate Requirements

(required contract provision)

Background and Applicability

On October 30, 2009, P.L. 111-88, "Making appropriations for the Department of the Interior, environment, and related agencies for the fiscal year ending September 30, 2010, and for other purposes," was enacted. This law provides appropriations for both the Clean Water State Revolving Fund (CWSRF) and the Drinking Water State Revolving Fund (DWSRF) for Fiscal Year 2010, while adding new requirements to these already existing programs. One new requirement requires the application of Davis-Bacon Act requirements.

Application of the Davis-Bacon Act requirements extend not only to assistance agreements funded with Fiscal Year 2010 appropriations, but to all assistance agreements executed on or after October 30, 2009, whether the source of the funding is prior year's appropriations, state match, bond proceeds, interest earnings, principal repayments, or any other source of funding so long as the project is financed by an SRF assistance agreement. If a project began construction prior to October 30, 2009 but is financed or refinanced through an assistance agreement executed on or after October 30, 2009, Davis-Bacon Act requirements will apply to all construction that occurs on or after October 30, 2009, through completion of construction.

Ohio EPA Responsibilities

With respect to the Water Pollution Control Loan Fund (WPCLF) and Water Supply Revolving Loan Account (WSRLA) revolving funds, EPA provides capitalization grants to each State which in turn provides funding assistance to eligible recipients within the State. Typically, the assistance recipients are municipal or other local governmental entities that manage the funds. Occasionally, the assistance recipients may be a private for profit or not for profit entity. Although EPA and the State are responsible for ensuring assistance recipients incorporate the wage rate requirements set forth herein as part of contracts for WPCLF and WSRLA funding, the assistance recipient has the primary responsibility to maintain payroll records and for compliance with Davis-Bacon Act requirements as described below.

Municipal Or Other Local Governmental Entities Recipient's Responsibilities

The following is intended to help assistance recipients understand and meet their obligations related to Davis-Bacon (DB). Each assistance recipients should, however, review the contract/subcontract requirements that are set forth later in this document for a more full understanding of DB obligations.

Prior to advertising for bids:

- > Obtain the wage determination for the locality in which a covered activity subject to DB will take place from the Department of Labor (DOL) at www.wdol.gov.
- > Incorporate these wage determinations into the request for bids.
- > Include the required contract provisions (see below) into the contract documents.
- > Require prime contracts to include provisions that subcontractors follow the wage determination incorporated into the prime contract.

During the advertisement period:

- > Monitor www.wdol.gov on a weekly basis to ensure that the wage determination contained in the request for bids remains current.
- > If DOL modifies the DB wage determination more than 10 days prior to the bid opening, issue an addendum reflecting the modification.
- > If DOL modifies or supersedes the DB wage determination less than 10 days prior to bid opening and you cannot issue an addendum for the change, you must request a finding from Ohio EPA that there is not reasonable time to notify interested contractors of the modification of the wage determination. The Ohio EPA will give you a report of its findings.

After opening bids:

- > If the contract(s) aren't awarded within 90 days of the bid opening you must monitor www.wdol.gov on a weekly basis to ensure that wage determinations used in the bids remain current.
- > If the contract(s) aren't awarded within 90 days of the bid opening, any modifications or supersedes that DOL makes to the wage determination must be incorporated into the contract unless (1) you request an extension from Ohio EPA AND (2) Ohio EPA obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv).

After contracts are signed and during construction:

- > Review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.
- > DOL may issue a revised wage determination applicable to one or all of your contracts after the award of the contract or execution of the change order which incorporated DB requirements into the contract if DOL determines that you have failed to incorporate a wage determination or have used a wage determination that clearly does not apply to the contract. If this occurs, you shall either terminate the contract or change order and rebid the contract OR incorporate DOL's wage determination retroactive to the beginning of the contract by change order. The contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.
- > Periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. You must use Standard Form 1445 or equivalent documentation to memorialize the interviews.
- > Establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, you must:
 - conduct all interviews in confidence.
 - conduct interviews with a representative group of covered employees within two weeks of each contractor or subcontractor's submission of its initial weekly payroll data and two weeks prior to the estimated completion date for the contract or subcontract.
 - conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB.
 - immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements.
- > Periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. You must:
 - establish and follow a spot check schedule based on your assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract.
 - spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract at a minimum.
 - conduct more frequent spot checks if the initial spot check or other information indicates that there

is a risk that the contractor or subcontractor is not complying with DB.

- during the examinations, verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

> Periodically review contractors' and subcontractors' use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the DOL or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews.

> Immediately report potential violations of the DB prevailing wage requirements to Andrew Lausted at EPA Region V at 312-886-0189 and to the appropriate DOL Wage and Hour District Office listed at <http://www.dol.gov/esa/contacts/whd/america2.htm>.

If contracts have already been signed and DB requirements need to be incorporated:

> If contracts have already been signed prior to WPCLF/WSRLA funding being provided, you must issue a change order, task order, work assignment or similar legally binding instrument and incorporate the appropriate DOL wage determination from www.wdol.gov as well as the required contract provisions into the contract(s).

> Initiate the contractor and subcontractor review and wage interview requirements as described above and provided in the **Contract And Subcontract Provisions**.

**Private For Profit Or Not For Profit (Non-Governmental) Entities
Recipient's Responsibilities**

The requirements, responsibilities and contract provisions for Private For Profit or Not For Profit Entities (Non-Governmental Entities) is exactly the same as for Municipal Or Other Local Governmental Entities EXCEPT for the following:

Prior to advertising for bids:

> Obtain the proposed wage determinations for specific localities from www.wdol.gov.

> Submit the wage determination to Ohio EPA for approval prior to inserting the wage determination into the solicitation unless subsequently directed otherwise by Ohio EPA.

Contract And Subcontract Provisions For Contracts In Excess Of \$2,000

The following language must be included in full in any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part with WPCLF or WSRLA funds and which is subject to the labor standards provisions of any of the acts listed in §5.1:

NOTE: Modify the first sentence to include the name of the WPCLF/WSRLA funding recipient prior to including these provisions in the contract documents.

Wage Rate Requirements

As used in these provisions "subrecipient" means _____ (fill in WPCLF/WSRLA funding recipient name here).

(a) The following applies to any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public

work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1.

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, www.wdol.gov.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The EPA award official shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the subrecipient(s) to the State award official. The State award official will transmit the report, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department

of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the questions, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account asset for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the

plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the subgrant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees --

(i) *Apprentices.* Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) *Trainees.* Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe

benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may be appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

Contract Provision For Contracts In Excess Of \$100,000 And Subject To The Overtime Provisions Of The Contract Work Hours And Safety Standards Act

The following language must be included in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These provisions are to be included in addition to the provisions for contracts in excess of \$2,000. As used in these paragraphs, the terms laborers and mechanics include watchmen and guards.

(b) Contract Work Hours and Safety Standards Act. The following applies to any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. As used in these paragraphs, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

Contract Provision For Contracts In Excess Of \$100,000 Subject ONLY To The Contract Work Hours And Safety Standards Act

In addition to the provisions for contracts in excess of \$2,000, for any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, you must insert clauses requiring:

(c) The following applies to any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1.

The contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid.

The records shall be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the Ohio EPA, EPA and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

BUILD AMERICA. BUY AMERICA (BABA) ACKNOWLEDGEMENT

The Contractor acknowledges to and for the benefit of the _____ (“Owner”) and the State of Ohio (State) that it understands the goods and services under this Agreement are being funded with federal monies and have statutory requirements commonly known as “Build America, Buy America;” that requires all of the iron and steel, manufactured products, and construction materials used in the project to be produced in the United States (“Build America, Buy America Requirements”) including iron and steel, manufactured products, and construction materials provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and Funding Authority (a) the Contractor has reviewed and understands the Build America, Buy America Requirements, (b) all of the iron and steel, manufactured products, and construction materials used in the project will be and/or have been produced in the United States in a manner that complies with the Build America, Buy America Requirements, unless a waiver of the requirements is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the Build America, Buy America Requirements, as may be requested by the Owner or the Funding Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner or Funding Authority to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Owner or Funding Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Funding Authority or any damages owed to the Funding Authority by the Owner). If the Contractor has no direct contractual privity with the Funding Authority, as a lender or awardee to the Owner for the funding of its project, the Owner and the Contractor agree that the Funding Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the Funding Authority.

Signature

Date

Name and Title of Authorized Signatory, Please Print or Type

Bidder’s Firm



November 3, 2022

MEMORANDUM

SUBJECT: Build America, Buy America Act Implementation Procedures for EPA Office of Water Federal Financial Assistance Programs

FROM: Radhika Fox
Assistant Administrator

A handwritten signature in dark ink, appearing to be "R. Fox", is placed to the right of the "FROM:" line.

TO: EPA Regional Water Division Directors, Regions I – X
EPA Office of Water Office Directors

OVERVIEW

The Biden-Harris Administration recognized the Nation's critical need for infrastructure investment, championing the Bipartisan Infrastructure Law (BIL), which Congress passed on November 15, 2021 (also known as the Infrastructure Investment and Jobs Act (IIJA)). The BIL will provide an unprecedented level of federal investment in water and wastewater infrastructure in communities across America.

In Title IX of the IIJA, Congress passed the Build America, Buy America (BABA) Act, which establishes strong and permanent domestic sourcing requirements across all Federal financial assistance programs for infrastructure. The U.S. Environmental Protection Agency (EPA) Office of Water is honored to help lead the implementation of these provisions and is proud of its near decade of successful implementation of the American Iron and Steel (AIS) provisions for its flagship water infrastructure programs.

This is a transformational opportunity to build a resilient supply chain and manufacturing base for critical products here in the United States that will spur investment in good-paying American manufacturing jobs and businesses. EPA's efforts to implement BABA will help cultivate the domestic manufacturing base for a wide range of products commonly used across the water sector but not currently made domestically. This will take time, and flexibility will be important to ensure that EPA can leverage critical water investments on time and on budget to protect public health and improve water quality.

IMPLEMENTATION

Recognizing the opportunity and need for BABA implementation guidance, the Made in America Office (MIAO) of the Office of Management and Budget (OMB) published [Initial Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure](#) (OMB Guidance M-22-11) on April 18, 2022. The guidance provides government-wide implementation direction for all Federal financial assistance programs for infrastructure. Despite the extensive guidance developed by MIAO, EPA's Office of Water infrastructure investment programs have received many questions that were not addressed in OMB Guidance M-22-11 or that require further clarification for EPA water infrastructure programs. The following questions and answers serve to supplement OMB Guidance M-22-11 with implementation procedures specific to EPA's relevant water infrastructure programs.

Section 70914(a) of the IIJA states when a Buy America preference under BABA applies: "Not later than... [May 14, 2022], the head of each Federal agency shall ensure that none of the funds made available for a Federal financial assistance program for infrastructure... may be obligated for a project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States." Therefore, Federal financial infrastructure investments obligated on or after May 14, 2022, must comply with the BABA requirements. Absent a waiver, all iron, steel, manufactured products, and construction materials permanently incorporated into an infrastructure project subject to the BABA requirements must be produced in the United States. For many of EPA's Office of Water infrastructure investment programs, the vast majority of products permanently incorporated into construction, maintenance, or repair projects must comply with the BABA requirements, with the exception of select construction materials (cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives), which are specifically excepted by the BABA statute.

EPA's Office of Water implements many infrastructure investment programs subject to BABA requirements, including the following:

- Alaska Native Villages and Rural Communities Water Grant Program (ANV) (and any associated Interagency Agreements with the Indian Health Service)
- Clean Water and Drinking Water State Revolving Fund Programs (CW and DWSRF)
- Clean Water and Drinking Water Grants to U.S. Territories and the District of Columbia
- Clean Water Indian and Drinking Water Tribal Infrastructure Grant Set-aside (and any associated Interagency Agreements with the Indian Health Service)
- Coastal Wetlands Planning, Protection and Restoration Act, (CWPPRA) Programs
- Congressionally Directed Spending/Community Project Funding (also known as Community Grants)
- Geographic Programs¹
- Gulf Hypoxia Program
- National Estuaries Program (CWA Section 320)

¹ Geographic Programs include: Great Lakes Restoration Initiative, Chesapeake Bay, San Francisco Bay, Puget Sound, Long Island Sound, Gulf of Mexico, South Florida, Lake Champlain, Lake Pontchartrain, Southern New England Estuaries, Columbia River Basin, Pacific Northwest

- 319 Nonpoint Source Management Program Implementation
- Reducing Lead in Drinking Water Grant Program (SDWA §1459B)
- Assistance for Small and Disadvantaged Communities Grants: Small, Underserved, and Disadvantaged Community Grant Program (SUDC), Emerging Contaminants in Small or Disadvantaged Communities (EC-SDC) and Drinking Water Infrastructure Resilience & Sustainability (SDWA §1459A)
- Sewer Overflow and Stormwater Reuse Municipal Grants (OSG)
- USMCA Implementing Legislation (Section 821 and Title IX, USMCA Supplemental Appropriations, 2020)
- U.S.-Mexico Border Water Infrastructure Program
- Voluntary School and Child Care Program Lead Testing and Remediation Grant Program (SDWA 1464(d))
- Water Infrastructure Finance and Innovation Act (WIFIA)

The questions and answers in this document apply to the implementation of BABA requirements for the Office of Water infrastructure programs listed above unless superseded by regulation, statute, or other applicable guidance. For many of the programs listed above which did not have domestic preference requirements prior to BABA, additional implementation details are pending or may be developed after the issuance of these procedures. In addition, EPA notes that more direction will be helpful to inform the determination and definition of domestic content in manufactured goods. Supplemental guidance on these and other issues, from either OMB or EPA, may be forthcoming. These implementation procedures may also apply to additional, unlisted EPA programs which may be required to apply BABA subsequent to publication of this memorandum (e.g., future funding programs which have been authorized, but not yet appropriated).

For more information on the BABA requirements, visit the EPA Office of Water’s dedicated website – <https://www.epa.gov/cwsrf/build-america-buy-america-baba> – or contact your funding authority (such as your grants officer, portfolio manager, or state contact). For information on approved waivers, visit <https://www.epa.gov/cwsrf/build-america-buy-america-baba-approved-waivers>. You may also email questions to BABA-OW@epa.gov.

This Implementation Procedures document is organized to provide responses to questions in the following topic areas:

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QUESTIONS AND ANSWERS

SECTION 1: GENERAL

- Q1.1: Will EPA provide documentation for BABA for bid solicitations and suggested contract language? Will EPA provide suggested language for Assistance Agreements?
 - A1.1: See Appendix 1, which includes suggested language for construction contracts which addresses the BABA requirements. In addition to the language suggested in Appendix 1, EPA also recommends that assistance recipients prepare contract bid solicitation documents with a statement for the consulting engineers and construction firms as follows: “By signing payment application and recommending payment, Contractor certifies they have reviewed documentation for all products and materials submitted for payment, and the certifications are sufficient to demonstrate compliance with Build America, Buy America Act requirements.” In most cases, the assistance recipient’s representatives assume the responsibility for their clients to conduct due diligence on compliance with applicable domestic preference requirements.

All Federal Financial infrastructure assistance agreements subject to BABA must have a clause requiring compliance with the requirements. See Appendix 2 for example assistance agreement language.
- Q1.2: Would federally-financed infrastructure projects outside of the United States need to comply with the BABA requirements?
 - A1.2: No. According to the OMB Guidance (M-22-11), a “project” is defined as “...any activity related to the construction, alteration, maintenance, or repair of infrastructure in the United States.” Therefore, the BABA requirements are not implicated for infrastructure projects occurring outside of the United States, such as projects funded through the United States-Mexico-Canada Agreement with infrastructure activities occurring in Mexico or Canada (that is, outside the United States).
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- Q1.3: If most of the project is BABA compliant, and a small portion is not, can an assistance recipient self-fund (i.e., paying with non-federal dollars) the non-compliant products?
 - A1.3: Any project that is funded in whole or in part with federal assistance must comply with the BABA requirements, unless the requirements are otherwise waived. All iron, steel, manufactured products, and construction materials used in a project must meet the BABA requirements unless waived. Absent a waiver, there is no “small portion” or product that does not need to satisfy the BABA requirements unless the requirements are waived (or specifically excluded as is the case for cement and cementitious materials; aggregates such as stone, sand, or gravel; aggregate binding agents or additives; or non-permanent products). An assistance recipient may request a waiver or inquire as to whether a broad waiver, such as a *de minimis* waiver, might apply.

- Q1.4: How do international trade agreements affect the implementation of the BABA requirements?
 - A1.4: The BABA requirements apply in a manner consistent with United States obligations under international trade agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to these trade agreements. In general, assistance recipients are not signatories to such agreements, so these trade agreements have no impact on BABA implementation. In the few instances where such an agreement applies to a municipality, that municipality is responsible for determining its applicability and requirements and communicating with the funding authority (such as EPA and/or a state) on the actions taken to comply with BABA.

SECTION 2: PRODUCT COVERAGE

- Q2.1: For products made of iron and steel, what is the difference between predominantly and primarily iron and steel?
 - A2.1: EPA considers the terms “predominantly” and “primarily” to be interchangeable, such that a product is considered predominantly (or primarily) iron and steel if it contains greater than 50 percent iron and steel by material cost.
- Q2.2: What is the definition of construction materials (with examples)?
 - A2.2: From OMB Guidance M-22-11: “construction materials” include an article, material, or supply (other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; aggregate binding agents or additives; or non-permanent products) that is or consists primarily of:
 - non-ferrous metals,
 - plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables), (including optic glass),
 - lumber, and
 - drywall.

For example, a plate of glass would be a construction material under BABA, but a framed window that incorporates the glass into a frame would be a manufactured product. Another common construction material for water infrastructure projects would be polyvinyl chloride (PVC) pipe and fittings. However, if PVC components are incorporated into a more complex product such as instrumentation and control equipment or a water treatment unit, those items would be manufactured products.

- Q2.3: What are manufactured products (with examples)?
 - A2.3: From OMB Guidance M-22-11: “...all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of

the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation...”

The manufactured products category would cover the majority of potential water infrastructure products, including complex products made up of a variety of material types and components. For water infrastructure projects, common manufactured products would include, but not be limited to, pumps, motors, blowers, aerators, generators, instrumentation and control systems, gauges, meters, measurement equipment, treatment equipment, dewatering equipment, actuators, and many other mechanical and electrical items.

- Q2.4: Which category will valves fall under for BABA? Will it differ from the American Iron and Steel (AIS) requirements?
 - A2.4: For programs that are subject to BABA and AIS (SRF, WIFIA, and Community Project Funding), projects using valves should classify them as iron and steel products under BABA as long as their material cost is made up of more than 50 percent iron and/or steel. Valves with 50 percent or less iron and/or steel by material cost would be considered manufactured products under the BABA requirements.

In accordance with OMB Guidance M-22-11, an article, material, or supply should be classified into only one of the three categories: iron and steel, manufactured products, or construction materials. Under the AIS requirements, all valves made primarily of iron and steel (that is, those with iron and/or steel material cost greater than 50 percent) must comply with the AIS requirements. For BABA, EPA interprets Section IV of OMB Guidance M-22-11 to mean that iron and steel products are those items that are primarily iron and steel, the same as for the AIS requirements.

- Q2.5: Does EPA have a list of products to be classified as “Iron and Steel” under BABA?
 - A2.5: Although this list is not comprehensive, the following products were classified as AIS products if made primarily (more than 50 percent) of iron and/or steel by materials cost (for programs subject to both AIS and BABA, this list would be equivalent for “iron and steel” items or products under either requirement):

Products likely made “primarily” of iron and steel to be classified as <u>Iron and Steel</u> under BABA		
Lined and Unlined Pipe	Lined and Unlined Fittings	Tanks
Flanges	Pipe Clamps and Restraints	Structural Steel
Valves	Hydrants	Pre-Cast, Iron/Steel Reinforced Concrete (of all types, regardless of iron/steel content percentage)
Manhole Covers and other Municipal Castings	Access Hatches	Ballast Screens
Iron or Steel Benches	Bollards	Cast Bases
Cast Iron Hinged Hatches	Cast Iron Riser Rings	Catch Basin Inlets

Cleanout/Monument Boxes	Construction Covers and Frames	Curb and Corner Guards

Products likely made “primarily” of iron and steel to be classified as <u>Iron and Steel</u> under BABA		
Curb Boxes	Curb Openings	Curb Stops
Detectable Warning Plates	Downspout Shoes	Drainage Grates
Drainage Grate Frames and Curb Inlets	Inlets	Junction Boxes
Lampposts	Manhole Rings and Frames	Manhole Risers
Meter Boxes	Service Boxes	Steel Hinged Hatches
Steel Riser Rings	Trash Receptacles	Tree Grates
Tree Guards	Trench Grates	Valve Boxes
Valve Box Covers and Risers	Access Ramps	Aeration Pipes and Fittings (separate from aeration/blowers)
Angles	Backflow Preventers/Double Check Valves	Baffle Curtains
Iron or Steel Bar	Bathroom Stalls	Beam Clamps
Cable Hanging Systems	Clarifier Tanks	Coiled Steel
Column Piping	Concrete Reinforcing Bar, Wire, and Fibers	Condensate Sediment Traps
Corrugated Pipe	Couplings	Decking
Digester Covers	Dome Structures	Door Hardware
Doors	Ductwork	Expansion Joints
Expansion Tanks (diaphragm, surge, and hydropneumatics)	Fasteners	Fencing and Fence Tubing
Fire Escapes	Flanged Pipe	Flap Gates
Framing	Gate Valves	Generic Hanging Brackets
Grating	Ground Testing Boxes	Ground Test Wells
Guardrails	HVAC Registers, Diffusers, and Grilles	Joists
Knife Gates	Ladders	Lifting Hooks, J-bar, Connectors within, and Anchors for Concrete
Lockers	Man Baskets and Material Platforms	Manhole Steps
Mud Valves	Municipal Casting Junctions	Non-mechanical (aka stationary) Louvers and Dampers
Overhead Rolling Doors/ Uplifting Doors (manual open, no motor)	Pipe Connectors	Pipe Hangers
Pipe Pilings (any type of steel piling)	Pipe Spool (pipe, flanges, connectors, etc.)	Pipe Supports
Pitless Adaptors	Pre-fab Steel Buildings/Sheds (simple structure, unfurnished)	Pre-stressed Concrete Cylinder Pipe (PCCP)
Railings	Reduced Pressure Zone (RPZ) Valves	Roofing
Service Saddles	Sheet Piling	Sinks (not part of eyewash systems)
Solenoid Valves	Stairs	Static Mixers
Stationary Screens	Surface Drains	Tapping Sleeves
Telescoping Valves	Tipping Buckets	Trusses
Tubing	Valve Stem Extensions	Valve Stems (excluding handwheels and actuators)

Wall Panels	Wall Sleeves/Floor Sleeves	Welding Rods
Well Casing	Well Screens	Wire
Wire Cloth	Wire Rod	Wire Rope and Cables

Q2.6: Does EPA have a list of products that could be made “primarily” of iron and steel but would be classified as “manufactured products” under BABA?

A2.6: Although this list is not comprehensive, the following products would be considered “manufactured products” under the BABA requirements, even if the item might be composed primarily of iron and steel by materials cost (Note: These items are not subject to the AIS requirements.):

Products likely made “primarily” of iron and steel to be classified as <u>Manufactured Products</u> under BABA		
Actuator Superstructures/ Support Structures	Aeration Nozzles and Injectors	Aerators
Analytical Instrumentation	Analyzers (e.g., ozone, oxygen)	Automated Water Fill Stations
Blowers/Aeration Equipment	Boilers, Boiler Systems	Chemical Feed Systems (e.g., polymer, coagulant, treatment chemicals)
Chemical Injection Quills	Chemical Injectors	Clarifier Mechanisms/Arms
Compressors	Controls and Switches	Conveyors
Cranes	Desiccant Air Dryer Tanks	Dewatering Equipment
Dewatering Roll-offs	Disinfection Systems	Drives (e.g., variable frequency drives)
Electric/Pneumatic/Manual Accessories Used to Operate Valves (such as electric valve actuators)	Electrical Cabinetry and Housings (such as electrical boxes/enclosures)	Electrical Conduit
Electrical Junction Boxes	Electronic Door Locks	Elevator Systems (hydraulic, etc.,)
Emergency Life Systems (including eyewash stations, emergency safety showers, fire extinguishers, fire suppression systems including sprinklers /piping/valves, first aid, etc.)	Exhaust Fans	Fall Protection Anchor Points
Fiberglass Tank w/Appurtenances	Filters (and appurtenances, including underdrains, backwash systems)	Flocculators
Fluidized Bed Incinerators	Galvanized Anodes/Cathodic Protection	Gear Reducers
Generators	Geothermal Systems	Grinders
Heat Exchangers	HVAC (excluding ductwork)	HVAC Dampers (if appurtenances to aerators/blowers)
HVAC Louvers (mechanical)	Intake and Exhaust Grates (if appurtenances to aerators/blowers)	Instrumentation
Laboratory Equipment	Ladder Fall Prevention Systems	Ladder Safety Posts
Lighting Fixtures	Lightning and Grounding Rods	Mechanical or Actuated Louvers/Dampers
Membrane Bioreactor Systems	Membrane Filtration Systems	Metal Office Furniture (fixed)

Meters (including flow, wholesale, water, and service connection)	Motorized Doors (unit)	Motorized Mixers
Motorized Screens (such as traveling screens)	Motors	Pelton Wheels
Pipeline Flash Reactors (similar to injectors)	Plate Settlers	Precast Concrete without Iron/Steel Reinforcement

Products likely made “primarily” of iron and steel to be classified as <u>Manufactured Products</u> under BABA		
Furnished Pre-fab Buildings (such as furnished with pumps, mechanics inside)	Presses (including belt presses)	Pressure Gauges
Pump Cans/Barrels and Strainers	Pumps	Mechanical Rakes
Safety Climb Cable	Sampling Stations (unless also act as hydrant)	Scrubbers
Sensors	Sequencing Batch Reactors (SBR)	Steel Shelving (fixed)
Slide and Sluice Gates	Spray Header Units	Steel Cabinets (fixed interior/furniture)
Supervisory Control and Data Acquisition (SCADA) Systems	Tracer Wire	Valve Manual Gears, Actuators, Handles
Voltage Transformer	Water Electrostatic Precipitators (WESP)	Water Heaters
Weir Gates		

- Q2.7: Is asphalt paving a covered product under BABA?
 - A2.7: No. EPA interprets Section 70917(c) of the IIJA to exclude asphalt from BABA requirements. Asphalt paving is a type of concrete composed of an aggregate material mixed with a binder (bitumen). EPA considers asphalt concrete to be excluded by section 70917(c) due to its similarities with cement and cementitious materials.

SECTION 3: CO-FUNDING

- Q3.1: If projects are co-funded with funding mechanisms that don’t require BABA, must the entire project comply with BABA?
 - A3.1: Yes. Any project that is funded in whole or in part with federal assistance must comply with the BABA requirements, unless the requirements are otherwise waived. A “project” consists of all construction necessary to complete the building or work regardless of the number of contracts or assistance agreements involved so long as all the contracts and assistance agreements awarded are closely related in purpose, time, and place. This precludes the intentional splitting of projects into separate and smaller contracts or assistance agreements to avoid BABA’s applicability on some portions of a larger project, particularly where the activities are integrally and proximately related to the whole. However, there are many situations in which major construction activities are clearly undertaken in separate phases that are distinct in purpose, time, or place, in which case, separate contracts or assistance agreements would carry separate requirements.

- Q3.2: How will project requirements be determined for co-funded projects subject to potentially different general applicability/programmatic waiver conditions (such as different adjustment period waivers)?
 - A3.2: OMB Guidance M-22-11 addresses cases with project co-funding from separate programs. EPA would apply the guidance’s “cognizant” program determination to projects that are co-funded with different general applicability/programmatic waivers. For instance, if a project were co-funded between WIFIA and SRF and the majority of the Federal funding for the project is from WIFIA, then WIFIA would be the “cognizant” program for application and determination of waivers. In that case, any conditions from an applicable WIFIA waiver would apply.

SECTION 4: WAIVERS

- Q4.1: Who may apply for a waiver and how do you apply?
 - A4.1: Assistance recipients and their authorized representatives may apply for a project-specific waiver. EPA does not accept waiver requests from suppliers, distributors, or manufacturers unless the assistance recipient endorses and submits the request on its own behalf to the funding authority. In the case where multiple programs are providing federal funds to the project, the assistance recipient should submit the waiver request to the cognizant program, the one providing the greatest amount of federal funds for the project. For information on applying for cost waivers, see questions 4.4 and 4.5. For information on the SRF program roles and responsibilities, see question 7.6.

Project-specific waiver requests should generally include: (1) a brief summary of the project, (2) a description and explanation of the need for the waiver for the product(s) in question, (3) a brief summary of the due diligence conducted in search of domestic alternatives (which could include correspondence between assistance recipient and supplier/distributors), (4) the quantity and materials of the product(s) in question, (5) all engineering specifications and project design considerations relevant to the product(s) in question, (6) the approximate unit cost of items (both foreign and domestic) in addition to an estimated cost of the materials and overall project, (7) the date any products will be needed on site in order to avoid significant project schedule disruptions, and (8) any other pertinent information relevant to EPA’s consideration of the waiver (e.g., if relevant for SRF projects: whether the project is designated as an equivalency project, the date the plans and specifications were submitted to the state, the date of construction initiation, expected date of project completion, any special considerations such as local zoning and building ordinances, seismic requirements, or noise or odor control requirements).

In the case of indirect federal assistance, such as the SRF programs, the state authority reviews and conveys the waiver request to EPA. States should submit waiver requests to the appropriate program waiver request inbox. For SRF projects, please use CWSRFWaiver@epa.gov or DWSRFWaiver@epa.gov.

- Q4.2: Can an assistance recipient request a waiver based on a specification written for a specific brand or model of product (that is, a specification that names a branded item or model)?
 - A4.2: In most cases, performance-based specifications are expected and required for the majority of infrastructure projects funded by EPA's financial assistance programs. In rare cases where "branded" or product-specific sourcing may be included in project specifications, it is suggested that the specifications include the item in question (that is, not simply a catalog page, but also materials of construction, sizing, quantities, and applicable engineering performance design characteristics for the project, etc.) in addition to the standard phrase "or equal." For the purposes of product alternative market research, EPA will evaluate the BABA requirements based on performance-based engineering specifications for the product(s) in question. If the project's specifications do not include performance-based specifications, or at least an "or equal" designation, EPA will base its research on an "or equal" designation using best professional judgment to the extent practicable.
- Q4.3: If a manufactured product is not readily available domestically, will EPA provide short-term "limited availability" product waivers?
 - A4.3: EPA will address the unavailability of domestic products through the waiver process, including potential national short-term waivers for specific products, if appropriate. To the extent practicable and with the intent to maximize domestic market and supply chain development, EPA intends to address issues of broad product unavailability with targeted, time-limited, and conditional waivers, as prescribed in OMB Guidance M-22-11. EPA will follow its robust and thorough product research processes (those put into place for the AIS requirements for the SRF and WIFIA programs and expanded for the new BABA requirements) to identify and determine those products for which proposed national/general applicability waivers may be appropriate.
- Q4.4: What information is needed when applying for a cost waiver under BABA?
 - A4.4: As part of the cost waiver request, the assistance recipient must demonstrate that implementation of the BABA requirements will increase the overall project cost more than 25 percent. Depending on the circumstances of the overall project cost increases, documentation to justify the cost waiver can vary but may include itemized cost estimates or bid tabulations comparing project costs with and without BABA implementation. Assistance recipients should begin assessing the potential cost impacts of the BABA requirements during the design phase of a project.
- Q4.5: Can administrative costs associated with tracking and verification of certifications be considered when determining if the cost of a project increases by 25 percent or more?
 - A4.5: Yes. Section 70914(b)(3) of the IIJA states that a waiver may be provided if the overall

cost of the project increases by more than 25 percent due to the “inclusion of iron, steel, manufactured products, or construction materials produced in the United States.” EPA interprets this to mean that the “inclusion” of the BABA-covered products could encompass reasonable administrative costs associated with complying with the BABA requirements, such as staff, contractor, and technological resources to collect and track BABA compliance documentation.

- Q4.6: How can assistance recipients and construction contractors address product delivery delays?
 - A4.6: Assistance recipients should reasonably plan for material procurement to account for known potential supply chain issues or extended lead times and shall notify the funding authority well in advance of the issues so that prompt attention can be given to explore options. Where extended lead times for compliant products are impacting project schedules and may significantly impact construction progress, timely communication with the funding agency is important. For products that are unavailable within a reasonable timeframe to meet the objectives and schedule of a project, EPA may consider a non-availability waiver with adequate justification. An assistance recipient would need to apply for the waiver and contact its funding authority (such as EPA and/or a state) to initiate the waiver process.

SECTION 5: DOCUMENTING COMPLIANCE

- Q5.1: Who will be responsible for BABA enforcement?
 - A5.1: Responsibility for BABA implementation applies at all levels, from manufacturers to suppliers and distributors, construction contractors, assistance recipients, and funding authorities.

The manufacturers have responsibility to provide adequate and accurate documentation of the products manufactured. If suppliers and distributors are involved, they are responsible for passing along compliance documentation for products supplied to projects that are subject to the BABA requirements.

The assistance recipient and their representatives are primarily responsible for ensuring the documentation collected for products used on the project is sufficient to document compliance with the BABA requirements.

The funding authority is responsible for providing oversight and guidance as needed to ensure the proper implementation of the requirements. The Uniform Grants Guidance (UGG) (Title 2 of the Code of Federal Regulations (CFR) Part 200) applies to many Federal financial assistance agreements that will include BABA requirements. The general provisions of 2 CFR Part 200 determine the responsible party for the grant funding authority.

For information on SRF program roles and responsibilities, see question 7.6. At all levels, where fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1-888- 546-8740

or OIG_Hotline@epa.gov. More information can be found at this website:
<http://www.epa.gov/oig/hotline.htm>.

- Q5.2: When will the BABA requirements be assessed for compliance? Do assistance recipients need to have waivers for potential non-domestic products before assistance agreements are in place, at the time products are procured or products are incorporated into the project (i.e., used)?
 - A5.2: Compliance is assessed where the domestic product is used (or installed) at the project site. Proper compliance documentation, whether it is a BABA certification letter or a waiver, should accompany a product prior to its “use”, in accordance with Section 70914(a) of IIJA. This may occur prior to assistance agreements being in place but is not necessary. Additionally, communication of BABA requirements through appropriate Terms and Conditions in financial assistance agreements and in project solicitation and contract documents is key in ensuring all parties involved are informed of the requirements for the project before construction is underway.
- Q5.3: How can product compliance with the BABA requirements be demonstrated?
 - A5.3: Assistance recipients and their representatives should ensure that the products delivered to the construction site are accompanied by proper documentation that demonstrate compliance with the law and be made available to the funding authority upon request. The documentation may be received and maintained in hard copy, electronically, or could be embedded in construction management software. The use of a signed certification letter for the project is the most direct and effective form of compliance documentation for ensuring products used on site are BABA-compliant prior to their installation; however, other forms of documentation are also acceptable as long as collectively, the following can be demonstrated:
 - (1) Documentation linked to the project. For example, this can be in the form of the project name, project location, contract number, or project number.
 - (2) Documentation linked to the product used on the project. For example, description of product(s) (simple explanation sufficient to identify the product(s)), or an attached (or electronic link to) purchase order, invoice, or bill of lading.
 - (3) Documentation includes statement attesting that the products supplied to the assistance recipient are compliant with BABA requirement. Reference to the Infrastructure Investment and Jobs Act (“IIJA”) or the Bipartisan Infrastructure Law (BIL) are also acceptable. For iron and steel items under BABA, references to the American Iron and Steel (AIS) requirements are also acceptable and reciprocal with BABA for such items.
 - (4) Documentation that manufacturing occurred in the United States, which could include, for example, the location(s) of manufacturing for each manufacturing step that is being certified. It is acceptable for manufactured products to note a single point of manufacturing, documenting that the final point of manufacturing is in the United States. Note that each BABA category may require different determinations for

compliance.

- (5) Signature of company representative (on company letterhead and signature can be electronic). The signatory of the certifying statement affirms their knowledge of the manufacturing processes for the referenced product(s) and attests that the product meets the BABA requirements.

In addition to compliance documentation, assistance recipients or their representatives should also conduct a visual inspection of the product when it arrives to the project site, especially for iron and steel products which are often stamped with the country of origin. (Note: A country of origin stamp alone is not sufficient verification of compliance with BABA and assistance receipts should not rely on it to ensure compliance.)

EPA may develop alternative procedures for demonstrating compliance. Additional project- or program-specific instructions may be developed on a case-by-case basis in order to meet individual circumstances.

- Q5.4: Will EPA provide a form or template for tracking and documenting compliance?
- A5.4: EPA does not require a specified format for tracking or documenting compliance. Assistance recipients are free to develop any system (from simple to complex software) for tracking items used on the project and the accompanying compliance documentation, e.g., certification letters, applicable waivers, if it helps with implementation and compliance. Elements that may help with keeping track of compliance may include: product description, quantity required/used, product category (i.e., iron and steel, manufactured product, or construction material), status of obtaining certification letter, product cost, and whether the item might qualify as *de minimis*, or qualify under another applicable waiver.
- Q5.5: If a manufacturer claims to comply with the Buy American Act, does it also comply with BABA?
 - A5.5: No. With the exception of the AIS requirements – which EPA interprets to be equivalent to the “iron and steel” requirements under BABA – EPA does not have an interpretation about the comparability of other domestic preference requirements relative to BABA. Any products that are to be certified as compliant with BABA should include a specific reference to the BABA requirements and appropriate attestation from a responsible manufacturing company official. See Question 5.3 for EPA’s recommendations for BABA certification letters.
- Q5.6: How will assistance recipients manage certification letters for hundreds, possibly thousands of products?

A5.6: EPA recognizes that the new BABA requirements will cover most products used in typical water and wastewater infrastructure projects, and that the number of items which may require certification at large and/or complex projects may reach several hundred. EPA is concerned about the potential administrative burden that this would place on assistance recipients. EPA recommends that projects with a high number of potentially covered

products meet with their funding authority about potential compliance strategies to minimize burden and streamline compliance activity. Assistance recipients should prepare contract bid solicitation documents with a statement for the consulting engineers and construction firms as follows: “By signing payment application and recommending payment, Contractor certifies they have reviewed documentation for all products and materials submitted for payment, and the documentation is sufficient to demonstrate compliance with Build America, Buy America Act requirements.” In most cases, the assistance recipient’s representatives may assume the responsibility for their clients to conduct due diligence on compliance with applicable domestic preference requirements.

- Q5.7: Who is responsible for documenting the 55 percent content requirement for manufactured products under BABA? What if the final manufacturer cannot trace or verify domestic origin for all components?
 - A5.7: The manufacturer who signs a certification letter is responsible for documenting compliance with any of the three categories of products (iron and steel, manufactured products, or construction materials). For manufactured products, BABA requires that greater than 55 percent of the total cost of all components of the manufactured product be from domestic sources. EPA recommends that the certification letter for manufactured products document whether the item passes the content test in the final product along with a statement attesting to compliance with the BABA requirements for manufactured products.
- Q5.8: How do final product fabricators document compliance when the final step of manufacturing may be simply assembling components?
 - A5.8: It is acceptable, in many cases, especially for highly complex manufactured products that utilize many sub-components, for the final point of assembly to certify without using a “step certification” process. Multiple certifications (i.e., step certifications) or a singular certification can be used for a product, as long as the certifying official is willing to attest to the product’s compliance with BABA requirements at all stages of manufacturing.
- Q5.9: Will Material Test Reports be acceptable in lieu of a BABA certification for iron and steel?
 - A5.9: Material Test Reports (MTRs, commonly referred to as “Mill Certifications” or “Mill Certs”) provide the chemical composition of steel and iron from a mill or foundry. If an MTR accompanies the delivery of steel or iron to a project site with an invoice or bill of lading, EPA will consider it sufficient to demonstrate compliance (equivalent to a certification letter) as long as the MTR includes a manufacturer representative’s signature in addition to the location (city and state) of the mill/foundry. It is common for MTRs to be the first letter in a “step certification” if the product is further fabricated or painted, etc., by another manufacturer.
- Q5.10: Can a manufacturer use a fillable certification letter for products?

- A5.10: EPA recommends that certifications be signed by representatives of the manufacturing entity. EPA does not oppose manufacturers using forms to internally develop letters within their company, thereby providing signed, non-manipulable certification letters to suppliers, distributors, and/or assistance recipients. A fillable form that can be changed by someone outside of the manufacturer after signature does not demonstrate compliance and may create compliance concerns for the manufacturer or assistance recipient.
- Q5.11: Are product certifications from suppliers and distributors allowed?
 - A5.11: EPA recommends that representatives of product manufacturers certify compliance and discourages suppliers and distributors from creating certification letters. EPA does not rule out the possibility that a third-party certification process, such as a certification by a distributor, may be viable. However, EPA is currently not aware of a system or proposed system that meets the EPA's recommendations for documentation of product certification.
- Q5.12: How long should assistance recipients keep compliance documentation?
 - A5.12: Assistance recipients should apply recordkeeping requirements for the project according to the procedures dictated by the funding authority. For most EPA grant programs, this is prescribed in the UGG at 2 CFR 200.334-200.338; e.g., the SRF programs require a minimum of three years. Other funding programs may require longer documentation retention periods.

SECTION 6: PROGRAMS WITH AMERICAN IRON AND STEEL REQUIREMENTS

- Q6.1: Does BABA supersede the American Iron and Steel (AIS) Requirements?
 - A6.1: The BABA requirements for items considered "iron and steel" are equivalent to those for covered iron and steel products under the AIS requirements in the Clean Water Act and the Safe Drinking Water Act. These requirements apply to the CWSRF, DWSRF, WIFIA, and Water infrastructure Community Grants. BABA includes a "Savings Provision" (Section 70917(b)) that states that BABA does not affect existing domestic content procurement preferences for infrastructure projects funded by Federal financial assistance programs that meet the requirements of section 70914. EPA views the AIS requirements as meeting the "iron and steel" product requirements of BABA Section 70914, as they both include the key requirement that items made of iron and steel be wholly manufactured in the United States from the point of melting and/or pouring the iron or steel components through final manufacturing step. Because of the "Savings Provision" of Section 70917, the AIS requirements satisfy the "iron and steel" requirements of BABA. For the programs that have AIS requirements, EPA intends to implement BABA requirements the same way for iron and steel items as it has done for AIS products.

- Q6.2: For iron and steel products, does a manufacturer need to demonstrate compliance from initial melting through the finished product?
 - A6.2: For iron and steel products, the BABA requirements are the same as the existing AIS requirements, in that all of the iron and steel in a covered product (that is, the product is comprised of more than 50 percent iron and steel by material cost) must be melted and poured in the United States and all subsequent manufacturing processes (such as grinding, rolling, bending, reheating, and casting) must occur in the United States.

Q6.3: Will EPA apply the same manufacturing standards for BABA iron and steel products as for the American Iron and Steel (AIS) requirements?

- A6.3: Yes. For AIS, EPA did not require raw materials used in the production of steel or iron to be domestically sourced. For BABA, EPA interprets the requirements to be the same. Hence, like AIS, raw materials in the production of iron and steel subject to BABA requirements would not need to be domestically sourced. The key step for both AIS and BABA domestic iron and/or steel production is the melting/pouring (that is, the location of the furnace), which must be in the United States.
- Q6.4: Will the certification process be similar to the process established for the American Iron and Steel requirements?
 - A6.4: EPA expects the certification process for the BABA requirements to be very similar to that established for the AIS requirements. For iron and steel products, the process should remain the same for AIS and BABA. EPA recommends for manufactured products and for construction materials that certification letters include direct reference to the product/material content requirements under BABA, in addition to an affirmative statement verifying that the product meets the BABA requirements.
- Q6.5: Will duplicate certification letters be required for AIS and BABA for iron/steel products?
 - A6.5: No. Compliance with BABA requirements will be sufficient to demonstrate compliance with AIS requirements for iron and steel products. If a project is subject to BABA, the only demonstration of compliance necessary is with the BABA requirements, of which the iron and steel requirements are equivalent to those of the AIS statutory requirements: the iron or steel in a product made primarily or predominantly of iron and steel (comprising more than 50 percent iron and steel by material cost) must be melted and/or poured in the United States and all subsequent manufacturing processes must occur in the United States.

SECTION 7: PROGRAM-SPECIFIC ISSUES

- Q7.1.: How do the BABA requirements apply to Community Grants?
 - A7.1: The Community Project Funding/Congressionally Directed Spending grants for the construction of drinking water, wastewater, and stormwater infrastructure and for water

quality protection are subject to the requirements specified in the explanatory statement accompanying the Consolidated Appropriations Act (Explanatory Statement for Division G of P.L. 117-13, the Consolidated Appropriations Act of 2022). The explanatory statement asserts: “Applicable Federal requirements that would apply to a Clean Water State Revolving Fund or Drinking Water State Revolving Fund project grant recipient shall apply to a grantee receiving a CPF grant under this section.” Therefore, the federally funded Community Project Funding/Congressionally Directed Spending grants are subject to the same requirements that apply to CWSRF or DWSRF projects, including BABA and AIS requirements. See also A1.2.

- Q7.2: Should SRF projects covered by the BABA SRF Projects Design Planning Adjustment Period Waiver follow the same procedures for demonstrating compliance as outlined for American Iron and Steel requirements?
 - A7.2: Yes. The SRF Design Planning Adjustment Period waiver does not waive the iron and steel requirements under BABA. The SRF programs have existing domestic preference requirements for SRF projects under CWA Section 608 and SDWA Section 1452(a)(4) (AIS requirements) to use iron and steel products that are produced in the United States. Sections 70917(a) and (b) of BIL explain the application of BABA to existing domestic preference requirements. Specifically, the savings provision in Section 70917(b) states that existing domestic preference requirements that meet BABA requirements are not affected by BABA. The statutory AIS requirements were existing at the time BABA became law and satisfy the BABA iron and steel requirements. Therefore, the statutory AIS requirements that have previously applied to SRF-funded projects will continue to do so, and compliance with AIS requirements will satisfy the BABA iron and steel requirements. Demonstration of compliance for iron and steel products will follow the AIS implementation policies for projects subject to the waiver.
- Q7.3: For SRF programs, is BABA considered a federal cross-cutting authority? (i.e., do “equivalency” rules apply?)
 - A7.3: Yes, BABA is considered a federal cross-cutting requirement that applies to SRF assistance equivalent to the federal capitalization grant (i.e., “equivalency” projects). EPA’s SRF regulations at 40 CFR 35.3145 and 35.3575 require states and recipients of SRF funds equivalent to the amount of the federal capitalization grant to comply with federal cross-cutting requirements. Section 70914 of the IIJA, which states when a Buy America preference applies, explains that “none of the funds made available for a Federal financial assistance program for infrastructure...may be obligated for a project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States.” Therefore, BABA only applies to projects funded in an amount equivalent to the federal capitalization grant and not to those projects receiving funds in excess of the capitalization grant (i.e., “non-equivalency” projects). (Note: The AIS requirements continue to apply for all SRF projects, including non-equivalency projects, and all WIFIA and Community Grant projects, because equivalency does not apply.)

- Q7.4: Do the BABA requirements apply to Drinking Water State Revolving Fund set-asides?
 - A7.4: Due to requirements related to the deposit of funds in the DWSRF program, almost all of the funds used to conduct set-aside activities are Federal dollars. Therefore, Federal cross-cutting requirements must be applied to all set-aside activities. However, in the case of most set-aside activities, the cross-cutting requirements will not be implicated because of the nature of the activities conducted under the set-asides. Because the BABA requirements only apply to infrastructure, and infrastructure typically is not an eligible set-aside expenditure (with one potential exception being loans for incentive-based source water protection measures under the Local Assistance and Other State Programs Set-Aside), the BABA requirements will not apply to most set-aside activities.
- Q7.5: What if an SRF project is refinanced using Federal financial assistance on or after May 14, 2022?
 - A7.5: If an SRF project began construction, financed from another funding source, prior to May 14, 2022, but is refinanced through an assistance agreement executed on or after that date, BABA requirements will apply to all construction that occurs on or after May 14, 2022, through completion of construction, unless a waiver applies. There is no retroactive application of the BABA requirements where a refinancing occurs for an SRF project that has completed construction prior to May 14, 2022. (Note: If SRF funding is used for the refinancing, the AIS requirements may still apply depending on the timing of construction.)
- Q7.6: What are the roles and responsibilities for SRF programs for BABA implementation?
 - A7.6: Implementation of the BABA requirements for the State Revolving Fund programs will continue the roles and responsibilities from the successful AIS implementation process.

As with AIS, it is both the assistance recipient's and the state's responsibility to ensure compliance with the BABA requirements. The state is the recipient of a federal capitalization grant and must comply with all grant conditions, including a condition requiring adherence to BABA requirements.

Consequently, states are strongly advised to conduct site visits of projects during construction and review documentation demonstrating the assistance recipient's proof of compliance. In EPA's experience, most states conduct periodic site visits and arrange timely meetings with funded projects. Observed best practices typically include a meeting early in the process (sometimes before bid and usually prior to commencing construction) and at least one project site visit during the construction process. Assistance recipients must maintain documentation of compliance with the BABA requirements, as explained in question 5.3. The documents must be kept by the assistance recipient and should be reviewed by the state during project reviews.

The state's role in the waiver process is to review any waiver requests submitted to the state to ensure that all necessary information has been provided by the assistance recipient prior to forwarding the request to EPA. If a state finds the request lacking, the state should work with

the assistance recipient to help obtain complete information. Question 4.1 explains the information needed by EPA to expediently review a waiver request.

In order to implement the BABA requirements, EPA has developed an approach for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow states, on behalf of the assistance recipients, to apply for waivers of the BABA requirements directly to EPA Headquarters. Only waiver requests received and/or endorsed from states will be considered. Pursuant to BABA, EPA has the responsibility to make findings as to the issuance of waivers to the BABA requirements.

Step-by-step SRF Waiver Process

The waiver process begins with the assistance recipient. To fulfill the BABA requirements, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American-made iron and steel, manufactured goods, and construction materials. It is essential that the assistance recipient include the BABA terms in any request for proposals or solicitations for bids, and in all contracts (see Appendix 2 for sample construction contract language). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three statutory conditions is demonstrated to EPA and approved.

To apply for a project-specific waiver, the assistance recipient should email the request in the form of a Word document (.doc) or editable PDF (.pdf) to the funding program. It is strongly recommended that each state identify a person or persons for BABA communications. The state designee(s) will review the application for the waiver and determine whether the necessary information has been included (Note: More information may be provided in the future regarding what information is required to be included in waiver requests). Once the waiver application is complete, the designee (State) will forward the application to the EPA for review.

Evaluation by EPA

After receiving an application for waiver of the BABA requirements and ensuring sufficient information was provided, EPA will publish the request on its website for 15 days and receive public comment. EPA will then determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the state designee whether a waiver request has been approved or not approved as soon as such a decision has been made. Granting such a waiver is a four-step process:

1. Research – After receiving an application for a waiver, EPA will perform market research to determine whether the iron, steel, manufactured goods, or construction materials are available domestically.
2. Posting – After research, if no domestic product has been identified, EPA is required to

publish the application and all material submitted with the application on EPA's website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at:
<https://www.epa.gov/cwsrf/build-america-buy-america-baba-waivers-open-public-comment>.

3. Evaluation – After receiving an application for waiver of the BABA requirements, EPA will determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver to determine whether or not to grant the waiver.

4. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program and post the signed waiver on the Agency's website. The assistance recipient should keep a copy of the signed waiver in its project files.

(Note: Additional steps may be required in the future regarding the waiver process depending on additional guidance from OBM) APPENDIX 1

AMERICAN IRON AND STEEL ACKNOWLEDGEMENT

The Contractor acknowledges to and for the benefit of the City of _____ (“Purchaser”) and the State of Ohio (the “State”) that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as “American Iron and Steel;” that requires all of the iron and steel products used in the project to be produced in the United States (“American Iron and Steel Requirement”) including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Signature

Date

Name and Title of Authorized Signatory, Please Print or Type

Bidder’s Firm

☐ Check here if the WPCLF or WSRLA applicant will be requesting an individual waiver for non-American made iron and steel products. Please note that the waiver box does not need to be marked for nationwide waivers.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 20 2014

OFFICE OF WATER

MEMORANDUM

SUBJECT: Implementation of American Iron and Steel provisions of P.L. 113-76, Consolidated Appropriations Act, 2014

FROM: f (Andrew D. Sawyers, Director C.
l) Office of Wastewater Management (4201M)

Peter C. Grevatt, Director
Office of Ground Water and Drinking Water (4601M)

TO: Water Management Division Directors
Regions I - X

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel (AIS)" requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use iron and steel products that are produced in the United States for projects for the construction, alteration, maintenance, or repair of a public water system or treatment works if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Federal Fiscal Year 2014.

Section 436 also sets forth certain circumstances under which EPA may waive the AIS requirement. Furthermore, the Act specifically exempts projects where engineering plans and specifications were approved by a State agency prior to January 17, 2014.

The approach described below explains how EPA will implement the AIS requirement. The first section is in the form of questions and answers that address the types of projects that must comply with the AIS requirement, the types of products covered by the AIS requirement, and compliance. The second section is a step-by-step process for requesting waivers and the circumstances under which waivers may be granted.

Implementation

The Act states:

Sec. 436. (a)(1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency (in this section referred to as the “Administrator”) finds that—

(1) applying subsection (a) would be inconsistent with the public interest;

(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

(e) The Administrator may retain up to 0.25 percent of the funds appropriated in this Act for the Clean and Drinking Water State Revolving Funds for carrying out

the provisions described in subsection (a)(1) for management and oversight of the requirements of this section.

(f) This section does not apply with respect to a project if a State agency approves the engineering plans and specifications for the project, in that agency's capacity to approve such plans and specifications prior to a project requesting bids, prior to the date of the enactment of this Act.

The following questions and answers provide guidance for implementing and complying with the AIS requirements:

Project Coverage

1) What classes of projects are covered by the AIS requirement?

All treatment works projects funded by a CWSRF assistance agreement, and all public water system projects funded by a DWSRF assistance agreement, from the date of enactment through the end of Federal Fiscal Year 2014, are covered. The AIS requirements apply to the entirety of the project, no matter when construction begins or ends. Additionally, the AIS requirements apply to all parts of the project, no matter the source of funding.

2) Does the AIS requirement apply to nonpoint source projects or national estuary projects?

No. Congress did not include an AIS requirement for nonpoint source and national estuary projects unless the project can also be classified as a 'treatment works' as defined by section 212 of the Clean Water Act.

3) Are any projects for the construction, alteration, maintenance, or repair of a public water system or treatment works excluded from the AIS requirement?

Any project, whether a treatment works project or a public water system project, for which engineering plans and specifications were approved by the responsible state agency prior to January 17, 2014, is excluded from the AIS requirements.

4) What if the project does not have approved engineering plans and specifications but has signed an assistance agreement with a CWSRF or DWSRF program prior to January 17, 2014?

The AIS requirements do not apply to any project for which an assistance agreement was signed prior to January 17, 2014.

5) What if the project does not have approved engineering plans and specifications, but bids were advertised prior to January 17, 2014 and an assistance agreement was signed after January 17, 2014?

If the project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the approval date for purposes of the exemption in section 436(f).

6) What if the assistance agreement that was signed prior to January 17, 2014, only funded a part of the overall project, where the remainder of the project will be funded later with another SRF loan?

If the original assistance agreement funded any construction of the project, the date of the original assistance agreement counts for purposes of the exemption. If the original assistance agreement was only for planning and design, the date of that assistance agreement will count for purposes of the exemption only if there is a written commitment or expectation on the part of the assistance recipient to fund the remainder of the project with SRF funds.

7) What if the assistance agreement that was signed prior to January 17, 2014, funded the first phase of a multi-phase project, where the remaining phases will be funded by SRF assistance in the future?

In such a case, the phases of the project will be considered a single project if all construction necessary to complete the building or work, regardless of the number of contracts or assistance agreements involved, are closely related in purpose, time and place. However, there are many situations in which major construction activities are clearly undertaken in phases that are distinct in purpose, time, or place. In the case of distinct phases, projects with engineering plans and specifications approval or assistance agreements signed prior to January 17, 2014 would be excluded from AIS requirements while those approved/signed on January 17, 2014, or later would be covered by the AIS requirements.

8) What if a project has split funding from a non-SRF source?

Many States intend to fund projects with “split” funding, from the SRF program and from State or other programs. Based on the Act language in section 436, which requires that American iron and steel products be used in any project for the construction, alteration, maintenance, or repair of a public water system or treatment works receiving SRF funding between and including January 17, 2014 and September 30, 2014, any project that is funded in whole or in part with such funds must comply with the AIS requirement. A “project” consists of all construction necessary to complete the building or work regardless of the number of contracts or assistance agreements involved so long as all contracts and assistance agreements awarded are closely related in purpose, time and place. This precludes the intentional splitting of SRF projects into separate and smaller contracts or assistance agreements to avoid AIS coverage on some portion of a larger project, particularly where the activities are integrally and proximately related to the whole. However, there are many situations in which major construction activities are clearly undertaken in separate phases that are distinct in purpose, time, or place, in which

case, separate contracts or assistance agreement for SRF and State or other funding would carry separate requirements.

9) What about refinancing?

If a project began construction, financed from a non-SRF source, prior to January 17, 2014, but is refinanced through an SRF assistance agreement executed on or after January 17, 2014 and prior to October 1, 2014, AIS requirements will apply to all construction that occurs on or after January 17, 2014, through completion of construction, unless, as is likely, engineering plans and specifications were approved by a responsible state agency prior to January 17, 2014. There is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to January 17, 2014.

10) Do the AIS requirements apply to any other EPA programs, besides the SRF program, such as the Tribal Set-aside grants or grants to the Territories and DC?

No, the AIS requirement only applies to funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12)

Covered Iron and Steel Products

11) What is an iron or steel product?

For purposes of the CWSRF and DWSRF projects that must comply with the AIS requirement, an iron or steel product is one of the following made primarily of iron or steel that is permanently incorporated into the public water system or treatment works:

- Lined or unlined pipes or fittings;
- Manhole Covers;
- Municipal Castings (defined in more detail below);
- Hydrants;
- Tanks;
- Flanges;
- Pipe clamps and restraints;
- Valves;
- Structural steel (defined in more detail below);
- Reinforced precast concrete; and
- Construction materials (defined in more detail below).

12) What does the term ‘primarily iron or steel’ mean?

‘Primarily iron or steel’ places constraints on the list of products above. For one of the listed products to be considered subject to the AIS requirements, it must be made of greater than 50% iron or steel, measured by cost. The cost should be based on the material costs.

13) Can you provide an example of how to perform a cost determination?

For example, the iron portion of a fire hydrant would likely be the bonnet, body and shoe, and the cost then would include the pouring and casting to create those components. The other material costs would include non-iron and steel internal workings of the fire hydrant (i.e., stem, coupling, valve, seals, etc). However, the assembly of the internal workings into the hydrant body would not be included in this cost calculation. If one of the listed products is not made primarily of iron or steel, United States (US) provenance is not required. An exception to this definition is reinforced precast concrete, which is addressed in a later question.

14) If a product is composed of more than 50% iron or steel, but is not listed in the above list of items, must the item be produced in the US? Alternatively, must the iron or steel in such a product be produced in the US?

The answer to both question is no. Only items on the above list must be produced in the US. Additionally, the iron or steel in a non-listed item can be sourced from outside the US.

15) What is the definition of steel?

Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel and other specialty steels.

16) What does ‘produced in the United States’ mean?

Production in the United States of the iron or steel products used in the project requires that all manufacturing processes, including application of coatings, must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives. All manufacturing processes includes processes such as melting, refining, forming, rolling, drawing, finishing, fabricating and coating. Further, if a domestic iron and steel product is taken out of the US for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components

do not have to be of domestic origin.

17) Are the raw materials used in the production of iron or steel required to come from US sources?

No. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-US sources.

18) If an above listed item is primarily made of iron or steel, but is only at the construction site temporarily, must such an item be produced in the US?

No. Only the above listed products made primarily of iron or steel, permanently incorporated into the project must be produced in the US. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

19) What is the definition of ‘municipal castings’?

Municipal castings are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and surface infrastructure. They are typically made of grey or ductile iron, or steel. Examples of municipal castings are:

- Access Hatches;
- Ballast Screen;
- Benches (Iron or Steel);
- Bollards;
- Cast Bases;
- Cast Iron Hinged Hatches, Square and Rectangular;
- Cast Iron Riser Rings;
- Catch Basin Inlet;
- Cleanout/Monument Boxes;
- Construction Covers and Frames;
- Curb and Corner Guards;
- Curb Openings;
- Detectable Warning Plates;
- Downspout Shoes (Boot, Inlet);
- Drainage Grates, Frames and Curb Inlets;
- Inlets;
- Junction Boxes;
- Lampposts;
- Manhole Covers, Rings and Frames, Risers;

Meter Boxes;
Service Boxes;
Steel Hinged Hatches, Square and Rectangular;
Steel Riser Rings;
Trash receptacles;
Tree Grates;
Tree Guards;
Trench Grates; and
Valve Boxes, Covers and Risers.

20) What is ‘structural steel’?

Structural steel is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees and zees. Other shapes include H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

21) What is a ‘construction material’ for purposes of the AIS requirement?

Construction materials are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered “structural steel”. This includes, but is not limited to, the following products: wire rod, bar, angles, concrete reinforcing bar, wire, wire cloth, wire rope and cables, tubing, framing, joists, trusses, fasteners (i.e., nuts and bolts), welding rods, decking, grating, railings, stairs, access ramps, fire escapes, ladders, wall panels, dome structures, roofing, ductwork, surface drains, cable hanging systems, manhole steps, fencing and fence tubing, guardrails, doors, and stationary screens.

22) What is not considered a ‘construction material’ for purposes of the AIS requirement?

Mechanical and electrical components, equipment and systems are not considered construction materials. Mechanical equipment is typically that which has motorized parts and/or is powered by a motor. Electrical equipment is typically any machine powered by electricity and includes components that are part of the electrical distribution system.

The following examples (including their appurtenances necessary for their intended use and operation) are NOT considered construction materials: pumps, motors, gear reducers, drives (including variable frequency drives (VFDs)), electric/pneumatic/manual accessories used to operate valves (such as electric valve actuators), mixers, gates, motorized screens (such as traveling screens), blowers/aeration equipment, compressors, meters, sensors, controls and switches, supervisory control and data acquisition (SCADA), membrane bioreactor systems, membrane filtration systems, filters, clarifiers and clarifier mechanisms, rakes, grinders, disinfection systems, presses (including belt presses), conveyors, cranes, HVAC (excluding ductwork), water heaters,

heat exchangers, generators, cabinetry and housings (such as electrical boxes/enclosures), lighting fixtures, electrical conduit, emergency life systems, metal office furniture, shelving, laboratory equipment, analytical instrumentation, and dewatering equipment.

23) If the iron or steel is produced in the US, may other steps in the manufacturing process take place outside of the US, such as assembly?

No. Production in the US of the iron or steel used in a listed product requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives.

24) What processes must occur in the US to be compliant with the AIS requirement for reinforced precast concrete?

While reinforced precast concrete may not be at least 50% iron or steel, in this particular case, the reinforcing bar and wire must be produced in the US and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the US. The cement and other raw materials used in concrete production are not required to be of domestic origin.

If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the US.

Compliance

25) How should an assistance recipient document compliance with the AIS requirement?

In order to ensure compliance with the AIS requirement, specific AIS contract language must be included in each contract, starting with the assistance agreement, all the way down to the purchase agreements. Sample language for assistance agreements and contracts can be found in Appendix 3 and 4.

EPA recommends the use of a step certification process, similar to one used by the Federal Highway Administration. The step certification process is a method to ensure that producers adhere to the AIS requirement and assistance recipients can verify that products comply with the AIS requirement. The process also establishes accountability and better enables States to take enforcement actions against violators.

Step certification creates a paper trail which documents the location of the manufacturing process involved with the production of steel and iron materials. A step certification is a process under which each handler (supplier, fabricator, manufacturer,

processor, etc) of the iron and steel products certifies that their step in the process was domestically performed. Each time a step in the manufacturing process takes place, the manufacturer delivers its work along with a certification of its origin. A certification can be quite simple. Typically, it includes the name of the manufacturer, the location of the manufacturing facility where the product or process took place (not its headquarters), a description of the product or item being delivered, and a signature by a manufacturer's responsible party. Attached, as Appendix 5, are sample certifications. These certifications should be collected and maintained by assistance recipients.

Alternatively, the final manufacturer that delivers the iron or steel product to the worksite, vendor, or contractor, may provide a certification asserting that all manufacturing processes occurred in the US. While this type of certification may be acceptable, it may not provide the same degree of assurance. Additional documentation may be needed if the certification is lacking important information. Step certification is the best practice.

26) How should a State ensure assistance recipients are complying with the AIS requirement?

In order to ensure compliance with the AIS requirement, States SRF programs must include specific AIS contract language in the assistance agreement. Sample language for assistance agreements can be found in Appendix 3.

States should also, as a best practice, conduct site visits of projects during construction and review documentation demonstrating proof of compliance which the assistance recipient has gathered.

27) What happens if a State or EPA finds a non-compliant iron and/or steel product permanently incorporated in the project?

If a potentially non-compliant product is identified, the State should notify the assistance recipient of the apparent unauthorized use of the non-domestic component, including a proposed corrective action, and should be given the opportunity to reply. If unauthorized use is confirmed, the State can take one or more of the following actions: request a waiver where appropriate; require the removal of the non-domestic item; or withhold payment for all or part of the project. Only EPA can issue waivers to authorize the use of a non-domestic item. EPA may use remedies available to it under the Clean Water Act, the Safe Drinking Water Act, and 40 CFR part 31 grant regulations, in the event of a violation of a grant term and condition.

It is recommended that the State work collaboratively with EPA to determine the appropriate corrective action, especially in cases where the State is the one who identifies the item in noncompliance or there is a disagreement with the assistance recipient.

If fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1-888-546-8740 or OIG_Hotline@epa.gov. More information can be found at this website: <http://www.epa.gov/oig/hotline.htm>.

28) How do international trade agreements affect the implementation of the AIS requirements?

The AIS provision applies in a manner consistent with United States obligations under international agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to such agreements. In general, SRF assistance recipients are not signatories to such agreements, so these agreements have no impact on this AIS provision. In the few instances where such an agreement applies to a municipality, that municipality is under the obligation to determine its applicability and requirements and document the actions taken to comply for the State.

Waiver Process

The statute permits EPA to issue waivers for a case or category of cases where EPA finds (1) that applying these requirements would be inconsistent with the public interest; (2) iron and steel products are not produced in the US in sufficient and reasonably available quantities and of a satisfactory quality; or (3) inclusion of iron and steel products produced in the US will increase the cost of the overall project by more than 25 percent.

In order to implement the AIS requirements, EPA has developed an approach to allow for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow States, on behalf of the assistance recipients, to apply for waivers of the AIS requirement directly to EPA Headquarters. Only waiver requests received from states will be considered. Pursuant to the Act, EPA has the responsibility to make findings as to the issuance of waivers to the AIS requirements.

Definitions

The following terms are critical to the interpretation and implementation of the AIS requirements and apply to the process described in this memorandum:

Reasonably Available Quantity: The quantity of iron or steel products is available or will be available at the time needed and place needed, and in the proper form or specification as specified in the project plans and design.

Satisfactory Quality: The quality of iron or steel products, as specified in the project plans and designs.

Assistance Recipient: A borrower or grantee that receives funding from a State CWSRF or DWSRF program.

Step-By-Step Waiver Process

Application by Assistance Recipient

Each local entity that receives SRF water infrastructure financial assistance is required by section 436 of the Act to use American made iron and steel products in the construction of its project. However, the recipient may request a waiver. Until a waiver is granted by EPA, the AIS requirement stands, except as noted above with respect to municipalities covered by international agreements.

The waiver process begins with the SRF assistance recipient. In order to fulfill the AIS requirement, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American made iron and steel products. It is essential that the assistance recipient include the AIS terms in any request for proposals or solicitations for bids, and in all contracts (see Appendix 3 for sample construction contract language). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three conditions is met:

1. Applying the American Iron and Steel requirements of the Act would be inconsistent with the public interest;
2. Iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
3. Inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Proper and sufficient documentation must be provided by the assistance recipient. A checklist detailing the types of information required for a waiver to be processed is attached as Appendix 1.

Additionally, it is strongly encouraged that assistance recipients hold pre-bid conferences with potential bidders. A pre-bid conference can help to identify iron and steel products needed to complete the project as described in the plans and specifications that may not be available from domestic sources. It may also identify the need to seek a waiver prior to bid, and can help inform the recipient on compliance options.

In order to apply for a project waiver, the assistance recipient should email the request in the form of a Word document (.doc) to the State SRF program. It is strongly recommended that the State designate a single person for all AIS communications. The State SRF designee will review the application for the waiver and determine whether the necessary information has been included. Once the waiver application is complete, the State designee will forward the application to the EPA for review.

Evaluation by EPA

After receiving an application for waiver of the AIS requirements, EPA Headquarters will publish the request on its website for 15 days and receive informal comment. EPA Headquarters will then use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to

determine whether or not to grant the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the State designee that a waiver request has been approved or denied as soon as such a decision has been made. Granting such a waiver is a three-step process:

1. Posting – After receiving an application for a waiver, EPA is required to publish the application and all material submitted with the application on EPA’s website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at: http://water.epa.gov/grants_funding/aisrequirement.cfm
2. Evaluation – After receiving an application for waiver of the AIS requirements, EPA Headquarters will use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.
3. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program, and post the signed waiver on our website. The assistance recipient should keep a copy of the signed waiver in its project files.

Public Interest Waivers

EPA has the authority to issue public interest waivers. Evaluation of a public interest waiver request may be more complicated than that of other waiver requests so they may take more time than other waiver requests for a decision to be made. An example of a public interest waiver that might be issued could be for a community that has standardized on a particular type or manufacturer of a valve because of its performance to meet their specifications. Switching to an alternative valve may require staff to be trained on the new equipment and additional spare parts would need to be purchased and stocked, existing valves may need to be unnecessarily replaced, and portions of the system may need to be redesigned. Therefore, requiring the community to install an alternative valve would be inconsistent with public interest.

EPA also has the authority to issue a public interest waiver that covers categories of products that might apply to all projects.

EPA reserves the right to issue national waivers that may apply to particular classes of assistance recipients, particular classes of projects, or particular categories of iron or steel products. EPA may develop national or (US geographic) regional categorical waivers through the identification of similar circumstances in the detailed justifications presented to EPA in a waiver request or requests. EPA may issue a national waiver based on policy decisions regarding the public's interest or a determination that a particular item is not produced domestically in reasonably available quantities or of a sufficient quality. In such cases, EPA may determine it is necessary to issue a national waiver.

If you have any questions concerning the contents of this memorandum, you may contact us, or have your staff contact Jordan Dorfman, Attorney-Advisor, State Revolving Fund Branch, Municipal Support Division, at dorfman.jordan@epa.gov or (202) 564-0614 or Kiri Anderer, Environmental Engineer, Infrastructure Branch, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

Attachments

Appendix 1: Information Checklist for Waiver Request

The purpose of this checklist is to help ensure that all appropriate and necessary information is submitted to EPA. EPA recommends that States review this checklist carefully and provide all appropriate information to EPA. This checklist is for informational purposes only and does not need to be included as part of a waiver application.

Items	✓	Notes
General • Waiver request includes the following information: — Description of the foreign and domestic construction materials — Unit of measure — Quantity — Price — Time of delivery or availability — Location of the construction project — Name and address of the proposed supplier — A detailed justification for the use of foreign construction materials • Waiver request was submitted according to the instructions in the memorandum • Assistance recipient made a good faith effort to solicit bids for domestic iron and steel products, as demonstrated by language in requests for proposals, contracts, and communications with the prime contractor		
Cost Waiver Requests • Waiver request includes the following information: — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products — Relevant excerpts from the bid documents used by the contractors to complete the comparison — Supporting documentation indicating that the contractor made a reasonable survey of the market, such as a description of the process for identifying suppliers and a list of contacted suppliers		
Availability Waiver Requests • Waiver request includes the following supporting documentation necessary to demonstrate the availability, quantity, and/or quality of the materials for which the waiver is requested: — Supplier information or pricing information from a reasonable number of domestic suppliers indicating availability/delivery date for construction materials — Documentation of the assistance recipient's efforts to find available domestic sources, such as a description of the process for identifying suppliers and a list of contacted suppliers. — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of construction materials • Waiver request includes a statement from the prime contractor and/or supplier confirming the non-availability of the domestic construction materials for which the waiver is sought • Has the State received other waiver requests for the materials described in this waiver request, for comparable projects?		

Appendix 2: HQ Review Checklist for Waiver Request

Instructions: To be completed by EPA. Review all waiver requests using the questions in the checklist, and mark the appropriate box as Yes, No or N/A. Marks that fall inside the shaded boxes may be grounds for denying the waiver. If none of your review markings fall into a shaded box, the waiver is eligible for approval if it indicates that one or more of the following conditions applies to the domestic product for which the waiver is sought:

1. The iron and/or steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.
2. The inclusion of iron and/or steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Review Items	Yes	No	N/A	Comments
Cost Waiver Requests • Does the waiver request include the following information? — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products — Relevant excerpts from the bid documents used by the contractors to complete the comparison — A sufficient number of bid documents or pricing information from domestic sources to constitute a reasonable survey of the market • Does the Total Domestic Project exceed the Total Foreign Project Cost by more than 25%?				
Availability Waiver Requests • Does the waiver request include supporting documentation sufficient to show the availability, quantity, and/or quality of the iron and/or steel product for which the waiver is requested? — Supplier information or other documentation indicating availability/delivery date for materials — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of materials • Does supporting documentation provide sufficient evidence that the contractors made a reasonable effort to locate domestic suppliers of materials, such as a description of the process for identifying suppliers and a list of contacted suppliers? • Based on the materials delivery/availability date indicated in the supporting documentation, will the materials be unavailable when they are needed according to the project schedule? (By item, list schedule date and domestic delivery quote date or other relevant information) • Is EPA aware of any other evidence indicating the non-availability of the materials for which the waiver is requested? Examples include: — Multiple waiver requests for the materials described in this waiver request, for comparable projects in the same State — Multiple waiver requests for the materials described in this waiver request, for comparable projects in other States — Correspondence with construction trade associations indicating the non-availability of the materials • Are the available domestic materials indicated in the bid documents of inadequate quality compared those required by the project plans, specifications, and/or permits?				

Appendix 5: Sample Certifications

The following information is provided as a sample letter of **step** certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Step Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the (melting, bending, coating, galvanizing, cutting, etc.) process for (manufacturing or fabricating) the following products and/or materials shipped or provided for the subject project is in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. XXXX
2. XXXX
3. XXXX

Such process took place at the following location:

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

The following information is provided as a sample letter of certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the following products and/or materials shipped/provided to the subject project are in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. XXXX
2. XXXX
3. XXXX

Such process took place at the following location:

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

**American Iron & Steel (AIS) Requirement of the Consolidated Appropriations Act of 2014
(Public Law 113-76)**

Q&A Part 2

PRODUCT QUESTIONS

1. Q: Do all fasteners qualify for de minimis exemption?

A: No. There is no broad exemption for fasteners from the American Iron and Steel (AIS) requirements. Significant fasteners used in SRF projects are not subject to the de minimis waiver for projects and must comply with the AIS requirements. Significant fasteners include fasteners produced to industry standards (e.g., ASTM standards) and/or project specifications, special ordered or those of high value. When bulk purchase of unknown-origin fasteners that are of incidental use and small value are used on a project, they may fall under the national de minimis waiver for projects. The list of potential items could be varied, such as big-box/hardware-store-variety screws, nails, and staples. The key characteristics of the items that may qualify for the de minimis waiver would be items that are incidental to the project purpose (such as drywall screws) and not significant in value or purpose (such as common nails or brads).

EPA also clarifies that minor components of two listed products – valves and hydrants -- may not need to meet the AIS requirements if the minor components compromise a very small quantity of minor, low-cost fasteners that are of unknown origin.

2. Q: Does PCCP pipe have to be domestically produced?

A: Yes. Pre-stressed concrete cylinder pipe (PCCP) or other similar concrete cylinder pipes would be comparable to pre-cast concrete which is specifically listed in the Consolidated Appropriations Act of 2014 as a product subject to the AIS requirement.

3. Q: If the iron or steel is made from recycled metals will the vendor/supplier have to provide a certification document certifying that the recycled metals are domestically produced?

A: No. Recycled source materials used in the production of iron and steel products do not have to come from the U.S. Iron or steel scrap, for instance, are considered raw materials that may come from anywhere. While certification is not required for the raw material, EPA does recommend that additional final processing of iron and steel be certified to have occurred in the U.S.

4. Q: Do tanks used for filtration systems, if delivered to the construction site separately and then filled with filtration media onsite, have to be domestically produced?

A: No. Tanks that are specifically designed to be filters, or as parts of a filtration system, do not have to be domestically produced because these parts are no longer simply tanks, even if the filter media has not been installed and will be installed at the project site, as is customary to do for shipping purposes. These parts have only one purpose which is to be housing for filters and cannot be used in another fashion.

5. Q: Can a recipient use non-domestic flanged pipe?

A: No. While the Consolidated Appropriations Act of 2014 does not specifically mention flanged pipe, since it does mention both pipe and flanges, both products would need to be domestically produced. Therefore, flanged pipe would also need to be domestically produced.

6. Q: Can a recipient use non-domestic couplings, expansion joints, and other similar pipe connectors?

A: No. These products would be considered specialty fittings, due to their additional functionality, but still categorized under the larger “fitting” categorization. Fittings are defined as a material that joins pipes together or connects to a pipe (AWWA, The Drinking Water Dictionary, 2000). Therefore, these products must comply with the AIS requirements and be produced domestically.

7. Q: Can a recipient use non-domestic service saddles and tapping sleeves?

A: No. These products are necessary for pipe repair, to tap a water main, or to install a service or house connection. Therefore, they are included under the larger “pipe restraint” category which is a specifically identified product subject to the domestic preference in the Consolidated Appropriations Act of 2014.

8. Q: The AIS guidance does not appear to cover reused items (i.e., existing pipe fittings, used storage tanks, reusing existing valves). How should reused items be addressed?

A: The AIS guidance does not address reuse of items. Reuse of items that would otherwise be covered by AIS is acceptable provided that the item(s) was originally purchased prior to January 17, 2014, the reused item(s) is not substantially altered from original form/function, and any restoration work that may be required does not include the replacement or addition of foreign iron or steel replacement parts. EPA recommends keeping a log of these reused items by including them on the assistance recipient’s de minimis list, and stating therein that these items are reused products. The donation of new items (such as a manufacturer waiving cost for certain delivered items because of concerns regarding the origin of a new product) is not, however, considered reuse.

9. Q: What does “time needed” mean in the AIS guidance, in reference to the definition of “Reasonably Available Quantity”?

A: For considering whether a product would meet reasonably available quantity, “time needed” is based on the construction schedule. If the item is delayed and there is substantial impact on the overall construction schedule, this would not be according to the “time needed.”

10. Q: If a product is not specifically included on the list of AIS covered products, must it comply with AIS?

A: Possibly. The AIS requirements include a list of specifically covered products, one of which is construction materials, a broad category of potential products. For construction materials, EPA’s AIS guidance includes a set of example items that it considers construction materials composed primarily of iron and steel and covered by the Act. This example list in the guidance is not an all-inclusive list of potential construction materials. However, the guidance also includes a list of items that EPA specifically does not consider construction materials, generally those of electrical or complex-mechanical nature. If a product is similar to the ones in the non-construction material list (and it is also not specifically listed by the Act), it is not a construction material. For all other items specifically included in the Act, coverage is generally self-evident.

11. Q: If a listed iron and steel product is used as a part for an assembled product that is non-domestic, do the AIS requirements apply?

A: AIS requirements only apply to the final product as delivered to the work site and incorporated into the project. Other assemblies, such as a pumping assembly or a reverse osmosis package plant, are distinct products not listed and do not need to be made in the U.S. or composed of all U.S. parts. Therefore, for the case of a non-covered product used in a larger non-domestic assembly, the components, even if specifically listed in the Consolidated Appropriations Act, do not have to be domestically produced.

12. Q: Is cast iron excluded from the AIS requirements?

A: No. Cast iron products that fall under the definition of iron and steel products must comply with the AIS requirements.

13. Q: The guidance states that “construction materials” do not include mechanical equipment, but then identifies ductwork as a construction material. Please clarify.

A: Ductwork is not mechanical equipment, therefore it is considered a “construction material” and must comply with the AIS requirements.

14. Q: Do “meters” mentioned in EPA’s guidance as non-construction materials include both flow meters and water meters?

A: Yes. “Meters” includes any type of meter, including: flow meters, wholesale meters, and water meters/service connections.

15. Q: Must coiled steel be domestic?

A: Yes. Coiled steel is an intermediate product used in the production of steel pipe and must come from a U.S. source or subject to a waiver in order to comply with the AIS requirements.

16. Q: Are pig iron, direct reduced iron (DRI), and ingot considered raw materials?

A: No. These are considered intermediate products used in the production of iron or steel and must come from a U.S. source or subject to a waiver in order to comply with the AIS requirements.

17. Q: Can assistance recipients rely on a marking that reads, “Made in the USA,” as evidence that all processes took place in the U.S.?

A: No. This designation is not consistent with our requirements that all manufacturing processes of iron and steel products must take place in the U.S.

18. Q: When determining what constitutes a product made “primarily” of iron or steel, who makes this determination?

A: The manufacturer will show if its product qualifies as primarily made of iron or steel. The recipient should expect the manufacturer to provide documentation/ certification that its product is AIS compliant.

19. Q: Do aerators need to be produced domestically in order to comply with AIS?

A: No. Aerators, similar to pumps, are mechanical equipment that do not need to meet the AIS requirements. “Blowers/aeration equipment, compressors” are listed in EPA’s guidance as non-construction materials.

20. Q: Are Sluice and Slide Gates considered valves?

A: No. Valves are products that are generally encased / enclosed with a body, bonnet, and stem. Examples include enclosed butterfly, ball, globe, piston, check, wedge, and gate valves. Furthermore, “gates” (meaning sluice, slide or weir gates) are listed in EPA’s guidance as non-construction materials.

AIS PROCESS QUESTIONS

21. Q: Will notices of waiver applications be published in the federal register?

A: No. Applications for waivers will be published on EPA’s website (http://water.epa.gov/grants_funding/aisrequirement.cfm). EPA will provide 15 days for open public comment, as noted on the website.

22. Q: Will states be collecting the step certification paper trail, as presented in the AIS guidance?

A. No. Assistance recipients must maintain documentation of compliance with AIS. EPA recommends use of the step certification process. This process is a best practice and traces all manufacturing of iron and steel products to the U.S. If the process is used, the state does not have to collect the documentation. The documents must be kept by the assistance recipient and reviewed by the state during project reviews.

23. Q: Why is it considered a best practice for states to conduct site visits, when it is the assistance recipient's responsibility to meet the AIS requirements?

A: It is both the assistance recipient's and the state's responsibility to ensure compliance with the AIS requirements. The state is the recipient of a federal grant and must comply with all grant conditions, including a condition requiring that the AIS requirements be adhered to. Therefore, it is recommended that states conduct site visits of projects during construction and review documentation demonstrating the assistance recipient's proof of compliance.

24. Q: Please further define the state's role in the waiver process.

A: The state's role in the waiver process is to review any waiver requests submitted to the state in order to ensure that all necessary information has been provided by the assistance recipient prior to forwarding the request to EPA. If a state finds the request lacking, the state should work with the assistance recipient to help obtain complete information.

25. Q: How much time does EPA have to evaluate the waiver during the evaluation step?

A: At a minimum, EPA is required to provide 15 days for open public comment. There is no specific deadline or time limit for EPA to review waiver requests. Each waiver request will come with its own specific details and circumstances and may require a different amount of time for review and analysis. For example, public interest waivers in general may take longer to review than availability waivers which are typically more straightforward. However, EPA understands that construction may be delayed while waiting for a waiver and will make every effort to review and issue decisions on waiver requests in a timely manner.

PROJECT QUESTIONS

26. Q: What if a project is funded by another funding entity (i.e., United States Department of Agriculture – Rural Development) where AIS is not required and begins construction after January 17, 2014 but then applies to the SRF to refinance the project? Are they ineligible?

A: The project is not ineligible. AIS requirements will apply to any construction that occurs after the assistance agreement is signed, through the end of construction. If construction is complete, there is no retroactive application of the AIS requirements.

27. Q: If the assistance recipient can demonstrate through market research that the AIS requirement will exceed the 25 percent cost threshold, is the entire project exempt from the AIS requirement?

A: If the waiver application shows that the inclusion of American iron and steel products causes the entire cost of the project to increase by more the 25 percent, a waiver may be granted for the entirety of the project.

28. Q: Can the recipient use non-SRF funds to pay for the non-compliant item.

A: No. It is not an acceptable to use non-SRF funds to pay for a non-compliant item. The Consolidated Appropriations Act of 2014 requires that all iron and steel products, no matter the source of funding, must be made in the U.S. if SRF funds are used in the project.

29. Q: What constitutes “satisfactory quality” as defined in the AIS guidance, in reference to the availability waiver process.

A: “Satisfactory quality” means the product meets the project design specifications. A waiver may be granted if a recipient determines that the project plans and design would be compromised because there are no American made products available that meet the project design specifications.

30. Q: The guidance states that the AIS requirement applies to any project “funded in whole or in part” by an SRF. Where is this in the Act?

A: The Act states that, “None of the funds made available by a ... [State SRF program] ... shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.” This sentence clearly states that no SRF program may use its funds for a project unless all of the iron and steel products used in the project are made in the U.S. This is true even if only \$1 of SRF funding is used in the project.

31. Q: There is always an expectation on the part of an assistance recipient that the construction phase of a planning and/or design only loan will be funded through the SRF. If the original planning and/or design only loan was executed prior to a January 17, 2014, does this mean the entire project will be exempt from the AIS requirement?

A: If the original loan includes construction, and was executed prior to January 17, 2014, then the AIS provision does not apply to the project. If the original loan was only for planning and/or design, then a written commitment or documented “expectation” is needed to show exemption from the

requirements. Appearance on a priority list in an Intended Use Plan along with written reasonable assurance from the state that the recipient will receive SRF funding for project construction could provide sufficient evidence of “expectation of funding”.

- 32. Q: What if there has been a change order or redesign requiring new plans and specifications to be approved and they were approved after January 17, 2014: does the project now have to comply with AIS?**

A: In most cases, no. Change orders are typically small enough changes that the original plan and specification date will still hold true. For example, if a pipe alignment has to be changed for a block or two due to unforeseen conditions, but new plans and specifications had to be submitted for this section of the project, then that could be considered a minor change. However, if there has been a major redesign, perhaps the whole project had to be redesigned starting from scratch, then the new plans and specification approval date would apply.

- 33. Q: What if the bids on a project with plans and specifications approved before January 17, 2014 but the loan is signed after January 17, 2014 come in low, and there is significant funding remaining in the loan agreement, so the community designs a second project with the remaining funds: does that project have to comply with the AIS requirements?**

A: If the second project is closely related in purpose, place and time to the first project, then the second project would be exempt from the AIS requirements. It is the assistance recipient’s responsibility (with state oversight) to show that a project is closely related, or not, in purpose, place and time.

- 34. Q: What if the assistance agreement was signed after January 17, 2014, state approval of plans for the first phase of the project was in place prior to January 17, 2014, but state approval of the plans for the second phase of the project was received after January 17, 2014?**

A: In such a case, the AIS provision would not apply to the first phase of the project. If the second phase of the project is considered the same project as the first phase, due to its close relation in purpose, place and time, the entire project may be exempt. It is the assistance recipient’s responsibility (with state oversight) to show that phases of a project is closely related, or not, in purpose, place and time.

- 35. Q: Do products purchased through procurement-only contracts have to be comply with AIS?**

A: Yes. For projects funded by SRF, the products procured under any form of contract must comply with AIS. A procurement-only contract generally involves the bulk purchase of common items (such as pipe, concrete, and/or pumps) of independent timing from a set of planned projects. If products which are purchased through a procurement-only contract are being installed under another contract, the procurement-only contract would probably not be considered a separate project in purpose, place and time; and therefore, would have to comply with the AIS requirements.

March 2015

American Iron & Steel Requirement for the Clean Water and Drinking Water State Revolving Funds

Q&A Part 3

*For CWSRF and DWSRF: On **January 17, 2014**, Public Law 113-76, the "Consolidated Appropriations Act, 2014," was enacted and included an American Iron and Steel requirement for the Clean Water and Drinking Water State Revolving Fund programs through the end of fiscal year 2014. Since then, the AIS requirement has continued for both programs, but through different statutes, with a few changes as described in the questions and answers provided below.*

*For CWSRF: On **June 10, 2014**, the Water Resources Reform and Development Act amended the Clean Water Act to include permanent requirements for the use of AIS products in CWSRF assistance agreements. Section 608 of the CWA now contains requirements for AIS that repeat those of the Consolidated Appropriations Act, 2014. All CWSRF assistance agreements must comply with Section 608 of the CWA for implementation of the permanent AIS requirement.*

*For DWSRF: On **December 16, 2014**, the President signed Public Law 113- 235, the "Consolidated and Further Continuing Appropriations Act, 2015," which provides fiscal year 2015 full-year appropriations through September 30, 2015. This law continues the requirement for the use of AIS products in DWSRF assistance agreements through September 30, 2015.*

CWSRF PROGRAM

- 1. Q: The Water Resources Reform and Development Act amended the Clean Water Act to include permanent requirements for the use of AIS for CWSRF funded assistance agreements. Does the CWA include an exemption for plans and specifications approved prior to the enactment of the legislation similar to the exemption included in the Consolidated Appropriations Act (CAA) 2014?**

A: Yes. The WRRDA amendment to the CWA, which included AIS requirements, included a similar exemption as the CAA 2014. For any CWSRF assistance agreement signed on or after October 1, 2014, if the plans and specifications were approved prior to June 10, 2014 (the enactment of WRRDA), then the project is exempt from AIS requirements. For assistance agreements signed prior to October 1, 2014, the previous dates in the CAA 2014 apply (see March 20, 2014, AIS guidance document).

If a project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the plans and specifications approval date for purposes of this exemption in Section 608 (f).

The following table summarizes AIS exemptions based on the plans and specifications approval date for CWSRF funded projects.

CWSRF AIS Project Exemption Based on Plans and Specifications Approval Date		
<u>Assistance Agreement Signed:</u>	<u>Exempt from AIS if Plans and Specifications Were Approved Before:</u>	<u>Basis for Exemption:</u>
1/17/2014 through 9/30/2014	4/15/2014	- Consolidated Appropriations Act 2014 - National waiver signed 4/15/2014*
On or after 10/1/2014	6/10/2014	Clean Water Act Section 608

** To be covered by the national waiver, the plans and specifications had to be submitted to the state prior to 1/17/2014*

2. Q: Does the AIS requirement apply to refinanced CWSRF projects?

A: Yes, in some cases. If a project began construction, financed from a non-CWSRF source prior to June 10, 2014, but is refinanced through a CWSRF assistance agreement executed on or after October 1, 2014, AIS requirements will apply to all construction that occurs on or after June 10, 2014, through completion of construction, unless engineering plans and specifications were approved by the responsible state agency prior to June 10, 2014. For CWSRF projects funded on or after October 1, 2014, there is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to June 10, 2014.

DWSRF PROGRAM

3. Q: The Consolidated and Further Continuing Appropriations Act 2015 continues the AIS requirements for DWSRF funded assistance agreements. Does the Act include an exemption for plans and specifications approved prior to the enactment of the legislation, similar to the exemption included in the Consolidated Appropriations Act (CAA) 2014?

A: Yes. The Consolidated and Further Continuing Appropriations Act 2015 includes a similar exemption as the CAA 2014. For any assistance agreement signed on or after December 16, 2014 (the enactment of the Act), if the plans and specifications were approved prior to December 16, 2014, then the project is exempt from the AIS requirements. For assistance agreements signed prior to December 16, 2014, the previous dates in the CAA 2014 apply (see March 20, 2014 AIS guidance document).

If a project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the plans and specifications approval date for purposes of the exemption in Section 424(f).

4. Q: Do DWSRF assistance agreements signed during the time period between September 30, 2014, and December 16, 2014, still have to comply with the AIS requirements?

A: Yes. The Continuing Appropriations Resolution 2015 was signed on September 19, 2014, which extended funding for the DWSRF with the same conditions that were made applicable by the language in the Fiscal Year 2014 appropriations, including the requirement for the use of American Iron and Steel products in projects receiving financial assistance from the DWSRF. Therefore, all assistance agreements starting October 1, 2014, through the enactment of the Consolidated and Further Continuing Appropriations Act 2015 (signed December 16, 2014), must include the AIS requirements. However, if the plans and specifications for any of these projects were approved prior to April 15, 2014 (the date the national waiver was signed), then the project is exempt from the AIS requirements.

The following table summarizes AIS exemptions based on the plans and specifications approval date for DWSRF funded projects.

DWSRF AIS Project Exemption Based on Plans and Specifications Approval Date		
<u>Assistance Agreement Signed:</u>	<u>Exempt from AIS if Plans and Specifications Were Approved Before:</u>	<u>Basis for Exemption:</u>
1/17/2014 through 9/30/2014	4/15/2014	• Consolidated Appropriations Act 2014 • National waiver signed 4/15/2014*
10/1/2014 through 12/15/2014	4/15/2014	• Continuing Appropriations Resolution 2015 (continued CAA 2014 requirements)** • National waiver signed 4/15/2014*
12/16/2014 through 9/30/2015	12/16/2014	• Consolidated and Further Continuing Appropriations Act 2015

** To be covered by the national waiver, the plans and specifications had to be submitted to the state prior to 1/17/2014*

*** Following the first continuing resolution, there were two additional CRs to fill the gap between 12/11/2014 and 12/16/2014*

5. Q: Does the AIS requirement apply to refinanced DWSRF projects?

A: Yes, in some cases. If a project began construction, financed from a non-DWSRF source prior to December 16, 2014, but is refinanced through a DWSRF assistance agreement executed on or after December 16, 2014, AIS requirements will apply to all construction that occurs on or after December 16, 2014, through completion of construction, unless engineering plans and

specifications were approved by the responsible state agency prior to December 16, 2014. For DWSRF projects funded on or after December 16, 2014, there is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to December 16, 2014.

BOTH CWSRF AND DWSRF PROGRAMS

6. **Q: If a coating is applied to the external surface of a domestic iron or steel component, and the application takes place outside of the United States, would the product be compliant under the AIS requirements?**

A: Yes. The product would still be considered a compliant product under AIS requirements. Any coating processes that are applied to the external surface of iron and steel components that would otherwise be AIS compliant would not disqualify the product from meeting the AIS requirements regardless of where the coating processes occur, provided that final assembly of the product occurs in the United States.

The exemption above only applies to coatings on the *external surface* of iron and steel components. It does not apply to coatings or linings on internal surfaces of iron and steel products, such as the lining of lined pipes. All manufacturing processes for lined pipes, including the application of pipe lining, must occur in the United States for the product to be compliant with AIS requirements.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

OFFICE OF WATER

DECISION MEMORANDUM

SUBJECT: De Minimis Waiver of Section 436 of P.L. 113-76, Consolidated Appropriations Act (CAA), 2014

FROM: Nancy K. Stoner
Acting Assistant Administrator

The EPA is hereby granting a nationwide waiver pursuant to the "American Iron and Steel (AIS)" requirements of P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), section 436 under the authority of Section 436(b)(1) (public interest waiver) for de minimis incidental components of eligible water infrastructure projects. This action permits the use of products when they occur in de minimis incidental components of such projects funded by the Act that may otherwise be prohibited under section 436(a). Funds used for such de minimis incidental components cumulatively may comprise no more than a total of 5 percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed 1 percent of the total cost of the materials used in and incorporated into a project.

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel" (AIS) requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use specific domestic iron and steel products that are produced in the United States if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Fiscal Year 2014, unless the agency determines it necessary to waive this requirement based on findings set forth in Section 436(b). The Act states, "[the requirements] shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency...finds that- (1) applying subsection (a) would be inconsistent with the public interest" 436(b)(1).

In implementing section 436 of the Act, the EPA must ensure that the section's requirements are applied consistent with congressional intent in adopting this section and in the broader context of the purposes, objectives, and other provisions applicable to projects funded under the SRF. Water infrastructure projects typically contain a relatively small number of high-cost components incorporated into the project. In bid solicitations for a project, these high-cost components are generally described in detail via project specific technical specifications. For these major components, utility owners and their contractors are generally familiar with the conditions of availability, the potential alternatives for each detailed specification, the approximate cost, and the country of manufacture of the available components.

Every water infrastructure project also involves the use of thousands of miscellaneous, generally low-cost components that are essential for, but incidental to, the construction and are incorporated into the physical structure of the project. For many of these incidental components, the country of manufacture and the availability of alternatives is not always readily or reasonably identifiable prior to procurement in the normal course of business; for other incidental components, the country of manufacture may be known but the miscellaneous character in conjunction with the low cost, individually and (in total) as typically procured in bulk, mark them as properly incidental. Examples of incidental components could include small washers, screws, fasteners (i.e., nuts and bolts), miscellaneous wire, corner bead, ancillary tube, etc. Examples of items that are clearly not incidental include significant process fittings (i.e., tees, elbows, flanges, and brackets), distribution system fittings and valves, force main valves, pipes for sewer collection and/or water distribution, treatment and storage tanks, large structural support structures, etc.

The EPA undertook multiple inquiries to identify the approximate scope of de minimis incidental components within water infrastructure projects during the implementation of the American Reinvestment and Recovery Act (ARRA) and its requirements (Buy American provisions, specifically). The inquiries and research conducted in 2009 applies suitably for the case today. In 2009, the EPA consulted informally with many major associations representing equipment manufacturers and suppliers, construction contractors, consulting engineers, and water and wastewater utilities, and performed targeted interviews with several well-established water infrastructure contractors and firms who work in a variety of project sizes, and regional and demographic settings to ask the following questions:

- What percentage of total project costs were consumables or incidental costs?
- What percentage of materials costs were consumables or incidental costs?
- Did these percentages vary by type of project (drinking water vs. wastewater treatment plant vs. pipe)?

The responses were consistent across the variety of settings and project types, and indicated that the percentage of total costs for drinking water or wastewater infrastructure projects represented by these incidental components is generally not in excess of 5 percent of the total cost of the materials used in and incorporated into a project. In drafting this waiver, the EPA has considered the de minimis proportion of project costs generally represented by each individual type of these incidental components within the many types of such components comprising those percentages, the fact that these types of incidental components are obtained by contractors in many different ways from many different sources, and the disproportionate cost and delay that would be imposed on projects if the EPA did not issue this waiver.

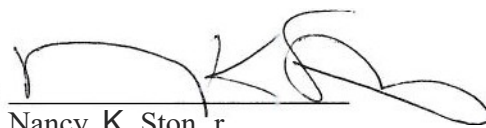
Assistance recipients who wish to use this waiver should in consultation with their contractors determine the items to be covered by this waiver and must retain relevant documentation (i.e., invoices) as to those items in their project files.

If you have any questions concerning the contents of this memorandum, please contact Timothy Connor, Chemical Engineer, Municipal Support Division, at connor.timothy@epa.gov or (202) 566-1059 or Kirsten Anderer, Environmental Engineer, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

April 5, 2014

Issued on: _____

Approved by: _____

A handwritten signature in black ink, appearing to read 'Nancy K. Stoner', written over a horizontal line.

Nancy K. Stoner
Acting Assistant Administrator

Ohio Water Pollution Control Loan Fund
Use of American Iron and Steel - De Minimis Final Utilization and Certification Form

The Consolidated Appropriations Act of 2014 (P.L. 113-76) Section 436 requires the use of American & Steel in SRF-funded projects. Under the authority of Section 436(b)(1), the EPA has issued a public interest waiver for De Minimis incidental components. The assistance recipient wishing to use this waiver should consult with their contractor(s) to maintain an itemized list of components covered under De Minimis. At the conclusion of the project, this form must be completed and retained in the assistance recipient's project files and a copy provided to DEFA. Please print clearly or type.

Project Name: _____ Loan Agrmt #: _____

NOTE: The De Minimis waiver is only applicable to the cost of materials for the entire project. Do not include other project costs (labor, installation costs, etc.) in the "Total Cost of Materials". The cost of a material must include delivery to the site and any applicable tax. Must have sufficient documentation to support all costs included in this calculation.

Funds used for de minimis incidental components cumulatively may comprise no more than a total of 5 percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed 1 percent of the total cost of the materials used in and incorporated into a project.

Total Cost of Materials:

5% Limit:

1% limit:

Manufacturer & Component Description	Part/Model #	Quantity (if applicable)	Cost per Unit (if applicable)	Component's Total Cost	How is Cost Documented?*

Use additional sheets as necessary

Total De Minimis Cost of Components:

If approaching the 5% or 1% limits, contact DEFA immediately

* Documentation must demonstrate confirmation of the components' actual costs (invoice, etc.).

Completed by:

Name: _____

Title: _____

Signature: _____

Date: _____

Violating Facilities Clause
(Required Contract Provision)

Language prohibiting this use of equipment or services from anyone on the EPA List of Violating Facilities must be included in the contract documents.

Violating Facilities:

The Contractor agrees to comply with all applicable standards, orders or requirements under Section 306 of the Clean Air Act, 42 USC 1857 (h), Section 508 of the Clean Water Act, 33 USC 1368, Executive Order 11738, and EPA regulations, 40 CFR Part 32, which prohibits the use under non-exempt Federal contracts, grants, or loans of facilities included on the EPA List of Violating Facilities.

NOTE: THE CONTRACT LANGUAGE SAMPLES PROVIDED HEREIN ARE EXAMPLES OF WHAT COULD BE INCLUDED IN ALL CONTRACTS THAT USE WPCLF OR WSRLA FUNDS. OHIO EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THESE CLAUSES WITH RESPECT TO STATE OR LOCAL LAW. IT IS IMPERATIVE THAT ANY PARTY INSERTING THESE CLAUSES INTO A CONTRACT VERIFY THAT THEY ARE LEGAL AND ENFORCEABLE ACCORDING TO STATE AND LOCAL LAWS, REGULATIONS, AND ORDINANCES.

Requirement For Utilization Of Small Businesses In Rural Areas (SBRA)

(Required Contract Provision)

The following policy should be added to the “Instructions to Bidders” section and referenced in the Table of Contents for the contract documents:

This procurement is subject to the EPA policy of encouraging the participation of small businesses in rural areas. It is EPA policy that recipients of EPA financial assistance awards utilize the services of small businesses in rural areas (SBRAs), to the maximum extent practicable. The objective is to assure that such small business entities are afforded the maximum practicable opportunity to participate as subcontractors, suppliers and otherwise in EPA-awarded financial assistance programs. This policy applies to all contracts and subcontracts for supplies, construction, and services under EPA grants or cooperative agreements. Small purchases are also subject to this policy.

If possible, also add the following language to the “Advertisement for Bids”:

This procurement is subject to the EPA policy of encouraging the participation of small business in rural areas (SBRAs).

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Insurance Provisions
(Required Contract Provision)

Section 3.5 of the WPCLF/WSRLA Loan Agreement contains specific requirements regarding insurance for all contractors and all subcontractors for the life of the contract. These insurance requirements must be reflected in the contract documents. Adjust the following language as needed to meet the specifics of the construction project and local requirements while still meeting the provisions of the Loan Agreement.

The Contractor shall, at his expense, furnish and maintain insurance in the form and amounts specified in subparagraphs 1 through 7 inclusive, of this section. Policies shall be with acceptable insurance companies authorized to do business in the State of Ohio.

The Contractor shall not commence Work nor shall he permit any of his Sub-contractors to commence Work until the insurance policies specified hereinafter, or otherwise required, have been submitted to, and approved by the Owner. Such insurance policies shall be kept in force until the Contractor receives final payment.

Insurance shall be endorsed so that it cannot be changed or canceled in less than ten (10) days after receipt by the Contractor and the Owner of written notice of such proposed action from the Insurer.

The insurance specified in Subparagraphs 1, 2, 3 and 4 shall be written under the comprehensive general form of liability insurance contracts.

The Contractor shall furnish three (3) certificates or, whenever specifically requested by the Owner, three (3) certified copies of the insurance policies themselves and a receipt evidencing full payment of the premiums.

In addition to the insurance described hereinafter, the Contractor shall secure and maintain such other insurance as may be designated elsewhere in the Contract document.

If the Contractor is required to repair or perform Work after the completion of the Work involved under this Contract or obtain new policies in accordance with the requirements in this section.

1. *Builders Risk*: In addition to such fire and other physical damage insurance as the Contractor elects to carry for his own protection, he shall also secure and maintain in the name of the Owner, the government agency sponsoring the Project, Subcontractors, the Consulting Engineer and any other parties having an interest in the Project, as named insured as their interest may appear; a builders' risk policy for fire, extended coverage, vandalism and malicious mischief in the amount of one hundred (100) percent of the value of the complete parts of the Project and Materials in storage, except that such coverage shall not be required in connection with sewer, water main or paving construction. Pump or lift station construction shall not be considered sewer or water main construction for purposes of this paragraph.

2. *Workers Compensation*: The Contractor shall provide Workers Compensation Insurance for all employees engaged in Work who may come within the protection of the workers compensation law, and, where applicable, employer's General Liability Insurances for employees not so protected and shall require all Subcontractors to provide corresponding insurance.

The Contractor shall indemnify the Owner and the Consulting Engineer against any and all liabilities, cost and expenses due to accidents or other occurrences covered by the workers compensation law.

3. *Contractor's Motor Vehicle Bodily Injury and Property Damage Liability Insurance*: Insurance to cover liability arising from the use and operation of motor vehicles in connection with the performance of the Contract (as customarily defined in liability insurance policies), whether they be owned, hired or non-owned by the Contractor, as follows:

- a. Bodily Injury Liability: \$500,000 for each person; limit of \$1,000,000 for each occurrence.
- b. Property Damage Liability: \$500,000 for each occurrence.

4. *Contractor's Public Liability and Property Damage Liability Insurance*: Contractor's Public Liability Insurance providing a limit of not less than \$500,000 for all damages arising out of bodily injuries, including accidental death to one person, and a total limit of \$1,000,000 for all damages arising out of bodily injuries, including accidental death, to two or more persons in any one occurrence. Contractor's Property Damage Liability Insurance providing for a limit on not less than \$500,000 for all damages to or destruction of property.

Coverage under this policy shall include, to the limits indicated above, the collapse or damage to any structure, building or its contents, public or private utility, or pavement during construction and for two (2) years thereafter.

Whenever Work under the Contract is to be done in the vicinity of existing underground utilities or structures, coverage under the policy shall also include, to the limits indicated, all damages to said underground utilities or structures during construction and for a period of two (2) years thereafter. Whenever Work under the Contract is to be done by blasting, coverage under the policy shall also include, to the limits indicated above, all damages of any kind whatsoever caused by blasting.

5. *Contractor's Protective Public Liability and Property Damage Liability Insurance*: Contractor's Protective Public Liability and Property Damage Liability Insurance for operations performed by Subcontractors providing for coverage and limits corresponding to those described in subparagraph 4.

6. *Owner's Protective Public Liability and Property Damage Liability Insurance*: Regular Owner's Protective Public Liability and Property Damage Liability Insurance for operations performed by the Contractor or any Sub-contractor providing for coverage and limits corresponding to those described in subparagraph 4.

This policy shall be written in the name of the Owner as a separate policy from those specified elsewhere herein.

7. *Railroad Protective Liability Insurance*: In any of the Work under this Contract is on railroad R/W, the Contractor shall at its sole cost and expense, procure and provide, for and in behalf of each railroad company. Protective Liability Insurance (AARAASHO form) with minimum limits per occurrence of not less than \$2,000,000 for bodily injury, death and/or property damage, subject to an aggregate limit of \$6,000,000 per annum. The policy shall name each railroad company as the insured and be issued to the Contractor. Each railroad company shall be provided with a copy of each policy of insurance prior to commencement of any work.

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Materials Testing
(Required Contract Provision)

In addition to the details included with specific equipment testing in the specifications, include an overall statement regarding testing for the project. Adjust the following language as needed to meet the specifics of the construction project

Testing Services

1. Contractor shall appoint, employ, and pay for specified services of an independent firm to perform testing.
2. The independent firm will perform tests and other services specified in individual specification sections and as required by the Architect/Engineer.
3. Testing and source quality control may occur on or off the project site. Perform offsite testing as required by the Architect/Engineer or the Owner.
4. Reports will be submitted by the independent firm to the Architect/Engineer and Contractor, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
5. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
 - a. Notify Architect/Engineer and independent firm 24 hours prior to expected time for operations requiring services.
 - b. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
6. Testing does not relieve Contractor to perform Work to contract requirements.
7. Re-testing required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Architect/Engineer. Payment for re-testing will be charged to the Contractor by deducting testing charges from the Contract Sum/Price.

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Continuous Treatment Provisions

(Required Contract Provision)

It is important that construction activities not result in any temporary violations of NPDES permit requirements (for permitted facilities) and construction activities should interrupt wastewater service to the individual resident as little as possible. For drinking water projects, it is important that construction activities not result in any disruption of service. Any disruption of service must be immediately reported to the Ohio EPA, Drinking Water Section of the appropriate district office.

The following example language is a sample of what might be appropriate for construction work occurring at an existing wastewater treatment plant. The language actually incorporated into the contract documents must be adjusted to meet the specifics of the construction project.

Continuous Treatment (wastewater projects)

Federal regulations prohibit by-passing of any sewage during construction operations. The Contractor will be responsible for providing any required temporary pumping facilities piping, etc., necessary to complete the project without any plant by-passing and continuous treatment must be provided at the same level during construction as existed prior to construction.

Unless otherwise previously or subsequently specified, the Contractor shall procure and pay for all permits, licenses, and approvals necessary for the execution of his Contract.

The Contractor shall comply with all laws, ordinances, rules, orders, and regulations relating to the performance of the work required to complete their Contract.

The following example language is a sample of what might be appropriate for construction work occurring at an existing drinking water treatment plant. The language actually incorporated into the contract documents must be adjusted to meet the specifics of the construction project.

Continuous Treatment (drinking water projects)

The Contractor will be responsible for obtaining approval from Ohio EPA for use of temporary pumping facilities, piping and other items in order to complete the project without any plant by-passing. Continuous treatment must be provided at the same level during construction as existed prior to construction.

Unless otherwise previously or subsequently specified, the Contractor shall procure and pay for all permits, licenses, and approvals necessary for the execution of his Contract.

The Contractor shall comply with all laws, ordinances, rules, orders, and regulations relating to the performance of the work required to complete their Contract.

NOTE: THE CONTRACT LANGUAGE SAMPLES PROVIDED HEREIN ARE EXAMPLES OF WHAT COULD BE INCLUDED IN ALL CONTRACTS THAT USE WPCLF OR WSRLA FUNDS. OHIO EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THESE CLAUSES WITH RESPECT TO STATE OR LOCAL LAW. IT IS IMPERATIVE THAT ANY PARTY INSERTING THESE CLAUSES INTO A CONTRACT VERIFY THAT THEY ARE LEGAL AND ENFORCEABLE ACCORDING TO STATE AND LOCAL LAWS, REGULATIONS, AND ORDINANCES.

CONTRACT CHANGE ORDER

RECIPIENT _____ CHANGE ORDER NBR _____
 LOAN NUMBER _____ CONTRACT _____
 OWDA PROJECT No. _____ DATE _____
 Description of Change: _____

The time provided for completion in the contract for the above items is (increased/decreased) by ____ calendar days.

RECOMMENDED BY: _____ DATE: _____
 (Engineer)

APPROVED BY: _____ DATE: _____
 (Recipient)

ACCEPTED BY: _____ DATE: _____
 (Contractor)

 (Company)

Original Contract Amt

Previous Changes (+ / --)

This Change (+ / --)

Adjusted Contract Amt

OWDA APPROVAL

The above proposal is hereby accepted and I recommend that it be approved and made a part of the contract noted above. The approval does not constitute an increase in the total loan amount, but represents approval for the work.

Ohio EPA Acceptance

Chief Engineer

Date _____

Date

CHANGE ORDER INSTRUCTIONS:

All Change Orders for this work, regardless of costs and whether Water Pollution Control Loan Fund (WPCLF) or Water Supply Revolving Loan Account (WSRLA) funding will be used to finance the changes, must be submitted to Ohio EPA for review.

Changes Requiring Prior Approval

Any change which substantially modifies the Project Facilities as specified in the Ohio EPA approved Facilities Plan and Final Permit to Install or Final Plan Approval (when applicable) or alters the direct or indirect impact of the Project Facilities upon the environment must be incorporated into a Change Order. One copy of the Change Order prior to execution is to be submitted to Ohio EPA for review and prior approval of the acceptability of the change. "Prior to execution" means before the Change Order is signed by the Owner.

Ohio EPA will review the Change Order and inform the Owner of the technical, environmental and operational acceptability of the change, and give the Owner permission to proceed with the proposed work.

All Other Changes

Change Orders not requiring prior approval as described above must be submitted to Ohio EPA within one (1) month of the time at which they are approved by the Owner. All change orders must be submitted electronically to dedicated change order email addresses for WPCLF and WSRLA projects.

Change Order Approval Process

After the Change Order is executed, one (1) copy of the Change Order, including the supporting documentation, is to be sent electronically to Ohio EPA for final review.

The dedicated e-mail address for the electronic submittal of WPCLF Change Orders is EPAWPCLFCO@epa.ohio.gov.

The dedicated e-mail address for the electronic submittal of WSRLA Change Orders is EPAWSRLACO@epa.ohio.gov.

After the Change Order is accepted and eligible costs determined, Ohio EPA will issue a letter informing the Owner and authorizing OWDA to disburse funds from Project Contingency for the work. The OEPA letter will be sent electronically along with a PDF of the WPCLF/WSRLA Change Order form which will be signed by all parties including Ohio EPA and OWDA.

Payments for Change Order Work

The Owner is precluded from submitting to the OWDA payment requests for Eligible Project Costs associated with the Change Orders until such time as the Ohio EPA's approval of the Change Orders has been obtained.

Local Protest Procedure

(suggested contract provision)

Some statement as to when a valid protest must be filed, in what form it must be filed and who it must be filed with should be included. ORC 153.12 has some default procedures for handling WPCLF and disputes. If the owner wants more control than provided in ORC, a procedure needs to be spelled out in the Contract Documents.

The following example language is a sample of language that could be included. Review all local procedures and requirements and adjust the language to meet the specifics of the project.

Protests

A protest based upon an alleged violation of the procurement requirement may be filed against the OWNER's procurement action by a party with an adversely affected direct financial interest. The protest shall be filed with the Mayor. The OWNER shall determine the protest. The OWNER may request additional information or a hearing in order to resolve the protest.

A protest shall be filed as early as possible during the procurement process, but must be received by the OWNER no later than one week after the basis of the protest is known or should have been known, whichever is earlier. If the protest is mailed, the protester bears the risk of nondelivery with in the required time period.

A protest must clearly present the procurement requirement being protested, the facts which support the protest, and any other information necessary to support the protest.

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Basis And Method For Award

(suggested contract
provision)

The contract documents should include some language that clearly states what the Owner will consider when determining the successful bidder and to provide a clear basis for the Owner when they have a need to reject the low bidder and go with a different bidder.

The following example language is a sample of language that could be included. Review all local procedures and requirements and adjust the language to meet the specifics of the project.

Basis for Award

1. Owner reserves the right to reject any and all Bids, to waive any and all informalities and to negotiate contract terms with the successful Bidder, and the right to disregard all nonconforming, nonresponsive or conditional bids. Discrepancies between words and figures will be resolved in favor of words. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.
2. In evaluating Bids, Owners shall consider the qualifications of the Bidder, whether or not the Bids comply with the prescribed requirements and alternates and unit prices if requested in the Bid forms. The Owner intends to accept alternates (if any are accepted) in the order in which they are listed in the Bid Form but Owner may accept them in any order or combination.
3. Owner may consider the qualifications and experience of Subcontractors and other persons and organizations (including those who are to furnish the principle items of material or equipment) proposed for those portions of the work as to which the identity of Subcontractors and other persons and organizations must submitted as provided in the Supplementary Conditions. Operating costs, maintenance considerations, performance data and guarantees of materials and equipment may also be considered by Owner.
4. Owner may conduct investigations he deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of the Bidders, proposed Subcontractors, and other persons and organizations to do the Work in accordance with the Contract Documents to Owner's satisfaction within the prescribed time.
5. Owner reserves the right to reject the Bid of any Bidder who does not pass investigation of evaluation to Owner's satisfaction. Owner may reject any Proposal where the unit price or individual lump sum prices are unbalanced and/or unfavorable to the Owner's interest.
6. Owner will not make any award or permit any award at any tier to any party which is debarred or suspended or is otherwise excluded from or ineligible for participation in Federal assistance programs under Executive Order 12549 "Debarment and Suspension." Each Contractor and supplier (over \$25,000) shall complete the Certification Regarding Debarment, Suspension, and Other Responsibility Matters.
7. If Contract is awarded, it will be awarded to the lowest responsive responsible Bidder whose evaluation by Owner indicates to Owner that the award will be in the best interest of the Project.
8. If the contract is awarded, Owner will give the Successful Bidder a Notice of Award within the time stated in the Advertisement after the day of the Bid opening.

9. When owner gives a Notice of Award to the Successful Bidder, it will be accompanied by at least three unsigned counterparts of the Agreement and three copies of all other Contract Documents. Within ten days thereafter, Contractor shall sign and deliver at least three counterparts of the Agreement to Owner with three copies of all other Contract Documents attached. Within fifteen days thereafter, Owner will deliver one copy of all fully signed counterparts to Contractor.

NOTE: THE CONTRACT LANGUAGE SAMPLES PROVIDED HEREIN ARE EXAMPLES OF WHAT COULD BE INCLUDED IN ALL CONTRACTS THAT USE WPCLF OR WSRLA FUNDS. OHIO EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THESE CLAUSES WITH RESPECT TO STATE OR LOCAL LAW. IT IS IMPERATIVE THAT ANY PARTY INSERTING THESE CLAUSES INTO A CONTRACT VERIFY THAT THEY ARE LEGAL AND ENFORCEABLE ACCORDING TO STATE AND LOCAL LAWS, REGULATIONS, AND ORDINANCES.

Payment Methods

(suggested contract provision)

To minimize uncertainty and arguments that can slow down the progress of construction it is useful to provide language stating how and when the Contractor will get paid. In addition to ORC and other local requirements, the involvement of public funding Agencies such as the WPCLF, Ohio Public Works Commission and Community Development Block Grant impact the process and timing for payments.

The following example language is a sample of language that could be included. Review all local procedures and requirements and adjust the language to meet the specifics of the project.

1. At least ten (10) days before each progress payment falls due (but not more often than once a month), the Contractor will submit to the Engineer a partial payment estimated filled out and signed by the Contractor covering the work performed during the period covered by the partial payment estimate and supported by such data as the Engineer may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitable stored at or near the site, the partial payment estimate shall also be accompanied by such supporting data, satisfactory to the Owner as will establish the Owner's title to the material and equipment and protect his interest therein, including applicable insurance. The Engineer will, with ten (10) days after receipt of each partial payment estimate, either indicate in writing his approval of payment and present the partial payment estimate to the Owner, or return the partial payment estimate to the Contractor indicating in writing his reason for refusing to approve payment.

In the latter case, the Contractor may make the necessary corrections and resubmit the partial payment estimate. The Owner will, within 30 days of presentation to him of an approved partial payment estimate, pay Contractor for labor performed and material incorporated in the Work, at the rate of 92 percent of the amount of the estimate as approved by the Engineer until 50 percent of the Work is completed. All labor performed and material incorporated in the Work after the job is 50 percent of completed shall be paid for at the rate of 100 percent of the amount of additional labor and material furnished and approved and the amount labor and material furnished and approved the amount previously retained shall be deposited in an escrow account. The funds in the escrow account with accumulated interest are to be paid the Contractor at the same time and in the same manner as specified for payment of the of the retained amount in Section 5.

Payment for material and equipment delivered and not incorporated shall be based on the scheduled of quantities and cost submitted. Any money due from Owner shall, on the day that it is due, be paid to Contractor, or deposited in an escrow account, whichever is applicable, with one or more banks or building and loan associations in the state selected by mutual agreement between the Contractor and the Owner. The agreement shall contain the following provisions:

- A. The money shall be deposited in a savings account or the escrow agent shall properly invest the entire escrow principal in obligations selected by the escrow agent, as stipulated in the agreement.
- B. The escrow agent shall hold the escrow principal and income until receipt of notice from the Owner and the Contractor, or until receipt of an arbitration order specifying the amount of escrow principal to be released and the person to whom it is to be released. Upon receipt of the notice or order, the agent shall properly pay such amount of principal and the portion of amount of the escrow income to the person indicated.

- C. The escrow agent shall be compensated for its services as agreed to by the Owner and the Contractor from the income from the escrow account.
- 2. The request for payment may also include an allowance for the cost of such major material and equipment which are suitably stored either at the site or near the site.

NOTE: THE CONTRACT LANGUAGE SAMPLES PROVIDED HEREIN ARE EXAMPLES OF WHAT COULD BE INCLUDED IN ALL CONTRACTS THAT USE WPCLF OR WSRLA FUNDS. OHIO EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THESE CLAUSES WITH RESPECT TO STATE OR LOCAL LAW. IT IS IMPERATIVE THAT ANY PARTY INSERTING THESE CLAUSES INTO A CONTRACT VERIFY THAT THEY ARE LEGAL AND ENFORCEABLE ACCORDING TO STATE AND LOCAL LAWS, REGULATIONS, AND ORDINANCES.

Prohibition on Telecommunications and Video Surveillance

§ 200.216 Prohibition on certain telecommunications and video surveillance services or equipment.

- (a) Recipients and subrecipients are prohibited from obligating or expending loan or grant funds to:
 - (1) Procure or obtain;
 - (2) Extend or renew a contract to procure or obtain; or
 - (3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in [Public Law 115–232](#), section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).
 - (i) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).
 - (ii) Telecommunications or video surveillance services provided by such entities or using such equipment.
 - (iii) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.
- (b) In implementing the prohibition under [Public Law 115–232](#), section 889, subsection (f), paragraph (1), heads of executive agencies administering loan, grant, or subsidy programs shall prioritize available funding and technical support to assist affected businesses, institutions and organizations as is reasonably necessary for those affected entities to transition from covered communications equipment and services, to procure replacement equipment and services, and to ensure that communications service to users and customers is sustained.
- (c) See [Public Law 115–232](#), section 889 for additional information.
- (d) See also [§ 200.471](#).

Resources:

[2 CRF 200.216](#)

FAQ's: [Sec. 889 of 2019 NDAA FAQ_20201124.pdf \(performance.gov\)](#)

[Public Law 115-232, Section 889](#)

[§ 200.471](#)

WPCLF/WSRLA CONTRACT DOCUMENTS REVIEW

Funding Applicant:	
Project Name:	Project Number:
Date Bid Advertisement will start:	Date Bids will be opened:
Engineer's estimate of construction cost:	
Time of completion for work (e.g., 9 months):	

Please provide the Section/PDF Page number from the contract documents that corresponds with each item below.

Program Requirements -Any item checked as "No" must be explained on a separate sheet

☐ Yes ☐ No	EEO Certification	Section/Page # _____
☐ Yes ☐ No	Certification Regarding Debarment & Suspension	Section/Page # _____
☐ Yes ☐ No	Prohibition on telecommunications and video surveillance equipment	Section/Page # _____
☐ Yes ☐ No	Contract provisions describing DBE requirements	Section/Page # _____
☐ Yes ☐ No	DBE Forms 6100-3, 6100-4 and 6100- 2	Section/Page # _____
☐ Yes ☐ No	Davis-Bacon wage rate requirements	Section/Page # _____
☐ Yes ☐ No	Build America, Buy America Acknowledgement Form	Section/Page # _____
☐ Yes ☐ No	American Iron and Steel Acknowledgement Form	Section/Page # _____
☐ Yes ☐ No	Violating Facilities clause	Section/Page # _____
☐ Yes ☐ No	Small Businesses in Rural Areas (SBRA)	Section/Page # _____
☐ Yes ☐ No	Insurance for both the contractor and all subcontractors:	Section/Page # _____
	☐ Yes ☐ No Workers' Compensation	☐ Yes ☐ No Vehicle Liability
	☐ Yes ☐ No Public Liability	☐ Yes ☐ No Flood (if appropriate)
	☐ Yes ☐ No Property Damage	☐ Yes ☐ No Builders Risk (can be held by owner instead)
☐ Yes ☐ No	Material Testing (statement regarding testing for specifications)	Section/Page # _____
☐ Yes ☐ No	Project-specific continuous service/treatment provisions	Section/Page # _____
☐ Yes ☐ No	WPCLF/WSRLA Change Order form & instructions	Section/Page # _____
☐ Yes ☐ No	Bid proposal forms (necessary for determining loan eligibility)	Section/Page # _____

Other Contract Requirements

☐ N/A - superseded by local requirements	
☐ Yes ☐ No	Text of the bid advertisement
☐ Yes ☐ No	Engineer's estimate of cost for construction
☐ Yes ☐ No	Description of how the bid price, including any alternates, is determined
☐ Yes ☐ No	Notice to Proceed form
☐ Yes ☐ No	Any material or equipment designated from a "sole source?"
	If yes, attach a description and justification for each item.
☐ Yes ☐ No	Bid includes a dedicated contract contingency/allowance amount
	Contract contingency is ☐ a fixed dollar amount ☐ a fixed percentage of the contract total

Ohio Revised Code Requirements - The following are required for municipalities (cities, villages, counties, sewer districts) but may be superseded by local charter or other local requirements.

☐ N/A - superseded by local requirements	☐ N/A - not a municipality
☐ Yes ☐ No	Bid Guarantee in the form required by ORC
☐ Yes ☐ No	Payment and Performance Bonds in the form required by ORC
☐ Yes ☐ No	Provisions for payment retention in conformance with ORC
☐ Yes ☐ No	A specific time for completion of the work

Checklist Prepared by: _____

Phone or E-mail _____

Bid Package Submittals

The following documents must be submitted to Ohio EPA – DEFA within one week after bids are received, or sooner dependent on your individual project schedule.

1. One copy of all addenda when they are issued.
2. A complete copy of the successful bidder's proposal(s).
3. A bid tabulation (a list of all bidders and their line item amounts) in the same format as the proposal.
4. The engineer's bid evaluation and recommendation.
5. A signed copy of the Contractor's EEO Certification Form
6. A signed copy of the Certification Regarding Debarment, Suspension, and Other Responsibility Matters.
7. Completed copies of Form 6100-3 Individual DBE Subcontractor Proposed Performance Form and Form 6100-4 DBE Subcontractor Utilization Summary that were provided by the successful bidder(s), as well as any alternate "good faith efforts" documentation.
8. A resolution from the loan recipient's governing body tentatively awarding the contract to the successful bidder.
9. A copy of the site title opinion stating that all sites, easements and / or right-of-way necessary to construct the project have been acquired.
10. Signed Build America, Buy America Acknowledgement Form, if applicable.
11. Signed American Iron and Steel Acknowledgement Form.
12. Useful Life Worksheet (must be completed for loan requests greater than 20 years)
 - WPCLF Useful Life Worksheet: <https://epa.ohio.gov/static/Portals/29/documents/ofa/CW-Useful-Life-Worksheet.xlsx?ver=2019-10-31-153519-907>
 - WSRLA Useful Life Worksheet: <https://epa.ohio.gov/static/Portals/29/documents/ofa/DW-Useful-Life-Worksheet.xlsx?ver=2019-10-31-153519-907>



AECOM
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216.622.2300

To Kathy McKillips, P.E., City of Elyria Pages 18

Subject Geotechnical Design Memorandum – Splitter Box No. 3
City of Elyria Waste Water Pollution Control Plant Improvements

From Makarand Jakate, P.E., AECOM
Erik J. Bogen, P.E., AECOM

Date July 14, 2025

This memorandum has been prepared in support of the new Splitter Box No. 3, proposed at the City of Elyria Waste Water Pollution Control Plant (WWPCP) in the City of Elyria, Ohio (City). The memorandum describes AECOM Corporation's (AECOM's) geotechnical exploration and analysis and presents geotechnical recommendations for the design and construction of the new facilities to be constructed in the Wet Weather Diversion and Piping Improvements project.

Project Understanding

This geotechnical exploration was performed in support of the larger program for improvements and reconfiguration of the existing aeration tanks at the Elyria Wastewater Pollution Control Plant. The existing Aeration Tank Nos. 8 and 9 are proposed to be reconfigured into one larger aeration tank measuring approximately 80 ft by 65 ft horizontally (to be designated Aeration Tank No. 7), and a smaller new anaerobic tank measuring approximately 80 ft by 21 ft horizontally to be located immediately adjacent to the south wall of the new Aeration Tank No. 7. In support of the aeration tank reconfiguration, a new splitter box (designated Splitter Box No. 3) is proposed adjacent to the east wall of the new anaerobic tank. This geotechnical investigation and memorandum specifically address the proposed Splitter Box No. 3.

Proposed Splitter Box No. 3

The proposed new Splitter Box No. 3 will be located adjacent to the east wall of the new anaerobic tank. The new splitter box is proposed to measure approximately 21 ft by 30 ft horizontally with a top of wall elevation of 617.00 ft (NAVD88) and a top of base slab elevation of 598.08 ft, for a total wall height of approximately 19 ft. The splitter box is proposed to be supported on 24-inch diameter drilled shaft foundations with a minimum of 3.0 ft embedment into bedrock.

General Geologic Setting

The project area is located approximately five to ten miles south of the Lake Erie shoreline and has historically been subjected to multiple glacial advances and retreats. The site is located within the Berea Headlands sub-region of the Erie Lake Plain physiographic region of Ohio, according to the Ohio Department of Natural Resources (ODNR) Division of Geological Survey (DGS) publication "Physiographic Regions of Ohio" (1998). The Erie Lake Plain is a part of the Interior Low Plateaus province within the Interior Plains division of Ohio. The general terrain of the Erie Lake Plain consists of areas of low relief along the southern shore of Lake Erie, separated from the lake by shoreline cliffs.

The Berea Headlands sub-region is underlain by the Berea Sandstone and Bedford Shale, Undivided bedrock formations. According to United States Geological Survey (USGS) Online Spatial Data, the bedrock consists primarily of sandstone and shale. The upper portion of the bedrock consists of brown sandstone with minor shale interbeds, ranging in thickness from 5 to 125 feet. The sandstone is underlain by gray to brown shale, ranging in thickness from 80 to 180 feet.

The ODNR DGS publication "Surficial Geology of the Lorain and Put-in-Bay 30x60 Minute Quadrangles" (2005) indicates that the surficial soils in the project location consists of Wisconsinan-age sand and gravel, silt, and glacial till. Surficial soils are glacial and glaciolacustrine in origin. Thickness of surficial soil averages between 10 and 20 feet in the project vicinity. Silt deposits may contain thin sand partings and clay, sand, or gravel layers. Sand and gravel are interbedded within sand and gravel layers, which may also contain thin, discontinuous layers of silt and clay. Till soils consist of a mix of silt, clay, sand, gravel, boulders, and contain lenses of silt, sand, or gravel. According to the ODNR 2005 publication, bedrock depth in general averages from 10 to 20 feet across the project site.

Subsurface Exploration

An exploratory boring was drilled and is shown in Figure 2. Boring B-1 was drilled in the WWPCP property limits. The boring was drilled on April 22, 2025. The boring was drilled by AECOM's subcontractor, Ohio TestBor (OTB). Boring B-1 was drilled using a Diedrich D-50 Rubber Track ATV rig. The boring was extended to a depth of 39.9 feet below existing ground surface (bgs).

Proposed boring locations were marked in the field by AECOM engineers and referenced to existing surface features. Boring locations were based upon proposed alignment alternatives being considered at the time of this investigation. After initial field marking, AECOM's subcontractor OTB notified the Ohio Utility Protection Service (OUPS) and requested marking of underground utilities at each boring location.

The City of Elyria Department of Public Works was also notified of the drilling activities prior to the start of work. Boring locations were adjusted in the field by the drilling subcontractor based on equipment access conditions and conflicts with utility markings.

A 2-inch split spoon was used for the soil sampling. Groundwater levels were measured during drilling, and at drilling completion. Upon completion of drilling and sampling, the boring was subsequently backfilled to the surface with cement/bentonite grout.

An AECOM geologist or geotechnical engineer was present for the drilling of all borings to monitor and direct the driller, classify and log samples, and collect samples. Soil and rock samples were collected from the borings for visual classification and testing. The samples were obtained by Standard Penetration Testing (SPT) with a split-spoon sampler, in general accordance with ASTM D 1586. Soil samples obtained were transported to the AECOM Cleveland office for review and storage. One rock core run was drilled and collected from 30 to 40 ft bgs in general accordance with ASTM D 2113.

A complete set of boring logs, including legend sheets for soil and rock descriptions and types of sampling, are provided in Appendix A. Table 1 below summarizes the as-surveyed completed boring locations, surveyed elevations, and total borehole depth.

Table 1: Summary of Soil Boring Location

Boring ID	Northing (ft)	Easting (ft)	Surface Elevation (ft)	Total Borehole Depth (ft bgs)
B-1	4584545.82	408929.88	611	39.9

Laboratory Testing

The representative samples obtained during drilling were placed in jars, sealed at the site, and transported to a Youngstown based soils laboratory. An AECOM geologist concurrently reviewed and selected samples for laboratory testing. Material samples were evaluated using types and numbers of laboratory tests from each location presented in the **Table 2**, below:

Table 2: Summary of Laboratory Tests

TEST SPECIFICATION	REFERENCE STANDARD	NUMBER OF TESTS
Atterberg Limits	ASTM D 2216	2
Particle Size Analysis - Sieve	ASTM D 6913	4
Unconfined Compressive Strength of Intact Rock	ASTM D 7012, Method C	1
Point Load Strength Index	ASTM D 5731	1

Complete lab results sheets are presented in **Appendix B**.

Subsurface Conditions

The exploration encountered a relatively uniform subsurface profile across the project site, consisting of predominantly fine-grained deposits. From highest to lowest elevation, the subsurface layers generally consisted of surficial materials, fill materials, native fine-grained deposits, and shale bedrock. The sections below describe the subsurface conditions encountered in greater detail.

Surficial Materials: Topsoil thickness was measured as 5" followed by brown sand extending to a depth of 1.0 feet.

Fill Materials: Fill materials were encountered from approximately 1.0 to 12.0 feet below ground surface (bgs), the subsurface profile consists of very stiff brown and gray lean clay (CL) with trace to some sand and trace gravel, with an average undrained shear strength (Cu) of 3000 psf. The SPT N values within the fill materials ranged from 3 to 8 blows per foot (bpf), with an average of about 6 bpf. A summary of laboratory testing performed on representative samples from the fill are provided in **Table 3**, below:

Table 3: Summary of Lab Test Results of Fill Materials

Laboratory Test	Range	Average Value	Number of Tests Performed
Particle Size Analysis (%)			
<i>Gravel</i>	4.6-5.6	5.1	2
<i>Sand</i>	25.4-29.7	27.6	2
<i>Fines (Silt and Clay)</i>	64.7-70.0	67.4	2
Atterberg Limits (%)			
<i>Liquid Limit</i>	33-37	35	2
<i>Plastic Limit</i>	19-24	22	2
<i>Plasticity Index</i>	13-14	14	A2

Alluvium/ Possible Residuum: Alluvium/possible residuum deposits were encountered below the fill material and extended to Residuum at depths from 12.0 to 24.0 feet bgs. The deposits generally consisted of a very loose to loose, wet clayey sand (SC), containing shale fragments. Groundwater was encountered within this layer at a depth of approximately 14.0 feet bgs. A summary of laboratory testing performed on representative samples from the alluvium are provided in **Table 4**, below:

Table 4: Summary of Lab Test Results of Alluvium

Laboratory Test	Range	Average Value	Number of Tests Performed
Particle Size Analysis (%)			
<i>Gravel</i>	--	19.1	1
<i>Sand</i>	--	60.7	1
<i>Fines (Silt and Clay)</i>	--	20.2	1

Residuum: From approximately 24.0 to 29.0 feet bgs, the subsurface profile consists of loose, wet, gray, clayey gravel (GC) with completely weathered shale fragments. A summary of laboratory testing performed on representative samples from the Residuum are provided in **Table 5**, below:

Table 5: Summary of Lab Test Results of Residuum Materials

Laboratory Test	Range	Average Value	Number of Tests Performed
Particle Size Analysis (%)			
<i>Gravel</i>	--	31.9	1
<i>Sand</i>	--	35.7	1
<i>Fines (Silt and Clay)</i>	--	32.4	1

Bedrock: Bedrock was encountered below the Residuum deposits at a depth of 29 ft bgs and consisted of moderately weathered dark gray shale. From depths of 29.0 to 32.0 ft bgs, a rock quality design (RQD) of 41% was measured. Below 32.0 ft, the profile transitions into a moderately to slightly weathered gray shale and siltstone from 32.0 to 39.9 ft bgs, with RQD values ranging from 77 to 99. Uniaxial compressive strength of the gray siltstone was measured by laboratory test to be 2,700 pounds per square inch (psi). Point load tests performed on the moderately weathered shale rock at depths of 32.1 ft and 34.3 ft estimated

uniaxial compressive strengths ranging from 1800 psi to 2300 psi with an average around 2000 psi.

Unconfined compressive testing and point load testing was performed on selected intact core samples. Results are summarized in **Table 6** and **Table 7**, below:

Table 6: Summary of Unconfined Compressive Strength Tests (ASTM D7012, Method C)

Core ID	Depth (ft)	Rock Type	Compressive Strength (psi)	Density (pcf)
B-1	35.78	Siltstone	2,700	156.1

Table 7: Summary of Point Load Strength Index Tests (ASTM D 5731)

Specimen No.	Depth (ft)	k**	UCS (psi)
Run 3	32.15	12	2335.04
Run 3	34.26	12	1797.06

Groundwater: Groundwater was encountered in the alluvium/possible residuum deposit at approximately 14.0 ft bgs. Due to the short time the boreholes were open and the tendency of drilling to seal off groundwater flow paths, these groundwater levels encountered may not be representative of the long-term groundwater level at the site. In addition, groundwater levels also tend to fluctuate due to seasonal changes.

Geotechnical Recommendations

The following sections present geotechnical recommendations to assist design and construction of the various elements of the proposed wet weather improvements. These recommendations are based on visual observations of the completed geotechnical investigation. The recommendations and analysis are presented below for each specific element of the project.

Deep Foundation Depth and Bearing Stratum

Axial Bearing Capacity

Drilled shafts should be constructed to bear in the bedrock encountered in boring B-1 at a depth of 29 ft below existing grade with a minimum socket length of 2.0 ft. Drilled shafts bearing at that depth may be designed as end-bearing deep foundations (neglecting side friction) with an allowable end bearing capacity of 25,000 pounds per square foot (psf).

Axial Uplift Resistance

Drilled shafts with shaft tops at elevation 596 ft NAVD88 and ends socketed into bedrock as specified above may be expected to provide side friction from the rock socket as given in **Table 8** below for 24-inch diameter shafts.

Table 8: Shaft Uplift Resistance Summary

Shaft Diameter (ft)	Rock Socket Length (ft)	Allowable Uplift Resistance per Pile (kips)
2.0	2.0	29.1
2.0	4.0	72.2
2.0	6.0	129

Lateral Load Capacities: Drilled shafts supporting the proposed splitter box will be required to support lateral loads and overturning moments.

A lateral load analysis should be performed using the computer program LPILE by Ensoft, Inc. Where a rigid cap or grade beam is provided to tie one or more drilled shafts together, a fixed-head boundary condition may be used in LPILE. Where single drilled shafts are used for support, a free head boundary condition should be used.

The LPILE analysis should utilize the selected drilled shaft design configuration, loading and soil material properties based on subsurface soils at the site with material input parameters as given in **Table 9**, below:

Table 9: LPILE Input Parameters for Lateral Analyses

Top Elevation (ft)	Bottom Elevation (ft)	LPILE Soil Layer Type	Effective Unit Weight (pcf)	Cohesion (psf)	Friction Angle (deg)	ϵ_{50} Soil	k (pci)
611	606	Neglect	-	-	-	-	-
606	600	Stiff Clay without water (Reese)	125	2,000	-	0.005	1,000
600	580	Sand (Reese)	58	-	29	0.01	75
580	570	Neglect	-	-	-	-	-

Drilled Shaft Spacing Requirements

To avoid group effects and maintain full bearing capacity, a minimum of center-to-center spacing of 3 times the shaft diameter is recommended between adjacent drilled shafts. For a typical 24-inch diameter shaft, this equates to a minimum spacing of 6 feet.

If a 6-foot spacing cannot be maintained, the axial bearing capacity should be reduced. For a reduced spacing of 1.5D, a reduction factor of 0.7 should be applied.

For intermediate spacing values between 1.5D and 1.0D, linear interpolation between a factor of 0.7 and 1.0 may be used.

Drilled Shaft Construction Recommendations

Drilled shafts socketed into the bedrock should be constructed in accordance with the requirements of ODOT C&MS Item 534 – Drilled Shafts. Due to the presence of water and granular alluvium/ residuum above the bedrock, it is recommended that casing, either temporary or permanent, be used to support the sides of the excavation prior to placement of concrete for the drilled shafts. The shaft bottom should be cleaned and free of soil debris/ water prior to placement of concrete if the dry method of concrete placement is used. If dry and clean shaft bottom cannot be maintained, concrete placement shall be performed with the wet construction method using a tremie pipe to place concrete for the drilled shaft.

Earth Pressure Recommendations

The following equivalent fluid pressures are recommended for the design of the retaining or below grade walls:

- At rest earth pressure (for restrained walls): 75 pcf
- Active earth pressure (for unrestrained walls): 55 pcf

For conservative design, the groundwater level should be assumed at the top of the wall to reflect worst case conditions, such as when the splitter box is empty during or following a significant rainfall event. While the observed groundwater level was 14 feet bgs, it is not recommended to use this value for buoyancy design due to potential fluctuations and transient loading conditions.

Side Friction Uplift Resistance from Walls

Frictional resistance between backfill soil and the walls of the proposed splitter box may be considered in resisting uplift forces. For the soil-wall contact surface from ground surface elevation 611 ft (NAVD88) to the bottom of the slab at 596 ft (NAVD88), an allowable average wall friction resistance of 40 psf may be considered. This results in an allowable uplift resistance of 600 lbf per foot of wall perimeter embedded 15 ft below grade.

Seismic Site Classification

Based on the subsurface conditions encountered, including the presence of cohesive and granular soils with variable stiffness and density, the site is classified as Seismic Site Class D, in accordance with the 2005 Ohio Building Code (Section 1615.1.1).

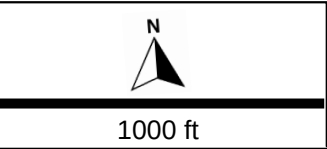
Limitations

The conclusions and recommendations presented in this memorandum are based on the assumption that our understanding of the existing site conditions and the scope of the project do not change substantially from what has been described herein, and that soil conditions do not deviate substantially from those represented by the borings taken during the subsurface exploration. Maintaining communication with AECOM is recommended to ensure that the suggestions made herein are properly interpreted and incorporated into the WWTB improvements design and construction.

Our project understanding has been stated in this memorandum. In the event that changes are made to the nature, design, or location of the proposed improvements, the conclusions and recommendations presented herein should not be considered valid, unless AECOM has reviewed the changes and addresses their impact on the recommendations provided.

The conclusions and recommendations presented in this memorandum are based on our analysis of the data collected for this project. The recommendations presented in this memorandum should not be used for other projects or purposes. Conclusions or recommendations made from these data by others are their responsibility. Our services were provided in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances and at the same period of time. No other representation is intended.

City of Elyria WWPCP - Aeration Box Splitter Box
GENERAL LOCATION PLAN



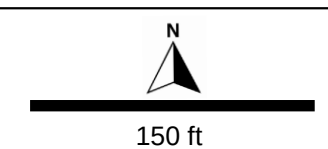
AECOM				
City of Elyria WWPCP - Aeration Box Splitter Box ELYRIA, OHIO				
GENERAL LOCATION MAP				
DRAWN BY: MAS	CHECKED BY: MJ	PROJECT No: 60332065	DATE: 05/07/25	FIGURE No: 1

City of Elyria WWPCP - Aeration Box Splitter Box

BORING LOCATION MAP

Legend

● Boring



AECOM

City of Elyria WWPCP - Aeration Box Splitter Box
ELYRIA, OHIO

BORING LOCATION PLAN

B-1

DRAWN BY: MAS	CHECKED BY: MJ	PROJECT No: 60332065	DATE: 05/07/25	FIGURE No: 2

Project: City of Elyria WWPCP - Aeration Box Splitter Box

Project Location: Elyria, Ohio

Project Number: 60332065

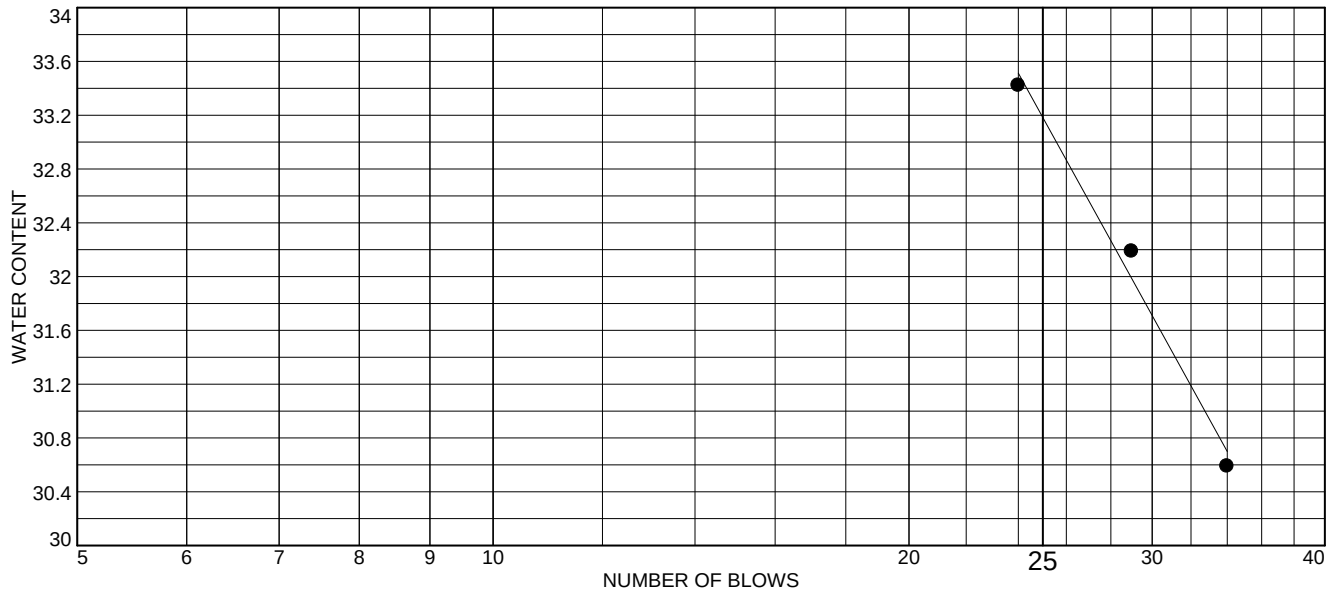
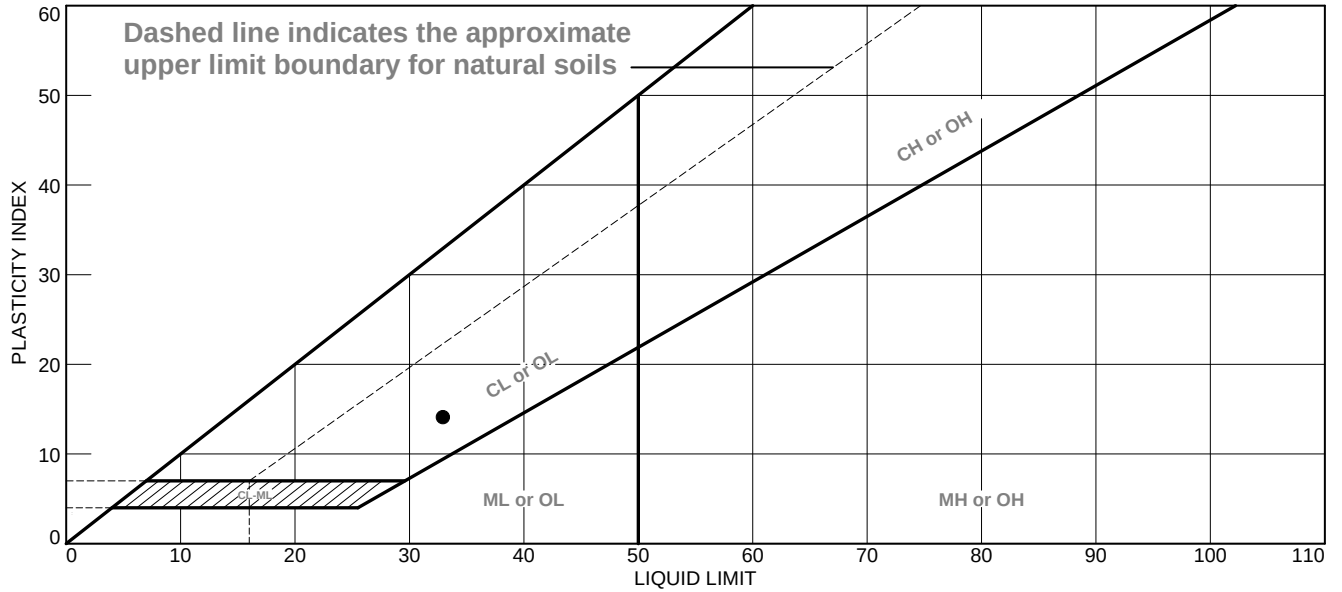
Log of Boring B-1

Sheet 2 of 2

Report: GEO_OR_WELL; File C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINT\CLIP\PROJECTS\ELYRIA\ELYRIA WWPCP.GPJ; 5/7/2025 1:11:40 PM

Elevation, feet	Depth, feet	SAMPLES					Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
		Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene- trometer (tsf)					
30											
		RC-1	41	100				becomes slightly weathered to fresh, weak			
580		RC-2	0	100							
		RC-3	77	95							
								becomes weak to medium strong			
35											
575		RC-4	99	100							
40							571.1	End of Boring at 39.9' bgs	39.9		
570											
45											
565											
50											
560											
55											
555											
60											
550											
65											

LIQUID AND PLASTIC LIMITS TEST REPORT



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● Brown, SANDY LEAN CLAY, some silt, trace gravel. (CL)	33	19	14	74.6	64.7	CL

Project No. Y25090x10 **Client:** Ohio TestBor, Inc.

Project: City of Elyria WWTCP Aeration Tank Footer Box

Source of Sample: B-1 **Depth:** 4.0
Sample Number: S-2



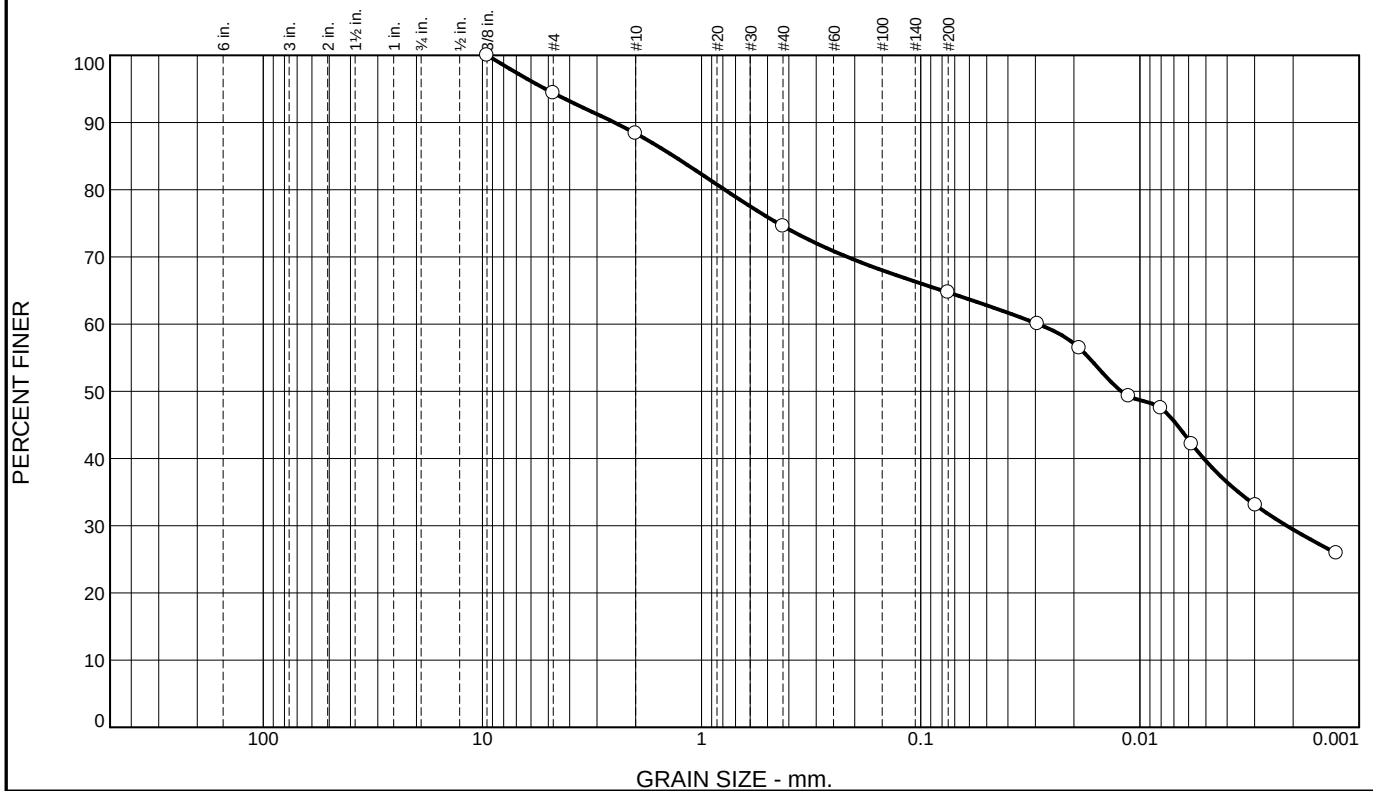
Remarks:

Figure ATT-B1-S2

Tested By: A. Gates

Checked By: G. Chammas, P.E.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.6	6.0	13.8	9.9	25.1	39.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	94.4		
#10	88.4		
#40	74.6		
#200	64.7		
0.0293 mm.	60.0		
0.0189 mm.	56.4		
0.0113 mm.	49.3		
0.0080 mm.	47.5		
0.0058 mm.	42.2		
0.0030 mm.	33.0		
0.0013 mm.	25.9		

* (no specification provided)

<u>Soil Description</u>		
Brown, SANDY LEAN CLAY, some silt, trace gravel. (CL)		
<u>Atterberg Limits</u>		
PL= 19	LL= 33	PI= 14
<u>Coefficients</u>		
D ₉₀ = 2.4981	D ₈₅ = 1.3395	D ₆₀ = 0.0292
D ₅₀ = 0.0122	D ₃₀ = 0.0021	D ₁₅ =
D ₁₀ =	C _u =	C _c =
<u>Classification</u>		
USCS= CL	AASHTO=	A-6(7)
<u>Remarks</u>		

Source of Sample: B-1 Depth: 4.0
 Sample Number: S-2

Date: 05/18/2025



Client: Ohio TestBor, Inc.
 Project: City of Elyria WWTCP Aeration Tank Footer Box

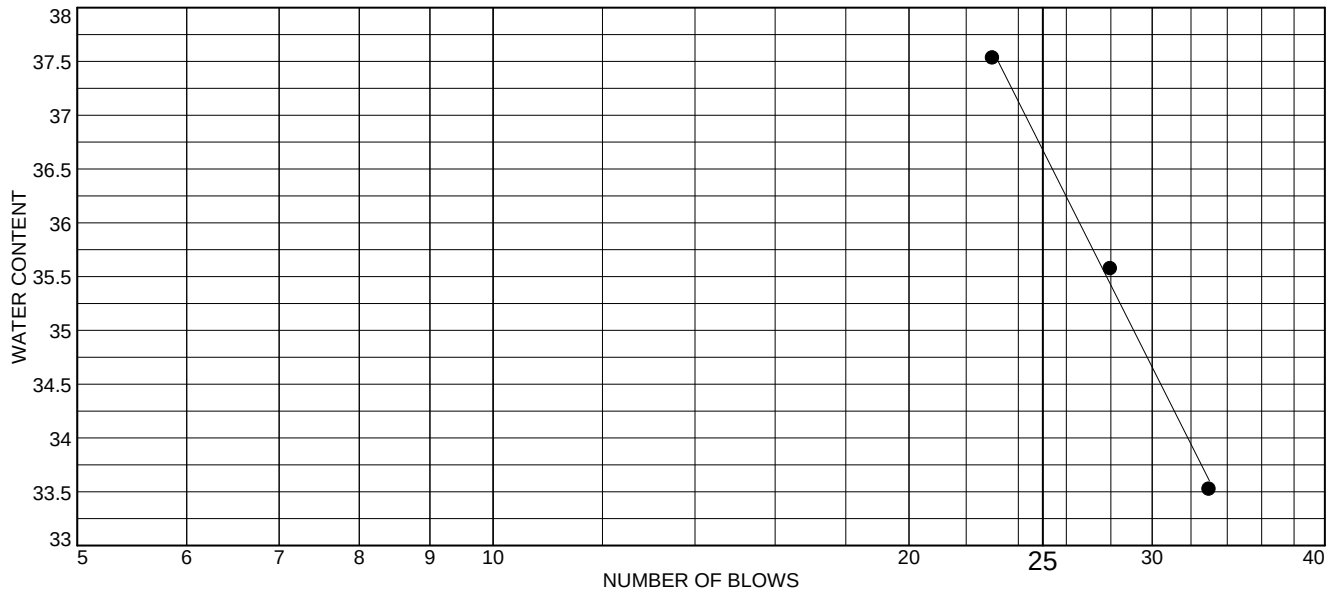
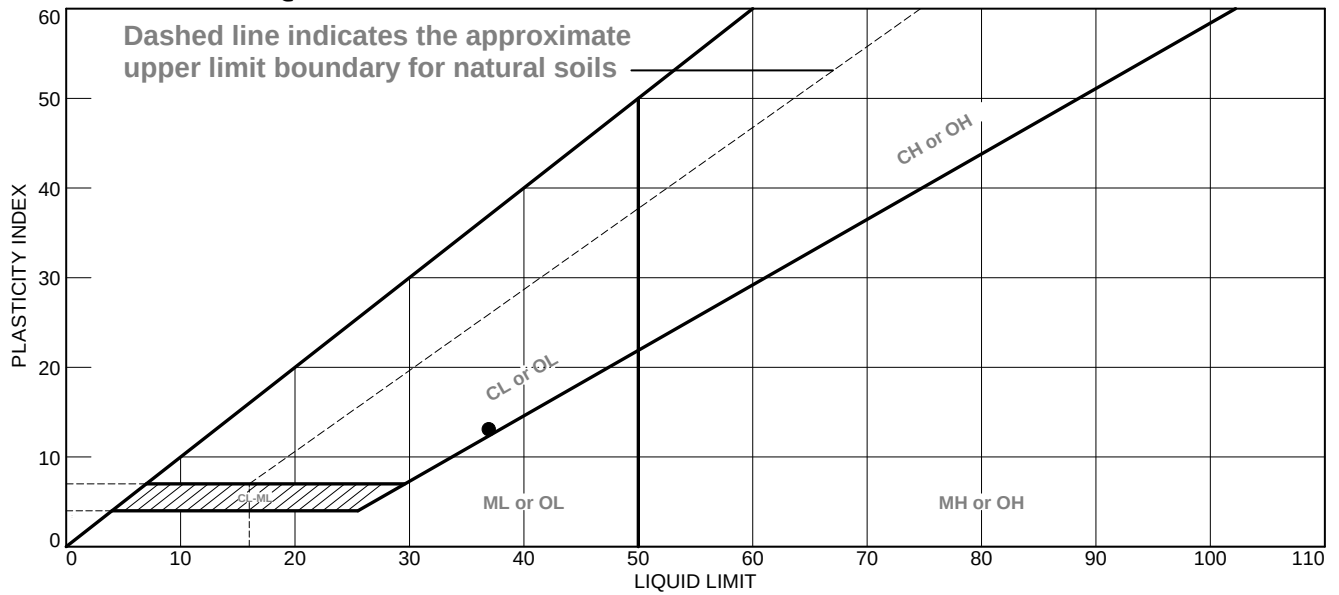
Project No: Y25090x10

Figure SA-B1-S2

Tested By: A. Gates

Checked By: G. Chammas, P.E.

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown, SANDY LEAN CLAY, and silt, trace gravel. (CL)	37	24	13	82.3	70.0	CL

Project No. Y25090x10 **Client:** Ohio TestBor, Inc.
Project: City of Elyria WWTCP Aeration Tank Footer Box
Source of Sample: B-1 **Depth:** 9.0
Sample Number: S-4



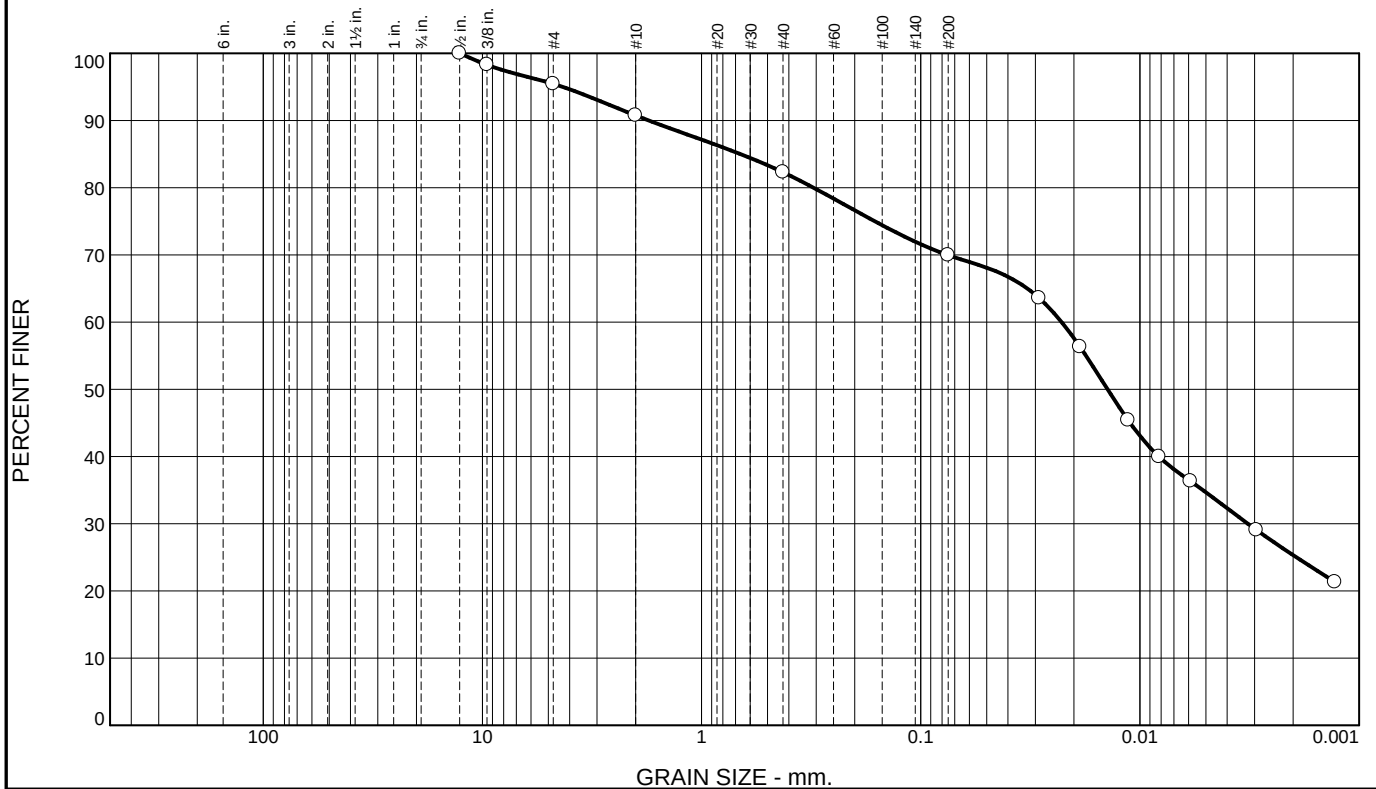
Remarks:

Figure ATT-B1-S4

Tested By: A. Gates

Checked By: G. Chammas, P.E.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.6	4.7	8.4	12.3	35.3	34.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	98.3		
#4	95.4		
#10	90.7		
#40	82.3		
#200	70.0		
0.0288 mm.	63.6		
0.0188 mm.	56.3		
0.0113 mm.	45.4		
0.0082 mm.	40.0		
0.0059 mm.	36.3		
0.0029 mm.	29.1		
0.0013 mm.	21.3		

* (no specification provided)

<u>Soil Description</u>		
Brown, SANDY LEAN CLAY, and silt, trace gravel. (CL)		
<u>Atterberg Limits</u>		
PL= 24	LL= 37	PI= 13
<u>Coefficients</u>		
D ₉₀ = 1.7449	D ₈₅ = 0.6644	D ₆₀ = 0.0228
D ₅₀ = 0.0141	D ₃₀ = 0.0032	D ₁₅ =
D ₁₀ =	C _u =	C _c =
<u>Classification</u>		
USCS= CL	AASHTO=	A-6(8)
<u>Remarks</u>		

Source of Sample: B-1 Depth: 9.0
 Sample Number: S-4

Date: 05/18/2025



Client: Ohio TestBor, Inc.
 Project: City of Elyria WWTCP Aeration Tank Footer Box

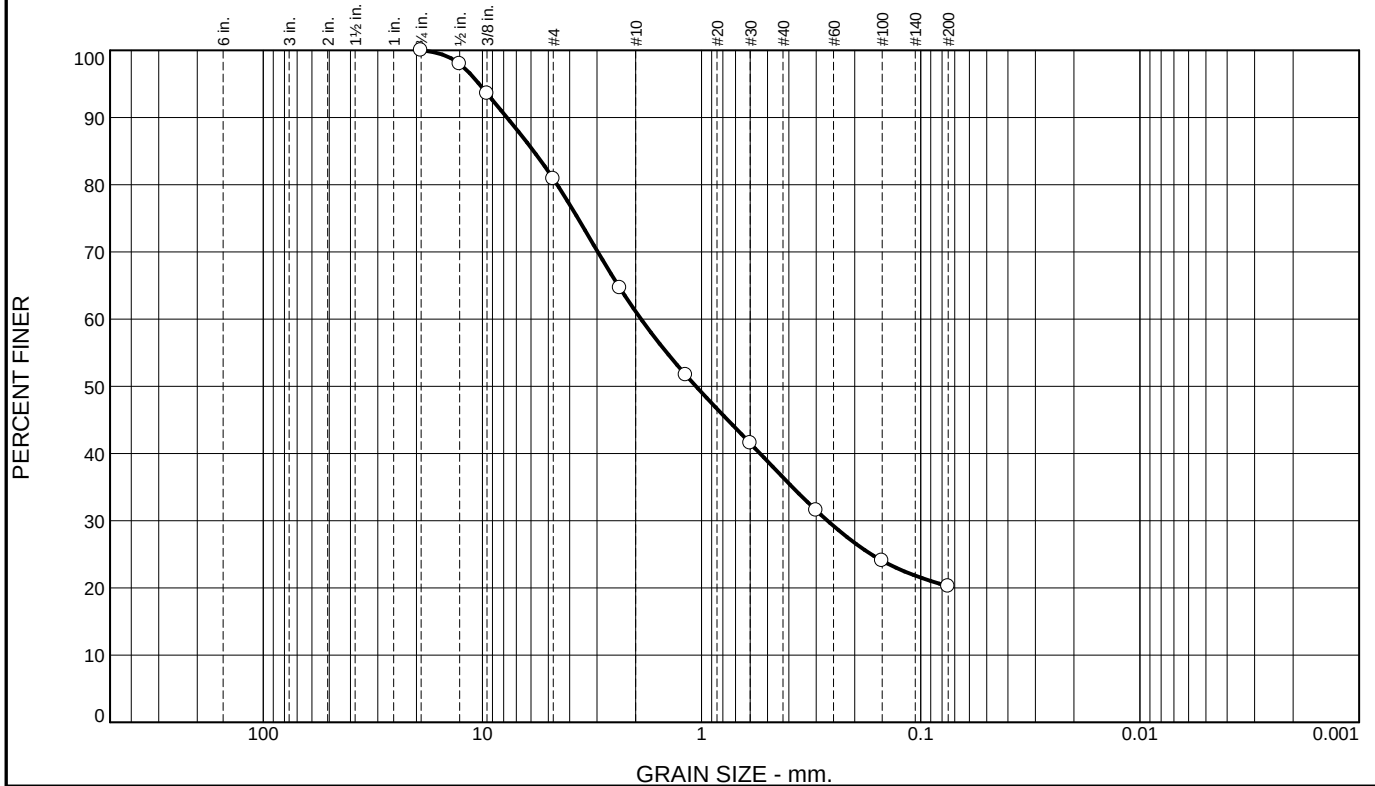
Project No: Y25090x10

Figure SA-B1-S4

Tested By: A. Gates

Checked By: G. Chammas, P.E.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	19.1	19.8	24.7	16.2	20.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	98.0		
3/8"	93.6		
#4	80.9		
#8	64.6		
#16	51.7		
#30	41.5		
#50	31.5		
#100	24.0		
#200	20.2		

* (no specification provided)

Soil Description
 Gray, CLAYEY SAND, little gravel. (SC)

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₉₀= 7.7342 D₈₅= 5.8402 D₆₀= 1.8895
 D₅₀= 1.0608 D₃₀= 0.2664 D₁₅=
 D₁₀= C_u= C_c=

Classification
 USCS= SC AASHTO=

Remarks

Source of Sample: B-1 Depth: 19.0
 Sample Number: S-6

Date: 05/18/2025



Client: Ohio TestBor, Inc.
 Project: City of Elyria WWTCP Aeration Tank Footer Box

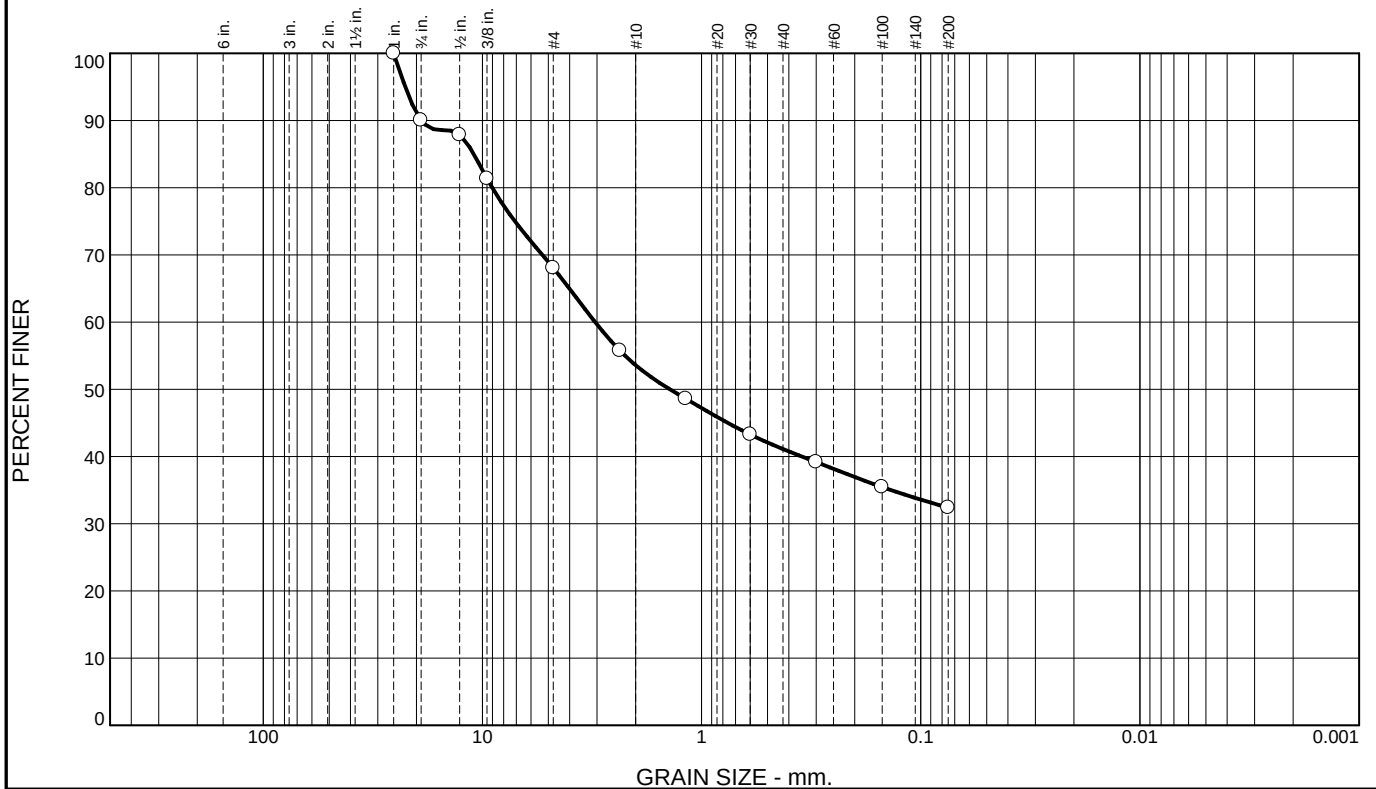
Project No: Y25090x10

Figure SA-B1-S6

Tested By: A. Gates

Checked By: G. Chammas, P.E.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.0	21.9	14.5	12.5	8.7	32.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	90.0		
1/2"	87.8		
3/8"	81.3		
#4	68.1		
#8	55.8		
#16	48.6		
#30	43.3		
#50	39.2		
#100	35.5		
#200	32.4		

* (no specification provided)

Soil Description
 Gray, CLAYEY GRAVEL, and sand. (GC)

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₉₀= 19.0194 D₈₅= 10.9548 D₆₀= 3.0579
 D₅₀= 1.3955 D₃₀= D₁₅=
 D₁₀= C_u= C_c=

Classification
 USCS= GC AASHTO=

Remarks

Source of Sample: B-1 Depth: 24.0
 Sample Number: S-7

Date: 05/18/2025



Client: Ohio TestBor, Inc.
 Project: City of Elyria WWTCP Aeration Tank Footer Box

Project No: Y25090x10

Figure SA-B1-S7

Tested By: A. Gates

Checked By: G. Chammas, P.E.

ACA ENGINEERING, INC.
741 McClurg Road, Suite A
Boardman, OH 44512
P: 330-729-1222 F: 330-729-9222

Project: City of Elyria WWTCP Aeration Tank
Footer Box
Location: Elyria, OH
Client: Ohio TestBor

Project No: Y25090x10

Date: 05-12-2025

Description: Unconfined Compressive
Strength of Intact Rock Core Specimens

Summary of Unconfined Compressive Strength Tests (ASTM D7012, Method C)

Test Boring No.	Rock Description	Sample No.	Sample Depth (ft)	Length (in.)	Diameter (in.)	Area (in ²)	Weight (lbs.)	Wet Density (pcf)	L/D	Max Load (lbs.)	Stress (psi)
B-1	Siltstone	Run 4	35.78	4.231	1.976	3.066	1.172	156.1	2.14	8,280	2,700



Failure Photograph of Run 4, 35.78 feet



Point Load Strength Index (ASTM D5731)

Project: City Elyria WWTCP Aeration Tank Footer Box
ACA Project No.: Y25090x10
Test Device: Humboldt
Readout: Digital Readout

Location: Elyria, OH
Date: 5/12/2025
Serial No.: 354
Calibrated: 8/15/2024

Boring No. : B-1
Depth (ft.): 32.15 and 34.26

Sample Details:

Siltstone, dark gray, RQD ranges from 0 to 99 percent, recovery ranges from 95 to 100 percent, sample was not wrapped in plastic, sample stored in core box since April 30, 2025.

Specimen No.	Test Type	Width (w), in	Diameter (D), in	Load (P), lbs	D_e^2 , in ²	D_e , in	I_s , psi	F*	$I_{s(50)}$, psi	k**	UCS, psi
Run 3, 32.15 feet	Axial,	1.970	1.299	662.1	3.258	1.805	203.21	0.958	194.59	12	2335.04
Run 3, 34.26 feet	Axial,	1.979	1.422	547.2	3.583	1.893	152.72	0.981	149.76	12	1797.06
								Averages:	172.171	12.000	2066.05

||= Parallel to plane of weakness

⊥= Perpendicular to plane of weakness

*= $\sqrt{D_e/1.9685394}$

as per ASTM D 5731 equation (5)

**= Per ODOT Geotechnical Design Manual section 406.2, to obtain UCS, conversion factor = 24 for competent rocks and 12 for incompetent rocks



Failure Photograph of Run 3, 32.15 feet



Failure Photograph of Run 3, 34.26 feet

SECTION 01 10 10
SUMMARY OF WORK

PART 1 - GENERAL

1.01 LOCATION OF WORK:

- A. The work of this Contract is located in the City of Elyria Wastewater Pollution Control Plant (WWPCP).

1.02 SCOPE OF WORK:

- A. Selective demolition of existing cast-in-place concrete tank structures, walls, and channels at the aeration tanks to reconfigure the existing secondary treatment process. Remove existing process aeration diffusers and piping, selected valves, slide gates, instrumentation, and related appurtenances.
- B. Construct a new cast-in-place concrete Flow Splitter Box to route mixed liquor flows to each process train.
- C. Retrofit the existing Splitter Box No. 1 to convey all combined primary effluent and return activated sludge (RAS) flows to the Anaerobic Zone. Construct a new cast-in-place concrete channel external to the existing structure and modify existing walls as necessary to facilitate flow routing from the Anaerobic Zone to Splitter Box No. 2.
- D. Retrofit the existing Splitter Box No. 2. To facilitate operation during construction, remove the isolation to the existing Aeration Tanks No. 1 through 4 inlet channel. Modify the weir plate elevation as shown on the Drawings to the existing Aeration Tanks No. 5 through 7 inlet channel.
- E. Replace the existing isolation gates at both influent and effluent ends of Aeration Tanks No. 2 through 4.
- F. Retrofit existing Aeration Tanks No. 5 through 9 into one Anaerobic Zone and three (3), three-pass process trains. Install new aeration diffusers, piping, valves, slide gates, submersible mixers, and related electrical, instrumentation and controls. Infill concrete and replace grating and handrail where indicated on the Drawings. [Note: Aeration diffusers and grids to be purchased by the Owner and stored on-site for installation by the Contractor.]
- G. Install 1,052 l.f. of 36-inch fiberglass reinforced polymer mortar pipe to connect the existing East Detritus Tank structures to the existing Wet Weather Holding Tanks. The new connecting sewer will include six (6) new manhole structures. External drop connections are required at two (2) of the new manhole structures.

- H. Install slide gates and related electrical and instrumentation equipment at the East Detritus Tank and junction structures downstream of the Primary Settling Tanks.
- I. Provide bypass pumping as necessary to maintain full operability of the treatment plant during construction.
- J. Provide all instrumentation, controls, programming, and integration as specified in the project documents.
- K. Contractor shall furnish all labor, equipment, supplies, and supervision of labor necessary to complete the work as shown on the contract drawings and specified herein.

1.03 WORK BY OTHERS:

- A. The Owner will directly procure and store the aeration piping and diffusers downstream of the flow control valves for installation by the Contractor. Installation shop drawings will be provided to the Contractor by the manufacturer.
- B. Refer to Article 7 of the General Conditions for additional requirements.

1.04 WORK SEQUENCE:

- A. The proposed sequence shall be in accordance with the approved schedule submitted by the Contractor.
- B. The WWPCP shall remain operational during the entire project to assure the final effluent limitations of the NPDES permit for the facility are met. Construction shall proceed and Contractor shall coordinate with Owner such that satisfactory operation of the WWPCP is maintained.

It is not possible to remove the WWPCP from service during the work. Contractor may coordinate with Owner to have flows reduced or adjusted in particular areas of the plant to the extent possible.

- C. The following general coordination notes are provided for the Contractor's use in developing their schedule for sequencing tank retrofits.
 - a. Prior to commencing work in Aeration Tanks No. 5 through 9, isolate influent channel upstream of existing Aeration Tanks No. 1 through 4. Drain existing Aeration Tanks No. 2 through 4 and replace existing isolation gates. Install instrumentation and place tanks in service.
 - b. After work in existing Aeration Tanks No. 2 through 4 is complete, no more than four (4) existing 20-ft. x 80-ft. tanks from Aeration Tank No. 5 through Aeration Tank No. 9 may be out of service at any given time.

- c. After each modified treatment process train (i.e. three-pass, anoxic, aerobic, aerobic zones) and associated equipment startup activities are complete, allow 72 hours for Owner to monitor treatment operations before subsequent tanks are removed from service.
- d. The construction of the new splitter box and distribution channel east of existing splitter box No. 2 may be performed at any stage in the construction sequence. However, the penetrations into existing structures must be appropriately sequenced with means of bypass and isolation as necessary.
- e. Existing structure walls and channels must be properly shored and supported at all times during construction accounting for the water level in the adjacent tank(s) if full or empty depending on the sequence of work activities. The contractor shall submit a shoring plan for any excavation activities adjacent to any full or partially full structure.

1.05 CONTRACTOR'S USE OF PREMISES:

- A. Contractor shall limit the use of the premises for the performance of the Work.
- B. Contractor shall coordinate with Owner necessary access for normal maintenance requirements.
- C. Contractor shall assume full responsibility for security of all his and his subcontractors' materials and equipment stored on the site.
- D. If directed by the Owner, Contractor shall move any stored items which interfere with operations of Owner.
- E. Contractor shall maintain access for plant employees to all equipment during performance of the Work.

1.06 SAFETY:

- A. Contractor is responsible for safety of personnel and plant staff during Contract period.
- B. Provide all devices, materials and equipment necessary to assure safety and health of personnel and plant staff.
- C. Comply with requirements of agencies having jurisdiction including confined space entry requirements. Various work areas at the plant are classified as confined spaces and appropriate measures shall be taken to perform work in these areas.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION 01 10 10

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SECTION 01 14 14

CONTROL OF WORK

PART 1 - GENERAL

1.01 PLANT AND HOURS OF CONSTRUCTION:

- A. Furnish equipment which will be efficient and appropriate to secure a satisfactory quality of work and a rate of progress which will ensure the completion of the work within the Contract Time. If at any time such equipment appears to the Engineer to be inefficient, inappropriate, or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character, or increase the plant equipment, and the Contractor shall conform to such order. Failure of the Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.
- B. Working hours shall take place only between the hours of 7:00 a.m. to 9:00 p.m., excluding Saturdays, Sundays, and legal holidays. Work outside the above time periods will be permitted only with the approval from the City.

1.02 OCCUPYING PRIVATE LAND:

- A. The Contractor shall not (except after written consent from the proper parties) enter or occupy with men, tools, materials, or equipment any land outside the rights of way or property of the OWNER. A copy of the written consent shall be given to the Engineer.

1.03 PIPE LOCATIONS:

- A. Piping is indicated exactly on the Drawings. Piping shall be arranged in a neat, compact, and workmanlike manner, with a minimum of crossing and interlacing, so as not to interfere with equipment or access ways, and, in general, without diagonal runs.

1.04 DIMENSION OF EXISTING STRUCTURES:

- A. Where the dimensions and locations of existing structures are of importance in the installation or connection of any part of the Work, the Contractor shall verify such dimensions and locations in the field before the fabrication of any material or equipment which is dependent on the correctness of such information.

1.05 OPEN EXCAVATIONS:

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, fencing, caution signs, lights, and other means to prevent accidents to persons and

damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access during construction shall be removed when no longer required. The length or size of excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Engineer.

- B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be well lighted at night.

1.06 CARE AND PROTECTION OF PROPERTY:

- A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the Engineer.

1.07 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES:

- A. The Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains, and electric and telephone cables, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operations shall be repaired by him at his expense.
- B. Assistance will be given the Contractor in determining the location of existing services. Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by the Contractor.
- C. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be a part of the work under the Contract and all costs in connection therewith shall be included in the Unit Prices Bid in the Bid Form.

1.08 COOPERATION WITHIN THIS CONTRACT:

- A. All firms or persons authorized to perform any work under this Contract shall cooperate with General Contractor and his Subcontractors or trades, and shall assist in incorporating the work of other trades where necessary or required.

- B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the Engineer.

1.09 CLEANUP AND DISPOSAL:

- A. During the course of the work, the Contractor shall keep the site of his operations in as clean and as neat a condition as is possible. He shall dispose of all residue resulting from the construction work and, at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures, and any other refuse remaining from the construction operations, and shall leave the entire site of the work in a neat and orderly condition.
- B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor and his subcontractors shall comply with all applicable Federal, State, and local laws, and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and elsewhere in the Specifications.
- C. The Contractor is advised that the disposal of excess excavated material in wetlands, stream corridors, and plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor or any person employed by him, will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. Therefore, the Contractor will be required to remove the fill at his own expense and restore the area impacted.

1.10 DUST CONTROL:

- A. During the course of the work, the Contractor shall protect all existing equipment from dust created by the Work. The Contractor will be required to maintain all work areas free from dust which cause hazards to local residents, equipment, or personnel.
- B. The Contractor shall submit dust control measures to the Engineer prior to any demolition, sandblasting or other work that will create dust.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION 01 14 14

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SECTION 01 29 01

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Contractor shall furnish all labor, materials, tools equipment, appurtenances and all services, including documentation, O&M Manuals, training and start-up services necessary to perform all work required, at the lump sum or unit prices bid for the Pay Items listed herein.
- B. Detailed breakdown of lump sum bid items as requested by the Engineer, project coordination and scheduling, assistance required by the Engineer to verify compliance with the contract documents, including measuring for final pay quantities, providing miscellaneous temporary or accessory works, verification of existing utility locations and material types, Contractor's field office, protection and/or replacement of existing property, sanitary requirements, testing, safety devices, approval drawings, water supplies, power, removal of waste, bonds, insurance, and all other requirements of the Contract Documents. Compensation for all such services, things and materials shall be included in the prices stipulated for the lump sum and unit price Pay Items as identified in the Contract.

1.02 BASIS FOR AWARD:

- A. Award of the contract shall be based on meeting or exceeding the minimum experience and performance requirements specified in the Bid Documents and the lowest price of the Base Bid at the Owner's discretion.

1.03 BASE BID: PRICES TO INCLUDE:

- A. **Bid Item No. 1 – Mobilization / Demobilization** – The lump sum price bid for this item shall include the preparatory work and operations for assembling equipment, supplies, personnel and incidentals to the project site, including but not limited to Performance Bond and Labor & Material Bonds. This item shall also include the cost to provide an area for staging and storage of materials, sanitation needs for workers, stormwater pollution prevention and inlet protection, preconstruction video and restoring project area to its original condition at the project completion. This item shall also consist of all preparatory work necessary for the project including field verification of all measurements shown on the plans. The lump sum price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications. Contractor shall be paid seventy-five (75%) percent of the lump sum price for Bid Item No. 1, less retainage, after coordinating with City of Elyria WWPCP, mobilizing equipment to the work area and approval of pre-construction documentation. Contractor shall be paid the remaining twenty-five (25%) percent of the lump sum price for Bid Item

No. 1, less retainage, after demobilization from the site. The cost of Bid Item No. 01 shall not exceed five (5) percent of the total contract price.

- B. **Bid Item No. 2 – Storm Water Pollution Prevention** – Method of Measurement – The lump sum price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to provide and install temporary erosion control measures as indicated in the plans and specifications. The lump sum price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- C. **Bid Item No. 3 – Concrete Demolition** – Method of Measurement – The lump sum price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to provide concrete demolition as indicated in the plans and specifications. The lump sum price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- D. **Bid Item No. 4 – Concrete Work – Detritus Tank Modification** – Method of Measurement – The lump sum price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to perform Detritus Tank modifications as indicated in the plans and specifications. The lump sum price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- E. **Bid Item No. 5 – Drilled Concrete Piers** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install drilled concrete piers as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- F. **Bid Item No. 6 – Concrete Work – New Splitter Box** – Method of Measurement – The lump sum price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to provide and install the New Splitter Box as indicated in the plans and specifications. The lump sum price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- G. **Bid Item No. 7 – Concrete Work – Aeration Tanks** – Method of Measurement – The lump sum price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to perform Aeration Tank modifications as indicated in the plans and specifications. The lump sum price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- H. **Bid Item No. 8 – Concrete Work – Existing Splitter Box** – Method of Measurement – The lump sum price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to perform Existing Splitter Box modifications as indicated in the plans and specifications. The lump sum price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.

- I. **Bid Item No. 9 – Aluminum Grating** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install aluminum grating as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- J. **Bid Item No. 10 – Aluminum Ladder** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install aluminum ladder as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- K. **Bid Item No. 11 – Guardrails** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install guardrails as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- L. **Bid Item No. 12 – Miscellaneous Metals** – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install miscellaneous metals as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- M. **Bid Item No. 13 – Slab Mounted Davit Cranes** – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install slab mounted davit cranes as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- N. **Bid Item No. 14 – Wall Mounted Davit Cranes** – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install wall mounted davit cranes as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- O. **Bid Item No. 15 – Aeration Tank Existing Equipment Removal** – Method of Measurement – The lump sum price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to existing equipment removal from the aeration tanks as indicated in the plans and specifications. The lump sum price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- P. **Bid Item No. 16 – 8-Inch Gate Valves** – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install 8-inch gate valves as indicated in the plans and specifications. The unit price bid shall also

include the requirements stipulated in the General Conditions and Division 1 of the specifications.

- Q. **Bid Item No. 17 – 4-Inch Gate Valves** – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install 4-inch gate valves as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- R. **Bid Item No. 18 – 3-Inch Gate Valves** – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install 3-inch gate valves as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- S. **Bid Item No. 19 – 4-Inch Butterfly Valves** – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install 4-inch butterfly valves as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- T. **Bid Item No. 20 – 6-Inch Butterfly Valves** – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install 6-inch gate valves as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- U. **Bid Item No. 21 – 4-Inch Air Flow Valves** – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install 4-inch air flow valves as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- V. **Bid Item No. 22 – 6-Inch Air Flow Valves** – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install 6-inch air flow valves as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- W. **Bid Item No. 23 – 2’x4’ Motorized Flush Gate with Actuator** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install a 2’x4’ slide gate and actuator in as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- X. **Bid Item No. 24 – 1’x1’ Motorized Flush Gates with Actuator** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install a 1’x1’ slide gate and actuator in

as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.

- Y. **Bid Item No. 25 – 9’7.5”x1’ Motorized Flush Gates with Actuator** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install a 9’7.5”x1’ slide gate and actuator in as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- Z. **Bid Item No. 26 – 8’9”x1’ Motorized Flush Gates with Actuator** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install an 8’9”x1’ slide gate and actuator in as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- AA. **Bid Item No. 27 – 6’6”x4’ Motorized Flush Gate with Actuator** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install a 6’6”x4’ slide gate and actuator in as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- BB. **Bid Item No. 28 – 4’6”x4’ Motorized Flush Gate with Actuator** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install a 4’6”x4’ slide gate and actuator in as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- CC. **Bid Item No. 29 – 3’x4’6” Motorized Flush Gates with Actuator** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install a 3’x4’6” slide gate and actuator in as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- DD. **Bid Item No. 30 – Installation of Aeration Diffuser System** – Method of Measurement – The lump sum price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to install the new aeration diffuser system in the aeration tanks as indicated in the plans and specifications. The diffuser system materials are provided by the City as indicated in the plans. The lump sum price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- EE. **Bid Item No. 31 – Electric Duct Installation** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment, testing, clearing, dewatering and appurtenances necessary to provide and install the electric duct as

indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.

- FF. **Bid Item No. 32 – Miscellaneous Electric Work** – Method of Measurement – The lump sum price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to provide miscellaneous electric as indicated in the plans and specifications. The lump sum price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications
- GG. **Bid Item No. 33 – Communication Work** – Method of Measurement – The lump sum price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to provide instrumentation and control as indicated in the plans and specifications. The lump sum price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- HH. **Bid Item No. 34 – Grading at Wet Weather Holding Tanks** – Method of Measurement – The lump sum price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to site grading at the Wet Weather Holding Tanks as indicated in the plans and specifications. The lump sum price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- II. **Bid Item No. 35 – 36-Inch FRPM Pipe** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment, testing, clearing, dewatering and appurtenances necessary to provide and install the pipe as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- JJ. **Bid Item No. 36 – New Manholes <20’ Deep** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to provide and install new Manhole Structures <20’ deep as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- KK. **Bid Item No. 37 – New Drop Manholes >20’ Deep** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to provide and install new Drop Manhole Structures >20’ deep as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.
- LL. **Bid Item No. 38 – Wet Weather Holding Tank Penetrations** – Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to construct Wet Weather Holding tank Penetrations as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.

MM. Bid Item No. 39 – Concrete Curb Remove and Replace – Method of Measurement –

The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to remove and replace concrete curb as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.

NN. Bid Item No. 40 – Full Depth Asphalt Pavement Removal and Replacement –

Method of Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to remove and replace full depth asphalt pavement as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.

OO. Bid Item No. 41 – Wet Weather Holding Tank Penetrations – Method of

Measurement – The unit price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary to construct Wet Weather Holding Tank Penetrations as indicated in the plans and specifications. The unit price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.

PP. Bid Item No. 42 – Site Work – Method of Measurement –

The lump sum price bid for this item shall include furnishing all materials, labor, equipment and appurtenances necessary remove the trees and to perform the seeding and restoration as indicated in the plans and specifications. The lump sum price bid shall also include the requirements stipulated in the General Conditions and Division 1 of the specifications.

QQ. Bid Item No. 43 – Additional Concrete Repair Allowance – Basis of Payment –

An allowance of \$200,000 shall be included as a Additional Concrete Repair allowance with the use to be specified during construction by the OWNER

RR. Bid Item No. 44 – Contingency Allowance– Basis of Payment –

An allowance of \$1,000,000 shall be included as a contingency allowance with the use to be specified during construction by the OWNER

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION 01 29 01

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SECTION 01 32 17

CONSTRUCTION PROGRESS SCHEDULES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. CONTRACTOR shall prepare and submit to Engineer for review within 10 days after Notice to Commence Work, a construction progress schedule.
- B. No work shall be done between 4 p.m. and 7 a.m. nor on Sundays or legal holidays without written permission of OWNER. However, emergency work may be done without prior permission.
- C. Night work may be established by CONTRACTOR as regular procedure with written permission of OWNER. Such permission, however, may be revoked at any time by OWNER if CONTRACTOR fails to maintain adequate equipment and supervision for proper prosecution and control of work at night.

1.02 FORM OF SCHEDULES:

- A. Prepare schedules in form of a horizontal bar chart.
 - 1. Provide separate horizontal bar for each trade or operation.
 - 2. Horizontal Time Scale: Identify first work day of each week.
 - 3. Scale and spacing to allow space for notations and future revisions.
- B. Format of Listings: Chronological order of start of each item of work.
- C. Identification of Listings: By major specification section numbers.

1.03 CONTENT OF SCHEDULES:

- A. Construction Progress Schedule:
 - 1. Show complete sequence of construction by activity.
 - 2. Show dates for beginning and completion of each major element of construction and installation dates for major items of equipment. Elements shall include, but not be limited to, the following:

- a. Shop drawing receipt from supplier/manufacturer submitted to ENGINEER, review and return to supplier/manufacturer.
 - b. Material and equipment order, manufacturer, delivery, installation, and checkout.
 - c. Performance tests and supervisory services activity.
 - d. Piping, duct work, and wiring installation.
 - e. Construction of various facilities.
 - f. Subcontractor's items of work.
 - g. Final cleanup.
 - h. Allowance for inclement weather.
 - i. Demolition.
3. Show projected percentage of completion for each item as of first day of each month.

1.04 SCHEDULE REVISIONS:

- A. Every 30 days CONTRACTOR shall revise construction schedule to reflect changes in progress of work and submit the revised schedule to engineer on monthly basis.
- B. Indicate progress of each activity at date of submittal.
- C. Show changes occurring since previous submittal of schedule.
 - 1. Major changes in scope.
 - 2. Activities modified since previous submittal.
 - 3. Revised projections of progress and completion.
 - 4. Other identifiable changes.
- D. Provide a narrative report as needed to define:
 - 1. Problem areas, anticipated delays, and impact on schedule.
 - 2. Corrective action recommended and its effect.

3. Effect of changes on schedules of other CONTRACTORS.

1.05 SUBMITTAL REQUIREMENTS:

- A. For initial submittal of construction schedule and subsequent revisions thereof, furnish six copies of schedule to ENGINEER.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION 01 32 17

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SECTION 01 32 33

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide pre-construction photographs of the project area. The photos shall include but not be limited to the areas of work, storage and layout area, interior of buildings and tunnels and exterior construction.
- B. Contractor shall provide a minimum of 20 photographs of the work site at each stage specified.

1.02 SUBMITTALS:

- A. One compact disk containing a digital file for each image with index.

1.03 QUALITY ASSURANCE:

- A. Dates for photography at site to be coordinated with Engineer and Engineer to be present during photographic periods at site unless approved otherwise by Engineer.
- B. Photographer to make and retain detailed records of all photographs by photographer under this Contract:
 - 1. The records to be in sufficient detail to support any attestation that may be required of photographer.
 - 2. Photographer to retain such records for a period not less than two years from the final acceptance of entire work under this Contract.
- C. Photographer shall have a minimum of five (5) years of experience in construction related photography. It is not acceptable for the contractor to take photographs required by this specification.

PART 2 - PRODUCTS

2.01 DIGITAL PHOTOS:

- A. Digital photos shall have a minimum of 4.0 megapixel resolution.

2.02 PRINT IDENTIFICATION:

- A. Each print to carry identification and information on it in a manner that results in minimum interference with exposure printed.
- B. On front of print in margins:
 - 1. Top margin:
 - a. Project name.
 - b. Brief title and view.
 - 2. Bottom margin.
 - a. Photographer's numbered identification of exposure.
 - b. Time and date of exposure.
 - c. Name of photographer making exposure.
 - d. Detailed description of view including point from which exposure made, compass direction of exposure, vertical inclination of exposure, identification of main features in view and any other data and information pertinent to purpose and identification of exposure photographer feels necessary to include.
 - e. Weather conditions under which exposure made.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS:

- A. Contractors notify Engineer at least 5 days in advance of any photographic sessions.
- B. Photographer to furnish additional prints beyond the number specified when request by Engineer at commercial rates applicable at time of purchase.
- C. All views to contain a relative dimension reference that is easily recognizable by the average person. In views where dimensions are critical use a recognizable measuring devices such as folding ruler, measuring tape in a manner the markings are clear and sharp in the photograph and the device located in close relationship with subject of photograph.

3.02 SITE PHOTOGRAPHY REQUIRED:

- A. Provide photographs at following stages of construction:

1. All areas where construction will be performed before commencement of any construction.
2. Upon completion of all contract work overall site photography.

3.03 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01 77 00.

END OF SECTION 01 32 33

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SECTION 01 33 00

SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This Section specifies the general methods and requirements of submissions applicable to the following work-related submittals.
 - 1. Shop Drawings.
 - 2. Product Data.
 - 3. Construction or Submittal Schedules.
- B. Additional general submission requirements are contained in Paragraph 6.17 of the General Conditions.
- C. Detailed submittal requirements will be specified in the technical specifications section.

1.02 SHOP DRAWINGS, PRODUCT DATA, SAMPLES:

- A. Shop Drawings:
 - 1. Shop drawings, as defined in the General Conditions, and as specified in individual work Sections include, but are not necessarily limited to: custom-prepared data such as usage information, coating detail drawings, and test reports including performance curves and certifications as applicable to the work.
 - 2. All shop drawings shall be submitted using the transmittal form furnished by the Engineer.
 - 3. All shop drawings submitted by subcontractors for approval shall be sent directly to the Contractor for checking. The Contractor shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials.
 - 4. The Contractor shall check all subcontractor's shop drawings regarding measurements, size of members, materials, and details to satisfy himself that they conform to the intent of the Drawings and Specifications. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission thereof.

5. All details on shop drawings submitted for approval shall show clearly the relation of the various parts of the main members and lines of the structure, and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the drawings before being submitted for approval.

B. Product Data:

1. Product data as specified in individual Sections, include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and printed installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances including certificates of compliance and applicability, catalog cuts, product photographs, printed performance curves, and test reports and certifications, and printed product warranties, as applicable to the Work.

C. Samples:

1. Samples specified in individual Sections, include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the Engineer or Owner for independent inspection and testing, as applicable to the Work.

1.03 CONTRACTOR'S RESPONSIBILITIES:

- A. The Contractor shall review shop drawings, product data and samples, including those by subcontractors, prior to submission to determine and verify the following:
 1. Field measurements
 2. Field construction criteria
 3. Catalog numbers and similar data
 4. Conformance with the Specifications
- B. 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." Shop drawings and product data sheets 11-in. X 17-in. and smaller shall

be bound together in an orderly fashion and bear the above Certification Statement on the cover sheet. The cover sheet shall fully describe the packaged data and include a listing of all items within the package. Provide to the Engineer a copy of each submittal transmittal form for shop drawings, product data and samples at the time of submittal of said drawings, product data and samples to the Engineer.

- C. If a shop drawing shows any deviation from the requirements of the Contract Documents, the Contractor shall make specific mention of the deviations in the Transmittal Form furnished by the Engineer and provide a description of the deviations in a letter attached to the submittal.
- D. The review and approval of shop drawings, samples or product data by the Engineer shall not relieve the Contractor from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error and omission are assumed by the Contractor and the Engineer will not have responsibility therefor.
- E. No portion of the work requiring a shop drawing, sample, or product data shall be started nor shall any materials be fabricated or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased or on-site construction accomplished which does not conform to approved shop drawings and data shall be at the Contractor's risk. The Owner will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.
- F. Project work, materials, fabrication, and installation shall conform with approved shop drawings, applicable samples, and product data.
 - 1. Manufacturer's printed installation instructions, a part of product data submitted to the Engineer will not be reviewed and are for informational purposes only.

1.04 SUBMISSION REQUIREMENTS:

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Work or in the work of any other contractor.
- B. All submittals shall be submitted sufficiently in advance of construction requirements to provide no less than fourteen working days, excluding Saturdays, Sundays and legal holidays for review from the time received at the Engineer's reviewing office. For submittals of major equipment, that require more than fourteen days to review, due to its sheer complexity and amount of detail and also requiring review by more than one engineering discipline, a letter will be sent by the Project Manager or his/her designee to the Contractor informing him/her of the circumstances and the date it is expected the submittal will be returned to the Contractor.
- C. Number of submittals required:

1. Shop Drawings: Unless otherwise stated in the respective Specifications Sections, submit eight (8) hard copies or one (1) electronic copy.
2. Product Data: Unless otherwise stated in the respective Specifications submit eight (8) copies or one (1) electronic copy.
3. Samples: Submit the number stated in the respective Specification Sections.

D. Submittals shall contain:

1. The date of submission and the dates of any previous submissions.
2. The Project title and number.
3. Contractor identification.
4. The names of:
 - a. Contractor
 - b. Supplier
 - c. Manufacturer
5. Identification of the product, with the specification section number, page and paragraph(s).
6. Field dimensions, clearly identified as such.
7. Relation to adjacent or critical features of the Work or materials.
8. Applicable standards, such as ASTM or Federal Specification numbers.
9. Identification of deviations from Contract Documents.
10. Identification of revisions on resubmittals.
11. An 8-in. X 3-in. blank space for Contractor and Engineer stamps.

E. Each shipment of drawings shall be accompanied by a transmittal form furnished by the Engineer providing a list of the drawing numbers and the names mentioned above.

F. Submittals shall be separated by specification section. Do not combine submittals for different specification sections under the same transmittal.

1.05 REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES:

- A. The Engineer's review is for general conformance with the design concept and contract drawings. Markings or comments shall not be construed as relieving the Contractor from compliance with the contract plans and specifications or from departures therefrom. The Contractor remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.
- B. The review of shop drawings, data, and samples will be general. They shall not be construed:
 - 1. as permitting any departure from the Contract requirements;
 - 2. as relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;
 - 3. as approving departures from details furnished by the Engineer, except as otherwise provided herein.
- C. If the shop drawings, data or samples as submitted describe variations and show a departure from the Contract requirements which the Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting an exception.
- D. Two (maximum) copies of shop drawings or product data will be returned to the Contractor via First Class United States Postal Service or one (1) electronic copy will be returned via email. Samples will not be returned.
- E. Submittals will be returned to the Contractor under one of the action codes indicated and defined on the transmittal form furnished by the Engineer.
- F. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing, on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the Engineer, on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the Contractor. The Contractor shall make corrections to any work done because of this type revision that is not in accordance to the Contract Documents as may be required by the Engineer.
- G. Partial submittals may not be reviewed. The Engineer will be the only judge as to the completeness of a submittal. Submittals not complete will be returned to the Contractor, and will be considered "Rejected" until resubmitted. The Engineer may at his option

provide a list or mark the submittal directing the Contractor to the areas that are incomplete.

- H. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the Contractor shall give written notice thereof to the Engineer at least seven working days prior to release for manufacture.
- I. When the shop drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

1.06 DISTRIBUTION:

- A. Distribute reproductions of approved shop drawings and copies of approved product data and samples, where required, to the job site file and elsewhere as directed by the Engineer. Number of copies shall be as directed by the Engineer but shall not exceed 6.

1.07 GENERAL PROCEDURES FOR SUBMITTALS:

- A. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work sections, of the Specifications, so that the installation will not be delayed by processing times including disapproval resubmittal (if required), coordination with other submittals, inspection, testing (off-site and on-site), purchasing, fabrication, delivery and similar sequenced activities. No extension of time will be authorized because of the Contractor's failure to transmit submittals sufficiently in advance of the Work.

1.08 CERTIFICATION FORMS:

- A. If specifically required in other Sections of these Specifications, the Contractor shall submit the applicable Certificate of Design for each item required, and in the form attached to this Section, completely filled in and signed and sealed by a registered professional engineer.

1.09 CERTIFICATES OF COMPLIANCE:

- A. Certificates of Compliance as required in the specifications shall include and mean certificates, manufacturer's certificates, certifications, certified copies, letters of certification and certificate of materials.
- B. The Contractor shall be responsible for providing Certificates of Compliance as required in the technical specifications. Certificates are required for demonstrating proof of compliance with specification requirements and shall be executed in 6 copies unless otherwise specified. Each certificate shall be signed by an official authorized to certify on behalf of the manufacturing company and shall contain the name and address of the

Supplier, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Supplier from furnishing satisfactory material, if after tests are performed on selected samples, the material is found not to meet the specific requirements.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION 01 33 00

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CERTIFICATE OF DESIGN

The undersigned hereby certifies that he/she is a Professional Engineer registered in the state of _____ and that he/she has been employed by (Name of Contractor) _____ to design _____ in accordance with Specifications Section _____ for the (Name of Project) _____. The undersigned further certifies that he/she has performed similar designs previously and has performed the design of the _____; that said design is in conformance with all applicable local, state, and federal codes, rules, and regulations and professional practice standards; that his/her signature and Professional Engineer (P.E.) Stamp have been affixed to all calculations and drawings used in, and resulting from, the design; and that the use of that stamp signifies the responsibility of the undersigned for that design.

The undersigned hereby certifies that he/she has Professional Liability Insurance with limits of \$1,000,000.00 and a Certificate of Insurance is attached.

The undersigned hereby agrees to make all original design drawings and calculations available to the Town/City of _____ or Owner's representative within seven (7) days following written request therefore by the Owner.

P.E. Name

Contractor's Name

Signature

Signature

Title

Title

Address

Address

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CERTIFICATE OF UNIT RESPONSIBILITY
For Specification Section _____

(Section title)

In accordance with Section 01300, paragraph 1.08 of the contract documents, the undersigned manufacturer accepts unit responsibility for all components of equipment furnished under specification Section _____. We hereby certify that these components are compatible and comprise a functional unit suitable for the specified and indicated performance and design requirements.

Notary Public

Name of Corporation

Commission expiration date Address

Seal: By: _____
Duly Authorized Official

Legal Title of Official

Date: _____

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SECTION 01 35 43

PROTECTION OF ENVIRONMENT

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. The work covered by this Section consists of furnishing all labor materials and equipment and performing all work required for the prevention of environmental pollution in conformance with applicable laws and regulations, during and as the result of construction operations under this Contract. For the purpose of this Specification, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic and/or recreational purposes.
- B. The control of environmental pollution requires consideration of air, water, and land, and involves management of noise and solid waste, as well as other pollutants.
- C. Schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the work. Provide erosion control measures such as diversion channels, sedimentation or filtration systems, berms, staked hay bales, seeding, mulching, or other special surface treatments as are required to prevent silting and muddying of streams, rivers, impoundments, lakes, etc. All erosion control measures shall be in place in an area prior to any construction activity in that area.
- D. Ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and its surroundings. It is the Contractor's responsibility to determine the specific construction techniques to meet these guidelines.
- E. Schedule and conduct all work in a manner that will minimize the level of noise escaping the site, especially at night and on weekends.

1.02 APPLICABLE REGULATIONS:

- A. Comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement.
- B. United States Environmental Protection Agency (USEPA):
 - 1. EPA-72-015: Guidelines for Erosion and Sedimentation Control Planning and Implementation
 - 2. EPA 43019-73-007: Processes, Procedures, and Methods to Control Pollution Resulting from All Construction Activity

1.03 NOTIFICATIONS:

- A. The Engineer will notify the Contractor in writing of any non-compliance with the foregoing provisions or of any environmentally objectional acts and corrective action to be taken. State or local agencies responsible for verification of certain aspects of the environmental protection requirements shall notify the Contractor in writing, through the Engineer, of any non-compliance with State or local requirements. The Contractor shall, after receipt of such notice from the Engineer or from the regulatory agency through the Engineer, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Owner may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it is later determined that the Contractor was in compliance.

1.04 IMPLEMENTATION:

- A. Prior to commencement of the work, meet with the Engineer to develop mutual understandings relative to compliance with this provision and administration of the environmental pollution control program.
- B. Remove temporary environmental control features, when approved by the Engineer, and incorporate permanent control features into the project at the earliest practicable time.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.01 EROSION CONTROL & INLET PROTECTION:

- A. Provide positive means of erosion control such as shallow ditches around construction to carry off surface water. Erosion control measures such as siltation basins, hay check dams, mulching, jute netting, and other equivalent techniques shall be used as appropriate. Offsite surface water shall be diverted around the site to a downstream channel ahead of siltation barriers. Flow of surface water into excavated areas shall be prevented. Ditches around construction area shall also be used to carry away water resulting from dewatering of excavated areas. At the completion of the work, ditches shall be backfilled and the ground surface restored to original condition.
- B. Contractor shall protect catch basins, inlet basins and manhole covers from water runoff generated by Work activities.

3.02 PROTECTION OF STREAMS, WETLANDS, AND SURFACE WATER:

- A. Care shall be taken to prevent or reduce to a minimum any damage to any stream, drainage ditch, storm drain or sewer from pollution by debris, sediment, or other material, or from the manipulation of equipment and/or materials in or near such streams. Water that has been used for washing or processing, or that contains oils or sediments that will reduce the quality of the water in the stream, shall not be directly returned to the stream. Such water will be diverted through a settling basin or filter before being directed into the streams.
- B. All preventative measures shall be taken to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with a contingency action drawing or plan approved by the Ohio EPA. Contractor shall submit to copies of approved contingency drawings or plans to the Engineer.

3.03 PROTECTION OF LAND RESOURCES:

- A. Land resources within the project boundaries and outside the limits of permanent work shall be restored to a condition, after completion of project that will appear to be natural and not detract from the appearance of the project.
- B. Outside of areas requiring earthwork for the construction of the new facilities, the Contractor shall not deface, injure, or destroy trees or shrubs, nor remove or cut them without prior approval. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless specifically authorized by the Engineer. Where such special emergency use is permitted, first wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. The Contractor shall in any event be responsible for any damage resulting from such use.
- C. Where trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment, dumping or other operations, protect such trees by placing boards, planks, or poles around them. Monuments and markers shall be protected similarly before beginning operations near them.
- D. Any trees or other landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition. The Engineer will decide what method of restoration shall be used and whether damaged trees shall be treated and healed or removed and disposed of.

All scars made on trees by equipment, construction operations, or by the removal of limbs larger than 1-in. in diameter shall be coated as soon as possible with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner

by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted.

Climbing ropes shall be used where necessary for safety. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the Contractor and are beyond saving in the opinion of the Engineer, shall be immediately removed and replaced.

- E. The locations of the Contractor's storage, and other construction building, required temporarily in the performance of the work, shall be cleared portions of the job site or areas to be cleared as shown on the Drawings and shall require written approval of the Engineer and shall not be within wetlands or floodplains. The preservation of the landscape shall be an imperative consideration in the selection of all sites and in the construction of buildings. Drawings showing storage facilities shall be submitted for approval of the Engineer.
- F. Remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess of waste materials, or any other vestiges of construction as directed by the Engineer. It is anticipated that excavation, filling, and plowing of roadways will be required to restore the area to near natural conditions which will permit the growth of vegetation thereon. The disturbed areas shall be prepared and seeded as approved by the Engineer.
- G. All debris and excess material will be disposed of outside wetland or floodplain areas in an environmentally sound manner.

3.04 PROTECTION OF AIR QUALITY:

- A. Burning. The use of burning at the project site for the disposal of refuse and debris will not be permitted.
- B. Dust Control. The Contractor will be required to maintain all demolition sites, excavations, embankments, stockpiles, access roads, plant sites, waste areas, and all other work areas within or without the project boundaries free from dust which could cause the standards for air pollution to be exceeded, and which would cause a hazard or nuisance to others.
- C. Comply with local environmental regulations for dust control. If Contractor's dust control measures are considered inadequate by Engineer, Engineer may require Contractor to take additional dust control measures.
- D. An approved method of stabilization consisting of sprinkling or other similar methods will be permitted to control dust. The use of chlorides may be permitted with approval from the Engineer.

- E. Sprinkling, to be approved, must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor must have sufficient competent equipment on the job to accomplish this if sprinkling is used. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs, as determined by the Engineer.

3.05 MAINTENANCE OF POLLUTION CONTROL FACILITIES DURING CONSTRUCTION:

- A. During the life of this Contract, maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created.

END OF SECTION 01 35 43

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SECTION 01 43 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This section covers Quality Assurance and Control requirements for this contract.
- B. The Contractor is responsible for controlling the quality of work, including work of its subcontractors, and suppliers and for assuring the quality specified in the Technical Specifications is achieved.
- C. Refer to the Article 6 - Contractor's Responsibilities, paragraphs 6.01, 6.02, and 6.03.

1.02 CONTRACTOR FURNISHED TESTING LABORATORY SERVICES:

- A. An independent commercial testing laboratory acceptable to the Engineer shall perform all tests that require the services of a laboratory to determine compliance with the Contract Documents. The laboratory shall be staffed with experienced technicians, properly equipped, and fully qualified to perform the tests in accordance with the specified standards.
- B. Preliminary Testing Services: The Contractor shall be responsible for all testing laboratory services in connection with concrete materials and mix designs, the design of asphalt mixtures, gradation tests for structural and embankment fills, backfill materials, and all other tests and engineering data required for the Engineer's review of materials and equipment proposed to be used in the Work. The Contractor shall obtain the Engineer's acceptance of the testing laboratory before having services performed, and shall pay all costs for services.
- C. The Contractor shall not retain any testing laboratory against which the Owner or the Engineer have reasonable objection, and if at any time during the construction process the services become unacceptable to the Owner, or the Engineer, either the Owner or the Engineer may direct in writing that such services be terminated. The request must be supported with evidence of improper testing or unreasonable delay. If the Engineer determines that sufficient cause exists, the Contractor shall terminate the services and engage a different testing laboratory.
- D. Transmittal of Test Reports: Written reports of testing and engineering data furnished by the Contractor for the Engineer's review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings.

- E. The Contractor's testing laboratory shall furnish four copies of a written report of each test performed by laboratory personnel within three days after each test is completed. Distribution shall be two copies of each test report to the Engineer's Representative, one copy to the Owner, and one copy for the Contractor.

1.03 QUALITY ASSURANCE:

- A. Codes and Standards: Refer to Article 3 - Contract Documents: Intent, Amending, Reuse, paragraph 3.03 of the General Conditions.
- B. Copies of applicable referenced standards are not included in the Contract Documents. Where copies of standards are needed by the Contractor for superintendence and quality control of the work, the Contractor shall obtain a copy or copies directly from the publication source and maintain at the jobsite, available to the Contractor's personnel, subcontractors, and Engineer
- C. Quality of Materials: Unless otherwise specified, all materials and equipment furnished for permanent installation in the Work shall conform to applicable standards and specifications and shall be new, unused, and free from defects and imperfections, when installed or otherwise incorporated in the Work. The Contractor shall not use material and equipment for any purpose other than that intended or specified unless the Engineer authorizes such use.
- D. Where so specified, products or workmanship shall also conform to the additional performance requirements included within the Contract Documents to establish a higher or more stringent standard or quality than that required by the referenced standard.

1.04 OFFSITE INSPECTION:

- A. When the specifications require inspection of materials or equipment during the production, manufacturing, or fabricating process, or before shipment, such services shall be performed by the Owner's independent testing laboratory, or inspection organization acceptable to Engineer in conjunction with or by the Engineer.
- B. The Contractor shall give appropriate written notice to the Engineer not less than 30 days before offsite inspection services are required, and shall provide for the producer, manufacturer, or fabricator to furnish safe access and proper facilities and to cooperate with inspecting personnel in the performance of their duties.

1.05 MATERIALS AND EQUIPMENT:

- A. The Contractor shall maintain control over procurement sources to ensure that materials and equipment conform to specified requirements in the Contract Documents.
- B. The Contractor shall comply with manufacturer's printed instructions regarding all facets of materials and/or equipment movement, storage, installation, testing, startup, and

operation. Should circumstances occur where the contract documents are more stringent than the manufacturer's printed instructions, the Contractor shall comply with the specifications. In cases where the manufacturer's printed instructions are more stringent than the contract documents, the Contractor shall advise the Engineer of the disparity and conform to the manufacturer's printed instructions. In either case, the Contractor is to apply the more stringent specification or recommendation, unless approved otherwise by the Engineer.

1.06 SHOP AND FIELD TESTING:

- A. The Contractor is responsible for providing advance notice of and access for the shop and field testing specified in the technical specification sections.
- B. The Contractor and its Subcontractor shall permit inspections, tests, and other services as required by the Contract Documents.
- C. Contractor shall provide twenty one days written notice to the Engineer so that the Engineer may schedule and witness off site and on site tests. The Engineer's witnessing of tests does not relieve the Contractor and/or Subcontractors of their obligation to comply with the requirements of the Contract Documents.

1.07 MANUFACTURER'S FIELD SERVICES:

- A. When specified in the technical specifications sections, the Contractor shall arrange for and provide technical representation from manufacturer's of respective equipment, items or components. The manufacturer's representative shall be a factory trained service engineer/technician with the type and length of experience specified in the technical specifications.
- B. Services Furnished Under This Contract: An experienced, competent, and authorized factory trained service engineer/technician representative of the manufacturer of each item of equipment for which field services are indicated in the specifications shall visit the site of the Work and inspect, operate, test, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer's service representative shall be present when the equipment is placed in operation. The manufacturer's service representative shall revisit the jobsite as often as necessary until all problems are corrected and the equipment installation and operation are satisfactory to the Engineer.

1.08 CERTIFICATION FORMS AND CERTIFICATES:

- A. The Contractor shall be responsible for submitting the certification forms and certificates in conformance with the requirements specified in Section 01 33 00 - Submittals.

PART 2 - PRODUCTS - (NOT USED)

PART 3 – EXECUTION

3.01 QUALITY CONTROL:

- A. Quality control is the responsibility of the Contractor, and the Contractor shall maintain control over construction and installation processes to assure compliance with specified requirements.
- B. Certifications for personnel, procedures, and equipment associated with special processes (e.g., welding, cable splicing, instrument calibration, surveying) shall be maintained in the Contractor's field office, available for inspection by the Engineer. Copies shall be made available to the Engineer upon request.
- C. Means and methods of construction and installation processes are the responsibility of the Contractor, and at no time is it the intent of the Engineer to supersede or void that responsibility.

END OF SECTION 01 43 00

SECTION 01 45 33

STRUCTURAL TESTS AND INSPECTIONS

PART 1 - GENERAL

1.01 GENERAL:

- A. The Structural Engineer of Record (SER) is required to prepare a program describing the structural tests and inspections that will be performed for this project. The SER is the structural engineer (an individual) who is in responsible charge of the preparation of the structural drawings and structural specifications for this project and whose professional engineering seal appears on said structural drawings. The parties responsible for the performance of the structural tests and inspections are noted on the Program of Structural Tests and Inspections prepared by the SER.
- B. The SER has prepared a Program of Structural Tests and Inspections (the "Program"), which has been or will be submitted to the building official who has jurisdiction over this project. This program is as noted on the Structural Drawings.
- C. The Program shall not relieve the Contractor or its subcontractors of their responsibilities and obligations for quality control of the Work, their other obligations for supervising the work, for any design work, which is included in their scope of services, and for full compliance with the requirements of the Contract Documents. The detection of, or failure to detect, deficiencies or defects in the Work during the testing and inspection conducted pursuant to the Program shall not relieve the Contractor or its subcontractors of their responsibility to correct all deficiencies or defects, whether detected or undetected, in all parts of the Work, and to otherwise comply with all requirements of the Contract Documents. Further, while the SER and the Resident Project Representative shall perform certain tasks in the Program requiring the review of certain construction activities, the SER and Resident Project Representative shall only perform such tasks to ensure compliance with the SER approved submittals and the specifications. Neither the SER nor the Resident Project Representative shall assume any responsibility or liability for the means, methods, procedures or techniques used by any construction contractor.
- D. The program of structural tests and inspection does not apply to the Contractor's equipment, temporary structures used by the Contractor to construct the project, the Contractor's means, methods, and procedures, and job site safety.

1.02 CONTRACTOR'S RESPONSIBILITIES:

- A. Where the Program of Structural Tests and Inspections indicates that a structural component or system is subject to structural tests and inspections and that the SER for the project has not been retained to design said component or system or to prepare a performance specification for said component of system, the Contractor shall retain, or require others under his aegis to retain, a professional engineer registered in the

jurisdiction where the project is located to design said component or system and to provide the required program of structural tests and inspections for said component or system.

- B. The Contractor shall provide free and safe access to the Work for the SER and all other individuals who are observing the Work or performing structural tests or inspections. The Contractor shall provide all ladders, scaffolding, staging, and up-to-date safety equipment, all in good and safe working order, and qualified personnel to handle and erect them, as may be required for safe access.

1.03 CONTRACTOR FURNISHED TESTING LABORATORY SERVICES:

- A. An independent commercial testing laboratory acceptable to the Engineer shall perform all tests that require the services of a laboratory to determine compliance with the Contract Documents. The laboratory shall be staffed with experienced technicians, properly equipped, and fully qualified to perform the tests in accordance with the specified standards.
- B. Preliminary Testing Services: The Contractor shall be responsible for all testing laboratory services in connection with concrete materials and mix designs, the design of asphalt mixtures, gradation tests for structural and embankment fills, backfill materials, and all other tests and engineering data required for the Engineer's review of materials and equipment proposed to be used in the Work. The Contractor shall obtain the Engineer's acceptance of the testing laboratory before having services performed, and shall pay all costs for services.
- C. The Contractor shall not retain any testing laboratory against which the Owner or the Engineer have reasonable objection, and if at any time during the construction process the services become unacceptable to the Owner, or the Engineer, either the Owner or the Engineer may direct in writing that such services be terminated. The request must be supported with evidence of improper testing or unreasonable delay. If the Engineer determines that sufficient cause exists, the Contractor shall terminate the services and engage a different testing laboratory.
- D. Transmittal of Test Reports: Written reports of testing and engineering data furnished by the Contractor for the Engineer's review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings.
- E. The Contractor's testing laboratory shall furnish five copies of a written report of each test performed by laboratory personnel within three days after each test is completed. Distribution shall be two copies of each test report to the Engineer's Representative, one copy to the SER, one copy to the Owner, and one copy for the Contractor.

1.04 OWNER FURNISHED TESTING AND INSPECTION SERVICES:

- A. The Owner will employ the services of an independent testing agency to conduct the Program of Structural Tests and Inspections as described in Section 01 45 33 and perform all quality control tests of materials of construction in the field or in the

laboratory during and after their incorporation in the Work. Field sampling and testing shall be performed in the general manner indicated in the specifications, with minimum interference with construction operations.

- B. The Contractor shall furnish a construction schedule and a minimum of 48 hour notice of readiness for testing and inspection of the work. The Engineer shall determine the exact time and location of field sampling and testing, and may require such additional sampling and testing as necessary to determine that materials and equipment conform with data previously furnished by Contractor and with the Contract Documents.
- C. The Contractor shall schedule the work to permit adequate time for testing and re-testing should test results not conform to the contract documents. Lack of testing or inspection which is attributable to insufficient notice by the Contractor or failure of the Contractor to cooperate, will be cause for rejection of the work.
- D. The Contractor shall deliver materials in sufficient quantities to the Owner's testing agency as may be required. Laboratory testing shall be performed within a reasonable time, consistent with the specified standards.
- E. The Contractor shall furnish material samples and cooperate in the field sampling and testing activities, interrupting the work when necessary. The Contractor shall furnish personnel, facilities and access to assist in the sampling and testing activities.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.01 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01 77 00.

END OF SECTION 01 45 33

SECTION 01 50 00

TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. The Contractor shall provide all temporary facilities for the proper completion of the work, as required and as specified.

1.02 SANITARY REGULATIONS:

- A. The Contractor shall provide adequate sanitary facilities for the use of those employed on the Work. Such facilities shall be made available when the first employees arrive on the site of the Work, shall be properly secluded from public observation, and shall be constructed and maintained during the progress of the Work in suitable numbers and at such points and in such manner as may be required.
- B. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the Owner, or on adjacent property.

1.03 SMOKING:

- A. Smoking shall be allowed only in designated areas.

1.04 WATER SUPPLY:

- A. For all necessary operations at the site of the work (except as noted in the next paragraph below) the Owner, without charge therefore, shall provide reasonable quantities of water at the then existing pressure from a mutually convenient hydrant of the water distribution system. The Contractor shall furnish all necessary pipe or hose extensions to conduct the water to the points of use and shall exercise due care not to waste water. The Contractor shall not contaminate the water supply and shall comply with all applicable regulations and code requirements.
- B. The Owner reserves the right to limit, suspend, or terminate the supplying of water as set forth above should it consider such action to be necessary on account of damage to the distribution system, the necessity of conserving water, or other emergency. In this event, the Contractor shall obtain water from some other approved source, at his own expense.

1.05 TEMPORARY HEAT:

- A. If temporary heat is required for the protection of the Work, the Contractor shall provide and install suitable heating apparatus, shall provide adequate and proper fuel, and shall maintain heat as required.

1.06 ELECTRICAL ENERGY:

- A. The Contractor shall make all necessary applications and arrangements and pay all fees and charges for electrical energy for power and light necessary for the proper completion of the Work and during its entire progress. The Contractor shall provide and pay for all temporary wiring, switches, connections, and meters.
- B. The Contractor shall provide sufficient electric lighting so that all work may be done in a workmanlike manner when there is not sufficient daylight.

1.07 TELEPHONE SERVICE:

- A. The Contractor shall make all necessary applications and arrangements and pay all fees and charges for telephone service required for the temporary facilities for the project.

1.08 PRECAUTIONS DURING ADVERSE WEATHER:

- A. During adverse weather and against the possibility thereof, the Contractor shall take all necessary precautions so that the Work may be properly done, satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, wood and building-paper shelters, or other suitable means.
- B. During cold weather, materials shall be preheated, if required, and the materials and adjacent structure into which they are to be incorporated shall be made and kept sufficiently warm so that a proper bond will take place and a proper curing, aging, or drying will result. Protected spaces shall be artificially heated by suitable means which will result in a moist or a dry atmosphere according to the particular requirements of the work being protected. Ingredients for concrete and mortar shall be sufficiently heated so that the mixture will be warm throughout when used.

1.09 CONTRACTOR'S FIELD OFFICE:

- A. Field Offices, General: Prefabricated or mobile unit with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. The Contractor shall maintain a temporary field office or other storage facility as needed near the work for his own use during the period of construction at which readily accessible copies of all contract documents shall be kept. The office shall be located where it will not interfere with the progress of the work. In charge of this office there shall be a competent full-time superintendent of the Contractor.

- C. The Contractor shall not occupy space within the wastewater pollution control plant for purposes other than those stipulated for construction. Temporary space shall be provided for contract worker's use during the project.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION 01 50 00

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SECTION 01 61 00

CONTROL OF MATERIALS

PART 1 - GENERAL

1.01 APPROVAL OF MATERIALS:

- A. All materials and equipment furnished by the Contractor shall be subject to the inspection and approval of the Engineer.
- B. All material and equipment must conform to the requirement of the Local Electrical code, National Electric Code, and Occupational Safety and Health Administration (OSHA).
- C. All material and equipment shall perform the work within the limits of the contract requirements. Rigid piping, containers, flexible hose, and similar material shall be leak free and in a fail-safe condition.

1.02 BOLTS, ANCHOR BOLTS AND NUTS:

- A. All necessary bolts, anchor bolts, nuts, washers, plates and bolt sleeves shall be furnished by the Contractor in accordance herewith. Anchor bolts shall have suitable washers and hexagonal nuts.
- B. All anchor bolts, nuts, washers, plates, and bolt sleeves shall be stainless steel unless otherwise indicated or specified.
- C. Unless otherwise specified, stud, tap, and machine bolts, and nuts shall conform to the requirements of ASTM Standard Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners, Designation A307. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to ANSI Standard B1.1 for Unified Inch Screw Threads (UN and UNR Thread Form).
- D. All bolts, anchor bolts, nuts, and washers are to be stainless steel shall be Type 304 or Type 316 stainless steel, unless otherwise indicated or specified.
- E. Anchor bolts shall be set accurately. They shall be carefully held in suitable templates of acceptable design. Where indicated on the Drawings, specified, or required, anchor bolts shall be provided with square plates at least 4 in. by 4 in. by 3/8 in. or shall have square heads and washers and set in the concrete forms with suitable pipe sleeves, or both. If anchor are set after the concrete has been placed, all necessary drilling and grouting or caulking shall be done by the Contractor and care shall be taken not to damage the structure or finish by cracking, chipping, spalling, or otherwise during the drilling and caulking.

1.03 GREASE FITTINGS:

- A. Provide extension fittings and tubing on all grease fittings that are installed in an inaccessible location. The extension is to be located so that equipment can be lubricated from the operating level without the use of ladders, staging or shutting down the equipment. Tubing: 316 stainless steel.

1.04 EQUIPMENT DRIVE GUARDS:

- A. All equipment driven by open shafts, belts, chains, or gears shall be provided with acceptable all-metal guards enclosing the drive mechanism. Guards shall be constructed of galvanized sheet steel or galvanized woven wire or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment. The guards shall conform in all respects to all applicable safety codes and regulations.

1.05 SPARE PARTS:

- A. Provide spare parts for products as specified in the individual technical specification sections.
- B. Pack spare parts to protect them during storage. Tag spare parts and containers to clearly identify them in accordance with Contractor's parts numbering system as reviewed by the Engineer. All parts shall be cross-referenced to their applicable the Specification Section.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION 01 61 00

SECTION 01 66 10

DELIVERY, STORAGE, AND HANDLING

PART 1 - GENERAL

1.01 GENERAL:

- A. This Section specifies the general requirements for the delivery handling, storage and protection for all items required in the construction of the work. Specific requirements, if any, are specified with the related item.

1.02 TRANSPORTATION AND DELIVERY:

- A. Transport and handle items in accordance with manufacturer's printed instructions.
- B. Schedule delivery to reduce long term on-site storage prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer.
- C. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.
- D. Deliver products to the site in manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting and installing.
- E. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended. All spare parts shall be cross-referenced to their applicable Specification Section.
- F. All items delivered to the site shall be unloaded and placed in a manner which will not hamper the Contractor's normal operation or those of subcontractors and other contractors and will not interfere with the flow of necessary traffic.
- G. Provide equipment and personnel to unload all items delivered to the site.
- H. Promptly inspect shipment to assure that products comply with requirements, quantities are correct, and items are undamaged. For items furnished by others (i.e. Owner, other Contractors), perform inspection in the presence of the Engineer. Notify Engineer verbally, and in writing, of any problems.
- I. Deliver spare parts at same time as pertaining equipment. Deliver spare parts to owner after completion of work.

1.03 STORAGE AND PROTECTION:

- A. Store and protect products and equipment in accordance with the manufacturer's instructions, with seals and labels intact and legible. Storage instruction shall be studied by the Contractor and reviewed with the Engineer by him. Instructions shall be carefully followed and a written record of this kept by the Contractor for each product and pieces of equipment.
- B. Arrange storage of products and equipment to permit access for inspection. Periodically inspect to make sure products and equipment are undamaged and are maintained under specified conditions.
- C. All mechanical and electrical equipment and instruments shall be covered with canvas and stored in a weathertight building to prevent injury. The building may be a temporary structure on the site or elsewhere, but it shall be satisfactory to the Engineer. Building shall be provided with adequate ventilation to prevent condensation. Maintain temperature and humidity within range required by manufacturer and to prevent condensation on the equipment being stored.
 - 1. All equipment shall be stored fully lubricated with oil, grease and other lubricants unless otherwise instructed by the manufacturer.
 - 2. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal "welding".
 - 3. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment at the time of acceptance.
 - 4. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION 01 66 10

SECTION 01 73 29

CUTTING, CORING, AND PATCHING

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Section Includes:

1. Alterations to existing buildings or structures.
2. Cutting, coring, and patching.

B. All cutting, coring, and rough patching shall be performed by the Contractor. Finish patching shall be the responsibility of the Contractor and shall be performed by the trade associated with the application of the particular finish.

C. Work Includes:

1. Alterations:

- a. Cutting, moving or removal of items as shown on Drawings.
- b. Cutting, moving or removal of items not shown to be cut, moved or removed, but which must be cut, moved or removed to allow new Work to proceed. Patch or reinstall Work or items which are to remain in finished Work after cutting, moving or removal, and make joints and finishes match adjacent or similar Work.
- c. Removal of existing surface finishes as needed to install new Work and finishes.
- d. Removal of abandoned items and removal of items serving no useful purpose, such as piping and electrical conduit.
- e. Repair or removal of dangerous or unsanitary conditions.
- f. Removal of unsuitable or extraneous materials not marked for salvage, such as abandoned furnishings, debris, grease buildup, rotted wood, rusted trench covers, and deteriorated concrete and masonry.

2. Cutting and Patching:

- a. Uncovering Work for installation of ill-timed Work.
- b. Removal and replacement of defective Work and Work not conforming to Contract Documents.

- c. Uncovering Work to provide observation by CM or inspection or tests by others of covered Work.
 - d. Removal of samples of installed materials for testing.
 - e. To make several parts fit properly.
3. Temporary enclosures and services.

1.02 REFERENCES:

- A. American Society for Testing and Materials International (ASTM):
 - 1. E84: Standard Test Method for Surface Burning Characteristics of Building Materials

1.03 ALTERATIONS, CUTTING, AND PROTECTION:

- A. Contractor is responsible to survey and record condition of existing facilities to remain in-place that may be affected by alteration operations. After alteration work is complete, survey conditions again and restore existing facilities to pre-alteration condition.
- B. Perform Work of moving, removal, cutting, and patching with trades qualified to perform Work in manner causing least damage to each type of Work.
 - 1. Cut finish surfaces such as masonry, tile, plaster or metals, by methods to terminate surfaces in straight line at natural point of division.
- C. Protect existing finishes, equipment, and adjacent Work which is to remain, from damage.
 - 1. Protect existing and new Work from weather and extremes of temperature.
 - a. Maintain existing interior work area above 60 degrees F (15 degrees C).
 - b. Provide weather protection, waterproofing, heat, and humidity control as needed to prevent damage to remaining existing and new Work.
- D. Provide shoring, needling, and bracing to keep building(s) or structures structurally secure and free of damaging deflection for installation of new structural members.
- E. Do not pile material to endanger building or structure.
- F. Discoveries of construction, furnishings, and articles having historic or private value shall remain in possession of Owner.
 - 1. Promptly notify Engineer.
 - 2. Protect discovery from damage from elements or Work.

3. Store items to be retained by Owner in safe, dry place on-site, or legally dispose of items which Owner releases.

1.04 HOLES IN EXISTING CONCRETE:

- A. When the Contractor is required to make new holes in existing concrete for piping, conduit, cables, or equipment, the Contractor shall accurately and carefully mark out the locations and the extent of cutting required and coordinate with the trade(s) involved. The Contractor shall make new holes using one of the methods described below:
 1. Prior to drilling any openings, the Contractor shall determine the location, if any, of existing services concealed in and/or behind the construction to be drilled. X-ray the walls or slabs, if required to determine the location.
 2. The Contractor shall chip with an electric hammer with chisel point. Adjust the location of holes as necessary to avoid electrical conduits if encountered. Cut reinforcing steel after permission is received.

1.05 SECURITY:

- A. When keys to locked areas are needed to provide access to areas to perform Work, obtain from Owner. Return keys at end of each day's Work.

1.06 PROTECTION AND CONTINUITY OF UTILITIES AND OPERATIONS:

- A. Protect existing utilities so they will continue to function during and after construction.
- B. Where interference with such facilities occurs, cooperate with Owner of facility and, if necessary, alter facility to eliminate interference.
- C. Service Continuity:
 1. Provide and maintain continuous electrical, plumbing, and HVAC services to functioning portions of process, building, facilities, or areas during hours normally in use.
 2. Temporary outages are permitted during cutover Work at such times and places as can be pre-arranged with Owner. Keep such outages to minimum number and length of time. Make no outages without prior acceptance.
 3. Include costs for temporary equipment, materials, and Work required in Contract Price.
 4. Remove temporary equipment and materials when no longer required or at completion of Work.
- D. Plant Operation:
 1. Maintain continuity of plant operation to functioning portions of existing plant.

2. Temporary shutoff is permitted during cutover Work at such times and places as can be pre-arranged with Owner. Keep such shutoffs to minimum number and length of time and, once Work has started on temporary shutoff, continue until Work is complete. Make no shutoffs without prior acceptance.
3. Include costs for temporary piping and Work required in Contract Price.
4. Remove temporary piping when no longer required or at completion of Work.

1.07 TEMPORARY ELECTRICAL AND MECHANICAL SERVICES:

- A. Comply with Section 01 50 00.

1.08 QUALITY ASSURANCE:

- A. Comply with the requirements specified in Section 01 43 00.
- B. Adhere strictly to the manufacturer's current printed recommendations regarding temperature at time of application for all work involving epoxy, cement base coating and protective coating.
- C. Use only products of the specified Repair Mortar System Manufacturer(s) or equal.
- D. Any changes in the specified repair mortar work methods shall be allowed only with the written acceptance of the CM.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Concrete repair mortar shall be a non-shrink, commercial formulation requiring only the addition of water with minimum 28-day compressive strength of 5,000 psi.
- B. Provide a non-shrink cementitious repair mortar material as manufactured by:
 1. Sika Repair 224 manufactured by Sika Corp.,
 2. EMACO S88CI manufactured by Master Builder, Inc.,
 3. Underlayment F-120 by Sauereisen, Inc.,
- C. Materials for finish patching shall be equal to those of adjacent construction.

2.02 PRODUCTS FOR PATCHING, EXTENDING, AND MATCHING:

- A. Provide same products, salvaged materials, types of construction or finish as that in existing structure, as needed to patch, extend or match existing Work.

1. Generally, Contract Documents will not define products or standards of workmanship present in existing construction, determine products by inspection and necessary testing and workmanship by use of existing as sample of comparison.

PART 3 - EXECUTION

3.01 GENERAL:

- A. All cutting and coring shall be performed in such a manner as to limit the extent of patching.
- B. All holes cut through concrete and masonry walls, slabs or arches shall be core drilled unless otherwise accepted. No structural members shall be cut without acceptance of the Structural Engineer of Record and all such cutting shall be done in a manner directed by him. No holes may be drilled in beams or other structural members. All work shall be performed by mechanics skilled in this type of work.
- C. Rough patching shall be such as to bring the cut or cored area flush with existing construction unless otherwise shown. Finish patching shall match existing surfaces.

3.02 PREPARATION:

- A. Where new work conceals existing surfaces or spaces Contractor shall remove foreign substances such as accumulated dirt, dust, grease, sludge, and odoriferous material before concealing existing surfaces.
- B. Where surfaces are to remain exposed Contractor shall remove foreign substances described above.

3.03 TEMPORARY ENCLOSURES:

- A. Exterior: Provide temporary weathertight enclosure for successive areas of building as Work progresses, to provide:
 1. Acceptable working conditions.
 2. Weather protection for materials.
 3. Effective temporary heating.
 4. Prevention of entry by unauthorized persons.
- B. Interior: Provide temporary enclosures to separate Work areas from areas of existing building occupied by Owner to prevent penetration of dust or moisture into occupied areas, to prevent damage to existing equipment, and to protect Owner's employees and operations from Work.

1. Temporary Partition and Ceiling Enclosures: Use framing and sheet materials complying with structural and fire rating requirements of applicable codes and standards.
 - a. Close joints between sheet materials, and seal edges and intersections with existing surfaces to prevent penetration of dust or moisture.
 - b. Provide mats at doors to reduce tracking of dust.
 - c. In locations where fire protection is required, paint both sides of partitions and ceilings with fire retardant paint to provide maximum flame spread of 25 when tested under ASTM E84 or as required by local fire regulations.
 - C. Relocate as required by progress of construction, by storage or Work requirements, and to accommodate requirements of Owner and other contractors employed at site.
 - D. Remove temporary materials, equipment, and services:
 1. When construction needs can be met by use of permanent construction.
 2. At completion of Project.
- 3.04 REMOVAL, RELOCATION AND SECURING MATERIALS AND EQUIPMENT:
- A. Where existing materials and equipment are removed or relocated, remove materials no longer used such as studs, straps, conduits, ducts, wires, anchors, piping and supports. Remove or cut off concealed or embedded materials such as conduit, boxes, anchors, piping or other materials to not less than 3/4-inches below finished surface.
 - B. Materials that cannot be removed shall be secured to adjacent structure to prevent coming loose.
 - C. Repair affected surfaces to conform to type, quality, and finish of adjacent surfaces.
- 3.05 CUTTING:
- A. Inspect existing conditions of Work, including components subject to damage or movement during cutting, patching, excavating or backfilling.
 - B. After uncovering Work, inspect conditions affecting installation of new materials.
 - C. Do not cut or notch structural members without specific written acceptance of CM.
 - D. Cutting shall be performed with a concrete saw and diamond saw blades of proper size.
 - E. Corners of square or rectangular openings shall be cored. Do not overcut corners of openings. Corners shall be chipped out square, if required, so as not to cause cracking at the corners.

- F. Provide for control of slurry generated by sawing operation on both sides of element.
- G. When cutting reinforced concrete, the cutting shall be done so as not damage bond between the concrete and reinforcing steel left in structure. Cut shall be made so that steel neither protrudes nor is recessed from face of the cut.
- H. Adequate bracing and/or shoring of area to be cut shall be installed prior to start of cutting. Check area during sawing operations for cracking and provide additional bracing as required to prevent a partial release of cut area during sawing operations.
- I. Provide equipment of adequate size to remove cut panel.

3.06 CORING:

- A. Coring shall be performed with an accepted non-impact rotary tool with diamond core drills. Size of holes shall be suitable for pipe, conduit, sleeve, equipment or mechanical seals to be installed.
- B. Provide protection for existing equipment, utilities and critical areas against water or other damage caused by drilling operation.
- C. Slurry or tailings resulting from coring operations shall be removed from the area following drilling.

3.07 PATCHING:

- A. Prepare surfaces to receive cementitious repair mortar in accordance with manufacturer's instructions.
- B. Mix the cementitious repair mortar material components in accordance with the manufacturer's instructions. Concrete surfaces should be surface saturated dry (SSD) with no standing water prior to mortar application.
- C. Work a wet scrub coat of the mortar per the manufacturer's recommendations into the pores and voids in the substrate and over the substrate prior to mortar application by trowel.
- D. Apply the cementitious repair mortar using a steel trowel to work the material into the surface. Fill voids from deepest to shallowest areas as the application work proceeds. Strictly follow the manufacturer's application requirements.
- E. Once the repair areas are filled with repair mortar, strike off the mortar level with the surrounding concrete substrate. Do not leave a broom finish. Finish with a steel trowel until closed up at the surface and flat.
- F. Cure the repair mortar in strict accordance with the manufacturer's instructions.

3.08 CLEANING:

- A. Perform periodic and final cleaning as specified in Section 01 74 23, and:
 - 1. Clean Owner-occupied areas daily.
 - 2. Clean spillage, overspray, and heavy collection of dust in Owner-occupied areas immediately.
- B. At completion of alterations work in each area, provide final cleaning and return space to condition suitable for use by Owner.
- C. Remove debris from site each day. Removed material, except that listed or marked by CM for retention, becomes property of Contractor.

3.09 CLOSEOUT ACTIVITIES:

- A. Provide in accordance with Section 01 77 00.

END OF SECTION 01 73 29

SECTION 01 74 23

CLEANING UP

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

- A. During its progress, the work and the adjacent areas affected thereby shall be cleaned up and all rubbish, surplus materials, and unneeded construction equipment shall be removed and all damage repaired so that the public and property owners will be inconvenienced as little as possible. Any dust created in the building created as a result of the work must be cleaned up upon completion of the work.
- B. Where material or debris has washed or flowed into or been placed in existing watercourses, ditches, gutters, drains, pipes structures, work done under this contract, or elsewhere during the course of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed of during the progress of the work, and the ditches, channels, drains, pipes, structures, and work, etc., shall, upon completion of the work, be left in a clean and neat condition.
- C. On or before the completion of the work, the Contractor shall, unless otherwise especially directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools, and machinery or other construction equipment furnished by him; shall remove, acceptably disinfect, and cover all organic matter and material containing organic matter in, under, and around privies, houses, and other buildings used by him; shall remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations in a neat and satisfactory condition.
- D. The Contractor shall thoroughly clean all materials and equipment installed by him and his sub-contractors, and on completion of the work shall deliver it undamaged and in fresh and new-appearing condition. All mechanical equipment shall be left fully charged with lubricant and ready for operation.
- E. The Contractor shall restore or replace, when and as directed, any public or private property damaged by his work, equipment, or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk, and landscaping work. Suitable materials, equipment, and methods shall be used for such restoration. The restoration of existing property or structures shall be done as promptly as practicable as work progresses and shall not be left until the end of the contract period.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Use only those cleaning materials which will not create hazards to property and persons or damage surfaces of material to be cleaned.
- B. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

PART 3 - EXECUTION

3.01 FINAL CLEANING:

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

- h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Remove labels that are not permanent.
 - k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - l. Leave Project clean and ready for occupancy.
- C. Prior to substantial completion or Owner occupancy, Contractor with Engineer and Owner, shall conduct inspection of sight-exposed interior and exterior surfaces and work areas to verify Work and site is clean.

END OF SECTION 01 74 23

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SECTION 01 77 00
CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
 - 1. Closeout procedures.
 - 2. Final cleaning.
 - 3. Adjusting.

1.02 RELATED WORK:

- A. Warranties and Bonds are included in Section 01 78 36.

1.03 CLOSEOUT PROCEDURES:

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection.
- B. Provide submittals to Engineer that are required by governing or other authorities.
- C. Submit closeout submittals specified in other Division 01 Sections, including project record documents, final completion photographic documentation, damage or settlement surveys, and similar final record information.
- D. Submit final Application for Payment identifying total adjusted Contract Sum, previous payment, and sum remaining due.

1.04 FINAL CLEANING:

- A. Complete the final cleaning operations in Section 01 74 23 before requesting inspection for Certification of Substantial Completion.

1.05 ADJUSTING:

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION 01 77 00

SECTION 01 78 36

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.

1.02 RELATED WORK:

- A. Refer to Conditions of Contract for the general requirements relating to warranties and bonds.
- B. General closeout requirements are included in Section 01 77 00 Contract Closeout.
- C. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Sections of Division 31 through 33.
- D. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

1.03 SUBMITTALS:

- A. Submit written warranties to the Owner prior to the date fixed by the Engineer for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Owner.
- B. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within fifteen days of completion of that designated portion of the Work.
- C. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Engineer for approval prior to final execution.

- D. At Final Completion, compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- E. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-in. by 11-in. paper.
- F. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification Section in which specified, and the name of the product or work item.
- G. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer, supplier, and manufacturer.
- H. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name, address, and telephone numbers of the Contractor and equipment supplier.
- I. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.04 WARRANTY REQUIREMENT:

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise

available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights or remedies.

- E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- G. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.05 DEFINITION:

- A. Standard Product Warranties are pre-printed written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION 01 78 36

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SECTION 02 41 19
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:

- 1. Demolition and removal of selected site elements.

1.03 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

1.04 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.05 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.

- 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.06 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for dust control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

1.07 FIELD CONDITIONS

- A. Owner will continue wastewater treatment operations immediately adjacent to selective demolition areas. Conduct selective demolition so that Owner's planned operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Storage or sale of removed items or materials on-site is not permitted.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

3.02 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - 5. Maintain adequate ventilation when using cutting torches.
 - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 9. Dispose of demolished items and materials promptly.

3.03 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

3.04 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.05 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

1.03 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, slag cement, and silica fume; subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.
- C. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- D. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Meetings." Minutes of the meeting shall be recorded, typed, and printed out by the Contractor and distributed by the Contractor to all parties concerned within 5 days of the meeting.
 - 1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.

- e. Laboratory responsible for field quality control.
 - f. Admixture manufacturer.
 - g. Concrete pumping equipment operator.
 - h. Owner's representative (attendance at Owner's option).
 - i. AECOM representative (attendance at Owner's option)
2. Review the following:
- a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction joints, contraction joints, isolation joints, and joint-filler strips.
 - c. Semirigid joint fillers.
 - d. Anchor rod and anchorage device installation tolerances.
 - e. Cold and hot weather concreting procedures.
 - f. Concrete finishes and finishing.
 - g. Curing procedures.
 - h. Forms and form-removal limitations.
 - i. Shoring and reshoring procedures.
 - j. Methods for achieving specified floor and slab flatness and levelness.
 - k. Floor and slab flatness and levelness measurements.
 - l. Concrete repair procedures.
 - m. Concrete protection.
 - n. Initial curing and field curing of field test cylinders (ASTM C31).
 - o. Protection of field cured field test cylinders.
 - p. Steel reinforcement installation.

1.05 ACTION SUBMITTALS

- A. Product Data: For each of the following:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Silica fume.
5. Aggregates.
6. Admixtures:
 - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
7. Curing materials.
8. Joint fillers.
9. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Slump limit.
6. Air content.
7. Nominal maximum aggregate size.
8. Sieve analysis reports.
9. Designation, type, quality, and source of fine and coarse aggregates.
10. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
11. Intended placement method.

12. Include certification test indicating compliance with any specified chloride ion content limits.
13. Include testing indicating compliance with any specified shrinkage limits.
14. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, tie spacing, hoop spacing, and supports for concrete reinforcement.
3. Detailing and orientation of Shop Drawing Plans and Schedules shall be consistent with the Construction Drawings. The reviewer reserves the right to reject, and order redrawn, any Shop Drawings that could cause field placement problems due to crowding, illegibility, or lack of detailing. Complicated structures shall have each level of reinforcing detailed individually. All resubmitted Shop Drawings shall have changes clouded.

D. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of the Engineer.

E. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.

2. Ready-mixed concrete manufacturer.
 3. Testing agency: Include copies of applicable ACI certificates.
- B. Material Certificates/Product Data: For each of the following, signed by manufacturers:
1. Cementitious materials.
 2. Admixtures.
 3. Each type of steel reinforcement
 4. Mechanical splice couplers
 5. Form materials and release agents
 6. Form ties
 7. Waterstops
 8. Curing compounds.
 9. Bonding agents.
 10. Adhesives.
 11. Semirigid joint filler.
 12. Joint-filler strips.
 13. Repair materials.
 14. Statement from supplier stating if aggregate is possibly alkali-reactive, based on tests and past service. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
 15. Statement from supplier stating if aggregate can possibly cause pop-outs, "D" cracking or other disruptions due to moisture gain, freezing or other mechanisms based on tests and past service.
- C. Material Test Reports of In-Place Construction: For the following, from a qualified testing agency:
1. Portland cement.
 2. Fly ash.
 3. Slag cement.

- 4. Silica fume.
- 5. Aggregates.
- 6. Admixtures.
- D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.
- E. Research Reports:
 - 1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
- F. Preconstruction Test Reports: For each mix design.
- G. Field quality-control reports.
- H. Minutes of preinstallation conference.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician with experience installing and finishing concrete.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for formwork and shoring and reshoring installations that are similar to those indicated for this Project in material, design, and extent.
- C. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.
 - 1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- D. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.
 - 1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

- E. Field Quality Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.
- F. References: Comply with the edition in effect per governing building code or the latest of the following, unless more stringent provisions are indicated. Maintain one copy of the publications in the Project field office at all times during concrete work. Contractor's supervisory personnel shall be familiar with the publications as they apply to this Project.
 - 1. ACI 301, "Specification for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials and Commentary."
 - 3. ACI 311.7, "Specification for Inspection of Concrete Construction."
 - 4. ACI 318, "Building Code Requirements for Structural Concrete and Commentary."
 - 5. ACI 306.1, "Standard Specification for Cold Weather Concreting."
 - 6. ACI 305.1, "Specification for Hot Weather Concreting."
 - 7. ACI 308.1, "Specification for Curing Concrete."
 - 8. ACI 350-20, "Code Requirements for Environmental Engineering Concrete Structures and Commentary."
 - 9. ACI 350.1-22, "Tightness Testing of Environmental Engineering Concrete Structures."
 - 10. SP-66, "ACI Detailing Manual."
 - 11. CRSI "Manual of Standard Practice."
 - 12. CRSI "Recommended Practice for Placing Reinforcing Bars."

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94 and ACI 301.
- B. Deliver, store, and handle steel reinforcement to prevent bending and damage.
- C. Waterstops shall be stored under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.09 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Cool ingredients before mixing to maintain concrete temperature at time of discharge to less than 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

- #### A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.02 PERFORMANCE REQUIREMENTS

- #### A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.
 - a. For concrete exposed to view when construction is complete, limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).

2.03 FORM-FACING MATERIALS

- A. Provide form materials compatible with finish surface indicated and achieving the specified finish quality and tolerances.
- B. As-Cast Surface Form-Facing Material:
 1. Provide continuous, true, and smooth concrete surfaces.
 2. Furnish in largest practicable sizes to minimize number of joints.
 3. Acceptable Materials: As required to comply with Surface Finish designations specified, and as follows:
 - a. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
- C. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
 1. Provide lumber dressed on at least two edges and one side for tight fit.
- D. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support the weight of plastic concrete and other superimposed loads.

2.04 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed.
- B. Steel Bar Mats: ASTM A184, assembled with clips.
 1. Steel Reinforcement: ASTM A615, Grade 60, deformed bars.

2.05 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
 - 1. Reinforcement chaired off earth such as in slabs on ground and footings shall utilize chairs that will not sink into the earth. Cast concrete cubes may be used, but clay brick chairs are not permitted.
- B. Mechanical Reinforcing Splicing Systems: conforming with ACI 318, Type 1 and Type 2.
 - 1. Unless specified, provide Type 1 couplers with tension and compression capacity of 125% of the specified yield strength (F_y) for the bar intended.
 - 2. Where indicated, provide Type 2 couplers with tension and compression capacity equal to the specified tensile strength (F_u) for the bar intended.
 - 3. Provide standard transition couplers with tapered thread for creation of mechanical butt splice of two different diameter sections of reinforcing steel. Reinforcing bars will require special end-preparation to engage with the couplers. See manufacturer for details.
 - 4. Mechanical lock-couplers with coupler sleeve and interlocking bolts may not be used without special request and acceptance on a case-by-case basis, due to the over-size of the system.
- C. Mechanically Anchored Deformed Bars in Tension: conforming with ACI 318-19, Section 25.4.5.1.
- D. Steel Tie Wire: ASTM A1064, annealed steel, not less than 0.0508 inch in diameter.
 - 1. Finish: Plain.

2.06 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.07 CONCRETE MATERIALS

- A. Source Limitations:
 - 1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for the entire Project.

2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150, Type I
2. Portland Cement: ASTM C150, Type II.
3. Fly Ash: ASTM C618, Class F.
4. Slag Cement: ASTM C989, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C33, Severe weathering region, Class 4S or 5S coarse aggregate, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Coarse-Aggregate Type: Limestone.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
4. For concrete exposed to view, provide coarse aggregate from sources that do not contain amounts of deleterious substances, as determined by the following limits:
 - a. Staining (Test Method ASTM C641)—An aggregate producing a stain index of 60 or higher shall be rejected when the deposited stain is found upon chemical analysis to contain an iron content, expressed as Fe_2O_3 equal to or greater than 1.5mg/200 g of sample.
5. Alkali Silica Reaction: Comply with one of the following:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.

D. Water: Potable and complying with ASTM C94.

E. Air-Entraining Admixture: ASTM C260.

- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
- G. Water-Reducing Admixture: ASTM C494, Type A.
- H. High-Range, Water-Reducing Admixture: ASTM C494, Type F
- I. Shrinkage-Reducing Admixture, ASTM C494, Type S.

2.08 WATERSTOPS

- A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes, leaving only straight butt joint splices in the field. Provide grommets or pre-punched holes at 12 inches on center along length of waterstop.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BoMetals, Inc.
 - b. Greenstreak.
 - c. Paul Murphy Plastics Company.
 - d. Vinylex Corp.
 - 2. Profile: Ribbed without center bulb.
 - 3. Dimensions: 9 inches by 3/8 inch thick; nontapered.
- B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Adeka Ultra Seal/OCM, Inc.; Adeka Ultra Seal.
 - b. Greenstreak; Hydrotite.
 - c. Vinylex Corp.; Duroseal Gasket.
 - d. Synko-Flex Plastic Adhesive Waterstop; Synko-Flex Products.
 - e. JP Specialties, Inc.; Type 20.

2.09 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd. dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- D. Curing Paper: Eight-feet-wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.
- E. Water: Potable.
- F. Clear, Waterborne, Membrane-Forming Dissipating Curing Compound: ASTM C309, Type 1, Class B, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, 18 to 25 percent solids, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C1315, Type 1, Class A.
- I. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Evaporation Retarder:
 - a. Spray-Film; ChemMasters, Madison, OH.
 - b. Aquafilm; Conspec Marketing & Manufacturing Co., Inc., Kansas City, KS.
 - c. Sure Film; Dayton Superior Corporation, Oregon, IL.
 - d. Eucobar; Euclid Chemical Co., Cleveland, OH.
 - e. MasterKure ER 50; Master Builders Solutions US LLC, Shakopee, MN.
 - 2. Clear, Waterborne, Membrane-Forming Curing Compound:
 - a. Safe-Cure Clear; ChemMasters, Madison, OH.
 - b. Day-Chem Rez Cure; Dayton Superior Corporation, Oregon, IL.
 - c. Kurez W VOX; Euclid Chemical Co., Cleveland, OH.

- d. MasterKure CC 180WB; Master Builders Solutions US LLC, Shakopee, MN.
 - e. 1100-CLEAR; W. R. Meadows, Inc., Elgin, IL.
- 3. Clear, Waterborne, Membrane-Forming Curing Compound, 18 to 25 Percent Solids:
 - a. Cure & Seal 18 Percent E, Symons by Dayton Superior.
 - b. Safe-Cure Clear; ChemMasters, Madison, OH.
 - c. MasterKure CC 200WB; Master Builders Solutions US LLC, Shakopee, MN.
 - d. Diamond Clear VOX; Euclid Chemical Co., Cleveland, OH.
 - e. Vocomp-20; W. R. Meadows, Inc., Elgin, IL.
- 4. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound:
 - a. Polyseal WB; ChemMasters, Madison, OH.
 - b. Lumiseal WB Plus; L&M Construction Chemicals, Inc., Omaha, NE.
 - c. Vocomp-30; W. R. Meadows, Inc., Elgin, IL.
 - d. Super Diamond Clear VOX; The Euclid Chemical Company, Cleveland, OH.

2.10 RELATED MATERIALS

- A. Expansion and Isolation Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy-Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and grade to suit requirements, and as follows:
 - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
 - 2. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Floor Slab Protective Covering: Eight-feet-wide cellulose fabric.

- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- G. Form Release Agent: Commercially formulated form release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form release agent with rust inhibitor for steel form-facing materials
 - 2. Form release agent for form liners shall be acceptable to form liner manufacturer.
- H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water barrier plates to walls indicated to receive dampproofing or waterproofing.

2.11 REPAIR MATERIALS

- A. Repair Overlayment: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch, and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C109.

2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
 - 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
- C. Proposed concrete proportions and mixes must be submitted to the Engineer and may be reviewed by the Engineer. However, the Contractor is solely responsible for producing concrete of the quality, durability and strength so stated in the Specifications and on the Drawings.
- D. Cementitious Materials in Concrete: Limit percentage, by weight, of cementitious materials other than Portland cement, including Class F fly ash and slag cement, in accordance with ACI 350-20 Tables 4.1.3(a), (b), (c), and (d).
- E. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 - 4. Do not air entrain normal-weight concrete for trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.
 - 5. Calcium chloride and admixtures containing calcium chloride shall not be used. Water soluble chloride ions in the total concrete mix shall not exceed specified limits.
 - a. Per ASTM C1281, submit a minimum of one test of the chloride content for each concrete mix with a specified maximum chloride limit. Mixture shall be tested at an age of between 28 and 42 days.

2.13 CONCRETE MIXTURES

- A. Class F: Normal-weight concrete for drilled piers.
 - 1. Exposure Class: ACI 318 F0, S0, W0, C1.
 - 2. Minimum Compressive Strength: 4,000 psi at 28 days.
 - 3. Cementitious Material Type: Per ACI 318 Table 19.3.2.1
 - 4. Maximum w/cm: 0.64.
 - 5. Slump Limit:

- a. 5 inches, plus or minus 1 inch
 - b. 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site
 6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- B. Class STX: Normal-weight concrete with exposure to wastewater, including mat foundations, slabs, walls, columns, beams and infills.
1. Exposure Class: ACI 350 EF2, ES0, EC1, ECA0, EE0.
 2. Minimum Compressive Strength: 5,000 psi at 28 days.
 3. Cementitious Material Type: As required per ACI 350-20 Tables 4.1.3(a), (b), (c), and (d).
 - a. Minimum 610 pounds of cementitious materials per cubic yard of concrete.
 4. Maximum w/cm: 0.40.
 5. Slump Limit:
 - a. 4 inches, plus or minus 1 inch
 - b. 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site
 6. Air Content:
 - a. 6 percent, plus or minus 1 percent at the point of delivery
 7. Limit water-soluble, chloride-ion content in hardened concrete to 0.10 percent by weight of cement.
- C. Class LC: Lean Concrete.
1. Exposure Class: Not Applicable
 2. Minimum Compressive Strength: As indicated on Drawings at 28 days.
 3. Maximum w/cm: 0.70.
 4. Fly ash content not to exceed 30 percent of cementitious material weight
 5. Slump Limit:

- a. 8 inches, plus or minus 1 inch

D. Class CLSM: Controlled Low-Strength Material.

- 1. Exposure Class: Not Applicable
- 2. Provide cellular, low-density, controlled low-strength material with the following physical properties:
 - a. Minimum Compressive Strength: As indicated on Drawings at 28 days.
 - b. Maximum Cast Density: 50 pcf at point of placement, when tested according to ASTM C138.

2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94, and furnish batch ticket information. Mixing of concrete with fibers shall comply with ASTM C1116.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

2.15 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.16 EMBEDDED ITEMS

- A. It is solely the Contractor's responsibility to coordinate with all Trades for the setting of sleeves, anchors, inserts, frames, and other items to be embedded and to provide all openings required for the installation of other work.

1. Such coordination shall include, but not be limited to, review of all Contract Documents and the various subcontractors' Shop Drawings.
 2. No insert shall be allowed to displace reinforcement.
 3. All inserts embedded in concrete exposed to the environment shall be hot-dipped galvanized.
 4. All inserts embedded in concrete exposed to wastewater shall be 316 stainless steel.
- B. Continuous concrete inserts shall be "Unistrut" type.
1. The anchors of the insert shall not be allowed to project past the body of the insert.
 2. The maximum height of the insert body shall be as follows:
 - a. Inserts placed in slabs and joists: 7/8 inch.
- C. Embedment of conduits and pipes shall be in accordance with ACI 318, "Conduits and Pipes Embedded in Concrete," except that;
1. No conduits shall be embedded in concrete slabs, beams, girders, walls and columns unless specifically detailed on the Structural Drawings.
 2. Aluminum shall not be embedded in concrete.
- D. Structural Integrity: Do not provide any sleeves or openings in structural members unless shown on the Structural Drawings.
- E. Anchor Bolts: The Contractor shall be responsible for the correct orientation and exact center line location of anchor bolts.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
 2. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.03 FORMWORK

- A. Comply with ACI 301.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the surface finish designations specified.
- C. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
 1. Wall or column footings may be trenched (excavated neat) and cast without formwork if the soil is suitable and the size of footing does not increase by more than 2 inches in any direction.
- D. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 1. Class A, 1/8 inch, for smooth formed surfaces.
 2. Class C, 1/2 inch, for rough formed surfaces.
- E. Construct forms tight enough to prevent loss of concrete mortar.
 1. Minimize joints.
 2. Exposed Concrete: Symmetrically align joints in forms.
- F. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 3. Install keyways, recesses, and other accessories, for easy removal.

- G. Do not use rust-stained, steel, form-facing material.
- H. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips
 - 2. Use strike-off templates or compacting-type screeds.
 - 3. The new floor construction must meet and match the existing floor line and elevation where tie-ins to adjacent structures are made.
- I. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
 - 3. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 - 4. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- J. Chamfer exterior corners and edges of permanently exposed concrete.
- K. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
- L. Form openings, chases, offsets, sinkages, keyways, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Engineer prior to forming openings not indicated on Drawings.
- M. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
 - 3. Place joints perpendicular to main reinforcement.

4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
 - a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings.
 - a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.04 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
 3. Clean embedded items immediately prior to concrete placement.

3.05 REMOVING AND REUSING FORMS

- A. It shall be solely the responsibility of the Contractor to remove the forms in a manner which will ensure complete safety of the structure.
- B. Formwork, for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete must also be hard enough to not be damaged by form-removal operations and curing and protection operations must be maintained.
- C. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:

1. At least 70 percent of 28-day design compressive strength.
 2. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.
 3. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- D. Clean and repair surfaces of forms to be reused in the Work.
1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 2. Apply new form-release agent.
- E. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
1. Align and secure joints to avoid offsets.
 2. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.06 SHORES AND RESHORES

- A. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring. Reshoring design and execution is the responsibility of the Contractor.
1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.07 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement.
1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 2. Do not tack weld crossing reinforcing bars.

- D. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars shall be lapped as indicated on Drawings.
 - 2. Stagger splices in accordance with ACI 318.
 - 3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
- G. Install welded-wire reinforcement in longest practicable lengths.
 - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
 - a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.
 - 2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
 - 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 - 4. Lace overlaps with wire.

3.08 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
 - 1. Place joints perpendicular to main reinforcement.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.
 - 3. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 4. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete. Provide keys in all construction joints, including footings, unless specifically noted otherwise in the Contract Documents.

5. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection. Locate joints in strip footings in the middle third of the distance between columns.
6. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
7. Space vertical joints in walls at a maximum of 40'-0" unless otherwise indicated on the Drawings. Space vertical joints in walls at a maximum of 20'-0" from corners unless otherwise indicated on Drawings. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
8. Space joints in footings at a maximum of 125'-0" unless otherwise indicated on the Drawings.
9. In foundation mat slabs and tank base slabs, space joints at a maximum of 40'-0" on center unless noted otherwise on the Drawings. Align joints in slabs and walls where possible.
10. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
11. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.09 INSTALLATION OF WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm.
 1. Install in longest lengths practicable.
 2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
 3. Allow clearance between waterstop and reinforcing steel of not less than 2 times the largest concrete aggregate size specified.
 4. Secure waterstops in correct position at 12 inches on center.
 5. Use factory-fabricated waterstop intersections produced by the waterstop manufacturer for all waterstop directional changes and intersections.
 6. Limit field-fabricated joints to butt joints. Fabricate according to manufacturer's written instructions.
 7. Clean waterstops immediately prior to placement of concrete.
 8. Support and protect waterstops during progress of the Work.

- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, according to manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.
 - 1. Install in longest lengths practicable.
 - 2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
 - 3. Protect exposed waterstops during progress of the Work.

3.10 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Notify Engineer and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Engineer, but not to exceed the amount indicated on the concrete delivery ticket
 - 1. Do not add water to concrete after adding high range water reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
 - 1. If a section cannot be placed continuously, provide construction joints as indicated.
 - 2. Deposit concrete to avoid segregation.
 - 3. If a variation in texture or color is evident, the Contractor shall revise construction procedures until uniformity is maintained.
 - 4. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 5. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.

- d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- 6. In no case shall concrete be allowed to drop freely for more than 3'-0". For drops greater than 3'-0", use a tremie or other approved method for placing.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Do not place concrete floors and slabs in a checkerboard sequence.
 - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 3. Maintain reinforcement in position on chairs during concrete placement.
 - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 5. Level concrete, cut high areas, and fill low areas.
 - 6. Slope surfaces uniformly to drains where required.
 - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 - 8. Do not further disturb slab surfaces before starting finishing operations.

3.11 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

- 1. ACI 301 Surface Finish Rough Formed Finish: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
 - b. Remove projections larger than 1 inch.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 Class C.
 - e. Apply to concrete surfaces not exposed to liquid or public view.
- 2. ACI 301 Surface Finish Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

- a. Patch voids larger than 3/4 inchwide or 1/2 inch deep.
- b. Remove projections larger than 1/8 inch.
- c. Patch tie holes.
- d. Surface Tolerance: ACI 117 Class A.
- e. Apply to concrete surfaces at the following locations:
 - 1) Interior of vaults, manholes, and similar structures.
 - 2) Interior of open-top water-containing structures from base slab up to within 1'-0" below the normal water level.
 - 3) All other formed surfaces unless specifically noted.

B. Rubbed Finish: Apply after concrete has been smooth-formed finished.

1. Smooth-Rubbed Finish:

- a. Perform no later than one day after form removal.
- b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
- c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
- d. Apply to concrete surfaces at the following locations:
 - 1) Interior of open-top water-containing structures from one foot below the normal water level up to the top of the formed surface.
 - 2) Top of curbs and walls of open-topped tank structures.

C. Related Unformed Surfaces:

- 1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
- 2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.12 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Trowel Finish:
 - 1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
 - 2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
 - 3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 4. Do not add water to concrete surface.
 - 5. Do not apply hard-troweled finish to concrete which has a total air content greater than 3 percent.
 - 6. Apply a trowel finish to all other slab surfaces.
 - 7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17; unless noted otherwise.
 - b. Specified overall values of flatness, F(F) 30; and levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and levelness, F(L) 15; for suspended slabs. (Measurements shall be taken prior to removal of shoring.)
 - 8. F(L) tolerances do not apply to floor surfaces specified to be inclined or cambered.
 - 9. F(L) tolerances do not apply to unshored elevated construction.
- C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
 - 2. Coordinate required final finish with Engineer before application.

3.13 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.14 CONCRETE CURING

- #### A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations. Apply evaporation retarder according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing if moisture loss exceeds this level.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
 - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
 - a. For Concrete used to Contain Liquids: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

- a) Lap edges and ends of absorptive cover not less than 12-inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
- 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
- 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- b. Floors to Receive Curing Compound (do not use curing compounds for structures used to contain liquid):
 - 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Maintain continuity of coating, and repair damage during curing period
 - 4) Curing compounds shall not be used to cure post-tensioned concrete.
 - 5) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
- c. Floors to Receive Curing and Sealing Compound:
 - 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.

- 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.
- 4) Do not use curing and sealing compounds on floors to receive floor coverings.

3.15 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least six months.
 2. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.
- D. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete. It is not required to patch voids less than 1/2 inch in depth unless total area of all voids in any 1-foot by 1-foot square area exceed 15 square inches. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture

and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar as specified by the Engineer.
- F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

- G. All repair procedures and products shall be reviewed and approved by the Engineer prior to commencing with the remedial work.

3.17 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
 - 1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31.
 - 2. Testing agency shall immediately report to Engineer, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 - 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Engineer, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
 - a. Test reports shall include reporting requirements of ASTM C31, ASTM C39, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.

- 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C172 shall be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.
 3. Testing Frequency: Obtain at least one composite sample for each 150 cu. yd. or 5000 square feet of slab or wall area or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 4. Slump: ASTM C143:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 - c. No concrete shall be placed that does not meet specified slump requirements. Slump exceeding the specified maximum, when occurring in 2 consecutive tests made on different portions of the same sample, will be cause for rejection of that truckload and shall be reported to the Engineer immediately. The replacement of such concrete shall be done at no additional expense to the Owner
 5. Air Content: ASTM C231 pressure method, for normal-weight concrete.

- a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. No concrete shall be placed that does not meet specified air content requirements.
- 6. Concrete Temperature: ASTM C1064:
 - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
- 7. Compression Test Specimens: ASTM C31:
 - a. Cast and laboratory cure two sets of two 6-inch by 12-inch or two sets of three 4-inch by 8-inch cylinder specimens for each composite sample.
 - b. Cast, initial cure, and field cure two sets of two standard 6-inch by 12-inch or three 4-inch by 8-inch cylinder specimens for each composite sample.
- 8. Compressive-Strength Tests: ASTM C39:
 - a. Test one set of laboratory-cured specimens at seven days and one set of two specimens at 28 days.
 - b. Test one set of field-cured specimens at seven days and one set at 28 days.
 - c. A compressive-strength test shall be the average compressive strength from a set of specimens obtained from same composite sample and tested at age indicated.
- 9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- 10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is less than or equal to 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
- 11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
- 12. If the 28-day test results do not meet the specified strength f'_c , the mix proportions shall be adjusted for the remaining portion of the structure at no additional expense to the Owner.

13. Additional Tests:

- a. Where concrete is considered partially deficient, the Owner may require additional testing to be made at no additional expense to the Owner. Any such testing shall be done by an independent testing laboratory. If additional tests do not indicate concrete meets the Project requirements, Contractor shall remove and replace deficient concrete as directed by Engineer. In lieu of additional testing, Contractor has option to immediately remove and replace deficient concrete at no additional expense to the Owner or Project Schedule
- b. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.
- c. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Engineer.
 - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.

14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 72 hours of completion of floor finishing and promptly report test results to Engineer.

F. Inspection Services: Inspection work shall be performed in accordance with ACI 311 by an independent testing laboratory.

1. The inspecting agency shall perform the following duties:

- a. Inspect batching and mixing operations of concrete.
- b. Inspect storage facilities and methods of material handling.
- c. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
- d. Inspect placed reinforcing steel, shoring, bracing, embedded items, anchor bolts, joints, etc.
- e. Inspect concrete handling, placing, consolidating, finishing, curing, protection, and repair or patching.

- f. Inspect stripping, form removal, shoring and reshoring.
 - g. Submit certified reports the same day that duties are performed to all those designated by the Engineer or the Owner. Any noncompliance with Project requirements shall be reported immediately.
- 2. The Contractor shall fully cooperate with the inspecting agency in their performance of specified duties and render any necessary physical assistance.
 - 3. The reinforcing steel and embedded item placement must be completed before inspection. Concrete placement shall not commence until the area has been inspected and given final approval by the inspecting agency.

3.18 PROTECTION

A. Protect concrete surfaces as follows:

- 1. Protect from petroleum stains.
- 2. Diaper hydraulic equipment used over concrete surfaces.
- 3. Prohibit use of pipe-cutting machinery over concrete surfaces.
- 4. Prohibit placement of steel items on concrete surfaces.
- 5. Prohibit use of acids or acidic detergents over concrete surfaces.

B. Slabs on ground shall not receive any type of loading other than people foot traffic until the concrete has cured for at least seven days and the concrete has reached 80 percent of its required strength.

3.19 LEAKING TESTING OF CONTAINMENT STRUCTURES

A. General

- 1. Hydrostatically test the fluid-containing reinforced concrete structures listed below to demonstrate conformance to the leakage criteria specified herein and show they are free of detectable leaks. Do not hydrostatically test walls restrained or laterally supported by slabs until slab concrete has obtained the specified compressive strength. Testing is required for the following structures:
 - a. New splitter box no. 3
 - b. New overflow tank structure adjacent to the detritus tank effluent channel
- 2. Prior to testing, clean exposed surfaces by thoroughly hosing and removing surface laitance and loose matter from walls and slabs. Remove wash water and debris from the structures by means other than washing through plant piping. All potential leakage points shall be identified and repaired prior to filling the tank with water

for the tightness test. Methods for repairing concrete shall be as described in the Drawings.

3. No backfilling, floor finish, concrete or mortar fill, wall insulation, gasproofing or protective coatings shall be applied to or installed in any new containment structures until they have been subjected to loading for settlement and tested for leakage. Testing shall not be done until the concrete has reached its specified design strength.

B. Preloading Test

1. A preloading test is only required for the new overflow tank structure adjacent to the detritus tank effluent channel.
2. For the Preloading Test the Contractor shall maintain the liquid level in the structures at the design maximum water level for 72-hours. If the characteristics of settlement of the structure so require, the loading shall continue for a longer period to permit the necessary consolidation of the foundation material, in which case the Contractor shall be entitled to no extra compensation, but a commensurate extension of time for completion of the whole work under this contract shall be allowed.

C. Leak Test Procedure

1. Leakage testing shall meet the provisions of ACI 350.1 Section 2, which covers hydrostatic tightness testing for open or covered containment structures. The test criterion shall be HST-050 (maximum allowable measured volumetric loss of 0.050 percent per day) for “other type” tanks as defined by ACI 350.1.
2. During the test period, the excavation around the structure shall be kept dewatered by the Contractor. Dewatering shall maintain the groundwater level to below the top of the base slab. The Contractor shall temporarily seal all bottom openings and wall openings below maximum water level in the structures, furnish and fill the structures to the design maximum water level with clean water. The Contractor shall make his own arrangements for handling the water for testing and its transfer from one structure to another and its final disposal.
3. During the leakage test period, the Engineer will inspect the structure for leakage or change in volume. If the containment structure fails Part 1 or 2 of the hydrostatic tightness test per ACI 350.1 Section 2, the Contractor shall furnish all materials and do all work necessary to locate the leaks and make the structure watertight to the complete satisfaction of the Engineer. No additional compensation will be allowed for such work.
4. If, in the opinion of the Engineer, weather conditions during testing are such that it becomes difficult to accurately monitor the water level in the tank, the test shall be stopped and started over again when weather permits at no additional cost to the Owner.

5. On conclusion of the test, the Contractor shall pump or drain the water from the structure and dispose of it without damage to structures or surrounding facilities.
6. Methods for repairing concrete not passing the leakage test shall be as described in the Contract Documents.
7. Provide closeout activities in accordance with Section 017700.

END OF SECTION 03 30 00

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes structural steel, as defined in the AISC Manual of Steel Construction, "Code of Standard Practice," and as otherwise indicated.
- B. Related Sections:
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.

1.03 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.04 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
 - 1. ANSI/AISC 303.
 - 2. ANSI/AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

1.05 SUBMITTALS

- A. Product Data for each type of product specified.
- B. Shop Drawings detailing fabrication of structural steel components.
 - 1. General
 - a. All Shop Drawings shall have a revision block that contains all dates of revision and reissuance, as well as all pertinent revision information.

- 1) Changes to Shop Drawings for resubmission shall be “clouded” or “flagged” to clearly indicate all changes (including additions and deletions) from the previous submission. Resubmissions will be reviewed only to verify those items clouded or flagged. All other information will be assumed to be unchanged from the previous submission.
 - 2) No changes or substitutions shall be made on the Shop Drawings, unless such changes or substitutions have previously been authorized in writing by the A/E.
- b. Erection Drawings: Subject to compliance with requirements, provide Drawings produced by one of the following methods:
- 1) Correctable, translucent prints of the A/E’s Drawings may be used for erection drawings. The A/E’s title block and profession seals shall not appear on submittals. Documents shall reflect current Construction Documents.
 - 2) Electronic copies of CAD Drawings may be available from the A/E. Contractors requiring this service must contact the A/E to verify availability and receive a price quote. The cost of copying will be established on an individual basis, relative to the time required to copy and process the information. Requests for copies should be addressed to the A/E’s Project Manager.
 - 3) The A/E’s title block and profession seals shall not appear on submittals. Documents shall reflect current Construction Documents.
- c. The entire plan of any floor or roof shall be completely detailed before being submitted for review. The minimum amount of detailing that will be reviewed is half of a plan, or the area between expansion joints.
- d. Detailing shall be done on a 24-inch by 36-inch sheet for erection plans and 11-inch by 17-inch for piece marks, minimum, and the sheets shall be filled completely to minimize the number of Shop Drawings.
2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 3. Include embedment drawings.
 4. Indicate welds by standard AWS symbols, distinguishing between shop-welds and field-welds, and show size, length, and type of each weld. See backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 5. Indicate type, size, and length of bolts, distinguishing between shop-bolts and field-bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.

6. Provide setting Drawings, templates, and directions for the installation of anchor bolts and other anchorages to be installed by others.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
 1. Power source (constant current or constant voltage).
 2. Electrode manufacturer and trade name, for demand critical welds.
- D. Qualification Data: For qualified Installer, fabricator, and testing agency.
- E. Control Submittals
 1. Mill test reports signed by manufacturers, certifying that their products comply with requirements, including the following:
 - a. Structural steel, including chemical and physical properties.
 - b. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
 - c. Direct-tension indicators.
 - d. Shear stud connectors.
 - e. Non-shrink grout.
 2. Shop and field inspection reports.
 3. Certifications that welders, both in shop and in field, have satisfactorily passed AWS qualifications within the past 12 months for the type of welds being made.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.
 1. A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
- B. Installer Qualifications: Engage an installer who participates in the AISC certification program and is designated an AISC-certified erector, Category ASCE.

- C. Comply with applicable provisions of the following specifications and documents:
1. AISC's "Steel Manual of Construction", LRFD.
 2. AISC's "Code of Standard Practice for Steel Buildings and Bridges.
 3. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
 4. AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members."
 5. ASTM A6 "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
 6. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."
1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
 2. Any welder found producing unsatisfactory work, even though certified, shall be immediately recertified or replaced with a qualified, certified welder.
 3. If recertification of welders is required, retesting and recertification are the Contractor's responsibility.
- E. Pre-installation Conference: Conduct conference at project site.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
1. Store fasteners in a protected place in sealed containers with manufacturer's labels intact. Clean and relubricate bolts and nuts that become dry or rusty before use.
 2. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.

3. Comply with manufacturer's written recommendations for cleaning and lubricating ASTM F3125, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.
4. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.08 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

- A. Rolled Steel Wide Flanges and WT Shapes
 1. Carbon Steel: ASTM A992, unless noted otherwise.
- B. Structural Steel Channels: As follows (unless noted otherwise on the Drawings):
 1. Carbon Steel: ASTM A36, 36,000 psi yield, or
 2. Carbon Steel: ASTM A992.
- C. Structural Steel Angles:
 1. High-Strength, Low-Alloy Columbium-Vanadium Steel: ASTM A572, Grade 50, unless noted otherwise.
- D. Structural Steel Plates and Bars up to 4-inches thick:
 1. High-Strength, Low-Alloy Columbium-Vanadium Steel: ASTM A572, Grade 50, unless noted otherwise.
- E. Structural Steel Plates and Bars over 4-inches thick:
 1. Carbon Steel: ASTM A36, 36,000 psi yield, unless noted otherwise.
- F. Cold-Formed Hollow Structural Sections (Round and Rectangular):

1. Carbon Steel: ASTM A500, Grade C, 50,000 psi yield, unless noted otherwise.
- G. Shear Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- H. Threaded Rods, Anchor Bolts, and Washers: As follows:
1. Threaded Rods: ASTM A36.
 2. Anchor Bolts: ASTM F-1554, Grade 55 (with Supplement S1), or as indicated on the Drawings.
 3. Washers: ASTM A36.
 4. Nuts: ASTM A563 heavy-hex carbon steel.
- I. Non-High-Strength Bolts, Nuts, and Washers: ASTM A307, Grade A; carbon-steel, hex-head bolts, carbon-steel nuts, and flat, unhardened steel washers ASTM A36.
1. Finish: Hot-dip zinc coating, ASTM A153, Class C, unless noted otherwise.
- J. High-Strength Bolts, Nuts, and Washers: ASTM F3125 Grade A325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts ASTM A563 Grade DH, and hardened carbon-steel washers ASTM F436 Type 1.
1. Finish: Hot-dip zinc coating.
 2. Direct-Tension Indicators: ASTM F 959, Type 325-1, compressible-washer type.
 - a. Finish: Hot-dip zinc coating.
- K. Welding Electrodes: Comply with AWS requirements.
1. Conform to the Specification for Mild Steel-Covered Arc-Welding Electrodes, AWS A5.1, latest edition.
 2. E-70 electrodes shall be used for all welding of structural materials, unless a higher strength electrode is required by Table 4.1.1 of AWS D1.1.

2.02 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, of consistency suitable for application, and a 30-minute working time.
1. Grout shall have a minimum 28-day compressive strength of 10,000 psi.

2.03 FABRICATION

- A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to ANSI/AISC 303 and 360 specifications referenced in this Section and in Shop Drawings.
 - 1. Identify high-strength structural steel according to ASTM A6 and maintain markings until steel has been erected.
 - 2. Mark and match-mark materials for field assembly.
 - 3. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
 - 4. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
 - 5. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.
- D. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's printed instructions.
- E. Bolt Holes and other Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.
 - 1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
 - 2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.
 - 3. Shop-drill or punch holes in members as required for bolts to secure structural steel, wood blocking, nailers, sash, etc. Burning of holes is not allowed.
 - 4. Drilling, cutting, or punching in members in the field for fastening of blocking, nailers, sash, etc., is not permitted without written approval from A/E.
 - 5. Provide holes required for securing other work to structural steel framing, and for the passage of other work through steel framing members, as indicated. Provide

threaded nuts welded to framing, and other specialty items as shown to receive work.

2.04 SHOP CONNECTIONS

- A. Install and tighten high-strength bolts, except where non-high-strength bolts are specifically indicated.
- B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 - 1. Bolts: ASTM A325 high-strength bolts, typical.
 - 2. Connection Type: Snug-tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
- C. Weld Connections: Comply with AWS D1.1 for procedures, tolerance, appearance and quality of welds, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp. Do not exceed tolerances in AISC 303 for mill material.
 - 2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of backside welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch and larger. Grind flush butt welds. Dress exposed welds.
- D. Headed Stud-Type Shear Connectors: All headed studs shall be end-stud-welded to steel members in accordance with the manufacturer's printed instructions.

2.05 MISCELLANEOUS FABRICATION ITEMS

- A. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place Work. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
- B. Equipment Supports and Mechanical Opening Framing
 - 1. All framing for equipment supports and for mechanical and electrical openings shown on Structural, Electrical, and Mechanical Drawings is for general arrangement only and may require modification to suit the actual purchased equipment. Such modification is the responsibility of the Contractor, who shall provide a complete job ready for installation of the equipment.
 - 2. Contractor shall submit a unit price per ton for fabricating and erecting support steel for equipment. This price per ton shall be for openings or equipment supports or both not shown or deleted.

- C. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:
 - 1. SSPC-SP 3 "Power Tool Cleaning" for enclosed or protected steel, unless noted otherwise.
 - 2. SSPC-SP 6 "Commercial Blast Cleaning," for unprotected or exposed steel and where indicated.

2.06 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A123.
 - 1. All structural steel that is exposed to earth shall be galvanized. Do not shop-paint.
 - 2. See Drawings for structural steel required to be galvanized.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds and repair-painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.

2.07 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.
 - 1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
 - 2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.
- B. If inspections or testing reveal deficiencies in structural steel, such deficiencies are to be corrected, or the structural steel removed and replaced.
- C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- D. Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 - 1. Direct-tension indicator gaps will be verified to comply with ASTM F959, Table 2.
- E. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

1. Liquid Penetrant Inspection: ASTM E165.
 2. Magnetic Particle Inspection: ASTM E709, performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 3. Radiographic Inspection: ASTM E94 and ASTM E142, minimum quality level "2-2T."
 4. Ultrasonic Inspection: ASTM E164.
- F. In addition to visual inspection, shop-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud-welding and as follows:
1. Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.
 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Before erection proceeds, and with the steel erector present, verify elevations of concrete bearing surfaces and locations of anchorages for compliance with requirements.
- B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
 1. At no time shall the structure be subjected to loads in excess of the design loads stated on the Drawings.

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to ANSI/AISC 303 and 360 specifications referenced in this Section.
- B. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

- C. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
- D. Splice members only where indicated.
- E. Finish sections thermally cut during erection equal to a sheared appearance.
 - 1. No cutting of sections (including flanges, welds, stems, or angles) shall be done without written permission from A/E.
- F. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.
- G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.04 FIELD CONNECTIONS

- A. Install and tighten high-strength bolts, except where non high-strength bolts are specifically indicated.
- B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 - 1. Bolts: ASTM A325 high-strength bolts, typical.
 - 2. Bolts: ASTM A490 high-strength bolts, where required.
 - 3. Connection Type: Snug-tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
- C. Weld Connections: Comply with AWS D1.1 for procedures, tolerances, appearance and quality of welds, and methods used in correcting welding work.
 - 1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp. Do not exceed tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.05 FIELD QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.
 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.
- B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
- C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 1. Direct-tension indicator gaps will be verified to comply with ASTM F959, Table 2.
- E. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
 1. Liquid Penetrant Inspection: ASTM E165.
 2. Magnetic Particle Inspection: ASTM E709, performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 3. Radiographic Inspection: ASTM E94 and ASTM E142; minimum quality level "2-2T."
 4. Ultrasonic Inspection: ASTM E164.
- F. In addition to visual inspection, field-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding and as follows:
 1. Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.
 2. Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.

3.06 CLEANING

- A. Galvanized Surfaces: Clean field-welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A780.

END OF SECTION 05 12 00

SECTION 05 52 13
PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Aluminum railings.

1.02 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete. Deliver such items to Project site in time for installation.

1.03 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of mechanically connected railings.
2. Fasteners.
3. Post-installed anchors.
4. Handrail brackets.
5. Bituminous paint.
6. Non-shrink, nonmetallic grout.
7. Anchoring cement.
8. Metal finishes.

- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

- C. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer in the state of Ohio responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For delegated design professional engineer in the State of Ohio and testing agency.
- B. Design data:
 - 1. Calculations and drawings and connections to structure sealed and signed by a Ohio registered Professional Engineer as evidence that furnished products meet or exceed the requirements of this section.
- C. Welding certificates.
- D. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.2, "Structural Welding Code - Aluminum."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.07 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. applied in any direction.

- b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - d. Space support posts 4 feet (1.2 m) oc, maximum.
2. Infill of Guards:
- a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
- 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Where minimum loads above are less than that required by the Ohio Building Code, comply with then more stringent requirement.
- E. It shall be the responsibility of the manufacturer and the supplier along with the General Contractor and his Subcontractor to conform to the wind, seismic and operating load design requirements for this Project and for the work of this specification section.

2.02 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.03 ALUMINUM RAILINGS

- A. Source Limitations: Obtain each type of railing from a single source from single manufacturer.
- B. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- C. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, Alloy 6063-T6.
 - 1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.

- D. Drawn Seamless Tubing: ASTM B210/B210M, Alloy 6063-T832.
- E. Plate and Sheet: ASTM B209/B209M, Alloy 6061-T6.
- F. Die and Hand Forgings: ASTM B247/B247M, Alloy 6061-T6.
- G. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.04 FASTENERS

- A. Fastener Materials:
 - 1. Aluminum Railing Components: Type 316 stainless steel fasteners.
 - 2. Finish exposed fasteners to match appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 - 2. Provide Phillips tamper-resistant square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
 - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.05 MISCELLANEOUS MATERIALS

- A. Handrail Brackets: Cast aluminum with center of handrail 2-1/2 inches from face of railing.
- B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
 - 1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

- C. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187.
- D. Non shrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for exterior applications.
- E. Anchoring Cement: Factory-packaged, Non shrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.06 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water.
 - 1. Provide weep holes where water may accumulate.
 - 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded or nonwelded connections unless otherwise indicated.

- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection, using an epoxy structural adhesive, if this is manufacturer's standard splicing method.
- J. Form changes in direction as follows:
 - 1. By bending to smallest radius that will not result in distortion of railing member.
- K. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
- O. Provide inserts and other anchorage devices for connecting railings to concrete work.
 - 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 - 2. Coordinate anchorage devices with supporting structure.
- P. Gate hinges: At swing gates indicated on the drawings, provide heavy duty round post self-closing stainless steel hinges and all necessary accessories, shims and adaptors to fit different post and gate diameters as required and capable of withstanding the gate load and load forces up to 700lb.



Q. Gate latches: Provide stainless steel drop bolt cane type springed or with hold open harness latches at swing gates similar or equal to the ones shown:

1. Provide dust proof floor receivers for cane when in the closed position.

R. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.07 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.

2. Install railings and gates level, plumb, square, true to line; without distortion, warp, or rack.

3. Set railings and gates accurately in location, alignment, and elevation; measured from established lines and levels.

4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.02 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches of post.

3.03 ANCHORING POSTS

- A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Cover anchorage joint with flange of same metal as post, Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:
 1. For aluminum railings, attach posts as indicated, using fittings designed and engineered for this purpose.

3.04 ATTACHING RAILINGS

- A. Anchor railing ends to concrete with flanges connected to railing ends and anchored to wall construction with anchors and bolts.

- B. Attach handrails to walls with wall brackets except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete anchorage, use drilled-in expansion shields and hanger or lag bolts.
- D. Install railing gates level, plumb, and secure for full opening without interference.
 - 1. Attach hardware using tamper-resistant or concealed means.
 - 2. Adjust hardware for smooth operation.

3.05 CLEANING

- A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

3.06 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 52 13

SECTION 05 53 13

BAR GRATINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Metal bar gratings.
 - 2. Grating frames and supports.

1.02 ACTION SUBMITTALS

- A. Product Data:
 - 1. Clips and anchorage devices for gratings.
- B. Shop Drawings:
 - 1. Include plans, sections, and attachment details.
 - 2. Signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Manufacturers' published load tables.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete.
- B. Welding certificates.

1.04 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
 - 1. AWS D1.2.
 - 2. AWS D1.3.

1.05 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 METAL BAR GRATINGS

- A. Metal Bar Grating Standards: Comply with NAAMM MBG 531.
- B. Riveted Aluminum Grating:
 - 1. Riveted Aluminum Grating shall match the existing on site in structural capacity and appearance. Field verify and contact Engineer of Record for discrepancies.
 - 2. Reference Structural Drawings for bearing bar spacing, bearing bar depth, bearing bar thickness, and rivet spacing.
 - 3. Traffic Surface: Plain.
 - 4. Aluminum Finish: Match existing grating on site.
 - a. Mill finish.
 - b. Class I, clear, anodized finish.

2.02 GRATING FRAMES AND SUPPORTS

- A. Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 - 1. Unless otherwise indicated, fabricate from same basic metal as gratings.
 - 2. Equip units indicated to be cast into concrete with integrally welded anchors. Size and space anchors as indicated on the Drawings.

2.03 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless steel fasteners for fastening aluminum.

2. Provide stainless steel fasteners for fastening stainless steel.

- B. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts, and, where indicated, flat washers; ASTM F593 (ISO 3506-1) for bolts and ASTM F594 (ASTM F836M) for nuts, Alloy Group 2 (A4).

2.04 MISCELLANEOUS MATERIALS

- A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

2.05 ALUMINUM

- A. General: Provide alloy and temper recommended by aluminum producer for type of use indicated, with not less than the strength and durability properties of alloy, and temper designated below for each aluminum form required.

- B. Extruded Bars and Shapes: ASTM B221, alloys as follows:

1. Alloy 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
2. Alloy 6061-T1, for grating crossbars.

- C. Aluminum Sheet: ASTM B209, Alloy 5052-H32.

2.06 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

- D. Fit exposed connections accurately together to form hairline joints.

- E. Welding: Comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
- G. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports and to match existing grating on site.
- H. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
 - 1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- I. Do not notch bearing bars at supports to maintain elevation.

2.07 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Field Welding: Comply with AWS recommendations and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.

- F. Corrosion Protection: With a heavy coat of bituminous paint, coat concealed surfaces of aluminum that will come into contact with grout, concrete, wood, or dissimilar metals.

3.02 INSTALLATION OF METAL BAR GRATINGS

- A. Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

END OF SECTION 05 53 13

SECTION 09 91 10

SHOP PAINTING

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide shop painting as specified and in compliance with Contract Documents.

1.02 REFERENCES:

- A. ASTM International (ASTM):

1. B117: Standard Practice for Operating Salt Spray (Fog) Apparatus.
2. D870: Standard Practice for Testing Water Resistance of Coatings Using Water Immersion
3. D4541: Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
4. D4585: Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation
5. G8: Standard Test Methods for Cathodic Disbonding of Pipeline Coatings

- B. The Society for Protective Coatings (SSPC):

1. SP6: Commercial Blast Cleaning
2. SP10: Near-White Blast Cleaning

1.03 SUBMITTALS:

- A. Submit the following shop drawings in accordance with Section 01 33 00.
- B. Manufacturer's specifications and data on the proposed primers and detailed surface preparation, application procedures and dry mil thicknesses, including list of items and surfaces to receive shop painting.

1.04 QUALITY ASSURANCE:

- A. Comply with the requirements specified in Section 01 43 00.

1.05 DELIVERY STORAGE AND HANDLING:

- A. Comply with the requirements specified in Section 01 66 10.

- B. Deliver materials to application area in original, unbroken containers, plainly marked with name and analysis of product, manufacturer's name, and shelf life date. Do not store or use contaminated, outdated, prematurely opened, or diluted materials.
- C. Store coated items to prevent damage or dirtying of coatings. Avoid need for special cleaning, and store coated items out of contact with ground or pavement. Place suitable blocking under coated items during storage.
- D. Do not expose surfaces to weather for more than six months before being topcoated, or less time if recommended by coating manufacturer.
- E. Protect surfaces not to receive paint coatings during surface preparation, cleaning, and painting.
- F. Protect coatings from damage during shipment and handling by padding, blocking, use canvas or nylon slings, and use care when handling.
- G. At time of delivery of shop painted items to job site, ensure coatings are undamaged and in good condition.

1.06 PROJECT/SITE CONDITIONS:

- A. Environmental Requirements:
 - 1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.
 - 2. Do not apply coatings when dust is being generated.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Coatings are divided into the following service types, as determined by conditions:
 - 1. Non-Potable Water:
 - a. All ferrous metals not subject to potable water provide one coat with a dry film thickness of 2.5 to 3.0 mils.
 - b. Manufacturers:
 - (1) Series 1 Prime made by Tnemec Co.
 - (2) Carbozinc 859 by Carboline Co.
 - (3) Multiprime EFD Epoxy Fast Dry Inhibitive Primer 94-109 made by PPG Protective & Marine Coatings (4.0 – 6.0 DFT).

c. Performance Data:

- (1) ASTM- D4541- Adhesion – No less than 1250 psi pull
- (2) ASTM- D4585- Humidity- no affect after 4800 hours with < 1% rust
- (3) ASTM- B117 Salt Spray- No cracking , delamination or >1/64 creep after 9800 hours

2. Potable Water:

a. Ferrous metals submerged or which are subject to splash action in contact with potable water, provide one coat with a dry mil thickness of 3.0 to 3.5 mils of a certified NSF Standard 61 product.

b. Manufacturers:

- (1) 94 H20 Urethane Zinc Rich Primer made by Tnemec Co.
- (2) Carboguard 561 made by Carboline Co.
- (3) Aquapon High Build Potable Water Epoxy 95-132 Series made by PPG Protective & Marine Coatings (4.0 – 6.0 DFT).

c. Performance Data:

- (1) ASTM –D4541 Adhesion no less than 1700 psi
- (2) ASTM-G8 Method A Cathodic Disbondment- No affect after 30 days
- (3) ASTM D870 Immersion – No affect after 22 months
- (4) ASTM B117 Salt Spray- no affect of coating film, < 1/16th creep after 9900 hours

B. Shop prime with primers guaranteed by the manufacturer to be compatible with their corresponding primers and finish coats specified in Division 09 “Field Painting” Section for use in the field and which are recommended for use together.

PART 3 - EXECUTION

3.01 APPLICATION:

A. Surface Preparation and Priming:

1. Sandblast clean in accordance with SSPC-SP-6, Commercial Grade, immediately prior to priming non-submerged components scheduled for priming, as defined above.

2. Sandblast clean in accordance with SSPC-SP-10, Near White, immediately prior to priming submerged components scheduled for priming, as defined above.
 3. Before priming, provide surfaces dry and free of dust, oil, grease and other foreign material.
 4. Shop prime in accordance with accepted manufacturer's printed recommendations.
- B. Non-primed Surfaces: Apply accepted coating in accordance with manufacturer's printed recommendation.

3.02 TOUCH-UP:

- A. Repair or replace damaged or defective coated areas. Resultant shop painting: Paint items as specified.
- B. Remove damaged or defective coatings by specified blast cleaning to meet surface cleaning requirements, just before recoating. When small areas of coating need touch up, surface preparation may be done with suitable power needle gun to match specified blast cleaning.

3.03 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01 77 00.

END OF SECTION

SECTION 09 91 13

FIELD PAINTING

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide and apply paints and coatings specified and indicated. Prepare, clean, and finish all new surfaces to be field painted as specified and indicated.
 - 1. The terms “paint” and “coating” used herein include emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, organic or inorganic, whether used as intermediate, or finish coats.
 - 2. Stainless steel piping, fittings and supports will not be field painted, except that identification of piping with stencil text shall be required by the work of this section.
- B. Complete painting in accordance with specifications, paint manufacturer's current surface preparation and application instructions and safety requirements. In the event of conflict, the more stringent specifications will apply.
- C. Furnish and apply pipe, valve, and equipment identification legends as specified.
- D. Items Not To Be Field Painted:
 - 1. All prefabricated items, including but not limited to, stainless steel and anodized aluminum items, prefabricated millwork and architectural woodwork.
 - 2. PVC pipe and copper, brass and bronze pipe and fittings.
 - 3. Operating parts include moving parts of operating equipment.
 - 4. Code-required labels such as UL and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.
 - 5. Identification markings, operating instructions, and informational placards unless specifically noted otherwise.

1.02 REFERENCES:

- A. Society for Protective Coatings (SSPC) Specifications:
- B. SSPC-PA 1: Shop, Field, and Maintenance Painting of Steel.

- C. SSPC-PA-2: Measurement of Dry Coating Thickness with Magnetic Gages.
 - D. SSPC-SP 1: Solvent Cleaning.
 - E. SSPC-SP 3: Power Tool Cleaning.
 - F. SSPC-SP 6: Commercial Blast Cleaning.
 - G. SSPC-SP10: Near-White Blast Cleaning.
 - H. American National Standards Institute (ANSI):
 - 1. A13.1: Scheme for the Identification of Piping Systems, Designation.
 - I. National Sanitation Foundation (NSF)
- 1.04 QUALITY ASSURANCE:
- A. Provide in accordance with Section 01 43 00 and as specified.
 - B. Use products of one manufacturer in any one paint coating system with compatible coating materials. Provide same coating product for touch-up as for original coating.
 - C. Do not use or retain contaminated, outdated, or diluted materials for painting. Do not use materials from previously opened containers.
 - D. Provide paint products having a minimum of five (5) years of service, with no peeling, flaking, chipping, blistering, or fading, under similar service conditions.
- 1.05 SUBMITTALS:
- A. Submit the following in accordance with Section 01 33 00 - Submittals:
 - 1. List of coating products (Paint Schedule) with brand, type and manufacturer including dry film thickness and volatile organic compound (V.O.C.) regulations conforming to these specifications. Refer to Paragraph 2.04.
 - 2. Manufacturer's current printed recommendations and data sheets for each product including performance criteria, surface preparation, applications and instructions.
 - 3. Product data and pertinent information including results of test patch data indicating compatibility of field applied coatings with shop applied primers including a schedule listing each primer with field applied coatings to be applied over the primer.

4. Color chip samples of materials proposed and matching color of coatings.
5. Color chip samples of manufacturer's full range of colors for initial selection by Engineer.
6. Color chip samples matching colors. Submit list of piping to be included under each color.
7. Submit manufacturer's published data showing service record specified in paragraph 1.04 D.
8. Submit letter(s) signed by paint manufacturer certifying that submitted products are suitable for application on the surfaces to be coated and for the service conditions.
9. Submit a Certificate of Compliance for coatings submerged in potable water with National Sanitation Foundation approval.)
10. Product data for mil thickness testing equipment including operating instructions.

B. Field Submittals:

1. Submit letter(s), signed by Contractor, stating that surfaces to be coated are ready for preparation as specified in paragraph 3.01 B.
2. Submit letter(s) signed by Painting Subcontractor, certifying that surfaces to be coated have been prepared in accordance with paint manufacturer's printed instructions and are ready for field paint application.
3. Approved mil thickness test results, including location, and surface or item for identification.

1.06 PAINT STORAGE AND MIXING AREAS, AND WASTE DISPOSAL:

- A. Store paints and painter's materials in area or areas designated by the Engineer solely for this purpose. Confine mixing, thinning, clean-up and associated operations, and storage of painting debris, to these areas before authorized disposal.
- B. Do not use plumbing fixtures, piping or mechanical equipment for mixing or disposal of paint materials.
 1. Transport water to paint area by temporary hose or piping.
 2. Store waste temporarily in closed, nonflammable containers until final disposal. Keep no rubbish in painter's area longer than 24 hours. Dispose any hazardous materials in accordance with regulatory requirements, and place all non-hazardous waste in a project trash container.

1.07 DELIVERY, STORAGE, AND HANDLING:

- A. General Contractor will provide storage and protection in accordance with Section 01 66 00.
- B. Deliver materials to painter's area in original, unbroken, containers with name and analysis of product, manufacturer's name, and shelf life date. Do not use or retain contaminated, outdated, prematurely opened, or diluted materials.
- C. Store coated items and protect coating from damage and foreign matter, by not allowing contact with soil or pavement, exposure to wind-blown particles, or other harmful contacts which necessitate special cleaning. Use blocking during storage.
- D. Protect coated items, whether prime or finish, from damage due to shipping and handling.

1.08 JOB CONDITIONS:

- A. Environmental Requirements:
 - 1. Comply with manufacturer's printed recommendations as to environmental conditions under which coatings and coating systems can be applied.
 - 2. Do not apply coatings when dust is being generated.
- B. Protection:
 - 1. Cover or otherwise protect finish work of other trades and surfaces not being painted concurrently or not to be painted.
 - 2. Do not paint over nameplates, tagging or other identification devices.

PART 2 – PRODUCTS

2.01 MANUFACTURERS:

- A. Tnemec Co., Inc.
- B. Carboline.
- C. PPG Industries.
- D. Or acceptable equivalent product.

2.02 MATERIALS – GENERAL:

A. Products:

1. Recommended by their manufacturer for intended service.

B. Material Compatibility:

1. Provide block fillers, undercoats and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
2. Provide field applied coatings that are compatible with shop applied primers.

2.03 COLORS AND FINISHES:

- A. Finish colors: Follow the color recommendations referred to in paragraph 3.06 B.
- B. Interior finish colors: As selected by Engineer from manufacturer's full range of colors.
- C. To provide contrast between successive coats, lightly tint each coat to distinguish it from preceding coats.
- D. Unless otherwise indicated for finish paint, use gloss or semi-gloss on metal, and satin finish on masonry and concrete.

2.04 COATING TYPES:

- A. Coatings are described in the COATING IDENTIFICATION SCHEDULE by abbreviations, generic type, minimum solids by volume and minimum dry film thickness. Provide coatings that comply with the volatile organic compounds (VOC) regulations applicable to the project site and in no case to exceed 3.5 lbs/gal.

B. COATING IDENTIFICATION SCHEDULE

ABBR.	GENERIC TYPE	SOLIDS BY VOL. (%)**	DFT THICKNESS (PER COAT) ***	TNEMEC PRODUCT	CARBOLINE PRODUCT	PPG PRODUCT
AGE	Alkyd-Enamel	49	2.0-3.0	Series 1026 Enduratone	Carbocoat 8125 VOC	PPG Industrial Alkyd Enamel 7-824 Series
AL	Emulsified Acrylic	43	2.0-3.0	Series 151	Carbocrylic 3350	PPG Pitt-Tech DTM Industrial Enamel 90-474 Series
APE	High Build Acrylic Polyurethane Enamel	60/ 74	3.0-5.0	Series 73 1074	Carbothane 133 HB or 134 HG	PPG High Build SG Urethane Enamel 95-8800 Pitthane
HSE	High Solids Catalyzed Epoxy	70	6.0-8.0	Series N69	Carboguard 890	PPG Pitt-Guard DTR Epoxy Mastic 97-145 Series
LTE	Polyamide Epoxy	58	4.0-6.0	Series 161 or N69F	Carboguard 890N	PPG Pitt-Guard 95-245 Series (97-946 for immersion)
PE*	Polyamide Epoxy	60	5.0-7.0	Series 161/ or N69F	Carboguard 890	PPG Aquapon HB Semi-Gloss 97-130 Series
PVA	Poly Vinyl-Acrylic-	28	2.0-3.0	Series 151-1051 Elasto-Grip FC	Sanitile 120	PPG Speedhide 6-2 Primer
PRW	Pressure washing and cleanup with materials recommended by Paint Manufacturer.					
ZR	Zinc Rich Primer	63	3.0-3.5	Series 1 Omnithane	Carbozine 859 or Carbozinc 11	PPG Sigma Zinc 68 GP

- * If application of PE type coating occurs during low temperatures, provide and apply LTE type coating in lieu of PE and substitute throughout in Paint Schedule at end of Section, unless otherwise recommended by coating manufacturer.
 - ** Solids by volume based on Tnemec Coatings. Contractor to verify values.
 - *** Dry film thickness and performance criteria based on Tnemec Coatings. Contractor to verify values and provide dry film thicknesses for equivalent products as recommended by manufacturer.
- C. Description of coating types includes minimum acceptable percent, by volume, of component solids. Brand identification is to establish standard of quality. Products meeting general physical characteristics and performance criteria, are acceptable.
 - D. Provide coatings submerged in potable water with National Sanitation Foundation approval.

2.05 PIPE, VALVE/EQUIPMENT IDENTIFICATION AND COLOR CODING:

- A. Provide identification of new pipes, valves, pumps, tanks and similar vessels by color as per the recommendations referred to in paragraph 3.06. Band with name of contents, directional flow arrows and other required legend.
 - 1. For new pipe systems, use stenciled letters and arrows or self-adhesive labels or tapes located at intervals no greater than 20 ft. apart on straight runs except that stainless steel piping at intervals shall be no greater than 15 ft. apart on straight runs. Mark each valve, branch, wye change in direction and each side of floor and wall penetrations.
 - a. Labels or tapes shall be moisture and U.V. resistant.
- B. Provide legend of size, character and location conforming to ANSI A13.1 for stenciled letters or labels.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work.
- B. Do not proceed with surface preparation or coating application until after submitting to the Engineer a letter signed by Contractor, stating that surfaces to be painted are in acceptable condition for preparation and painting according to the Painting Subcontractor and in accordance with paint manufacturer's printed instructions.

- C. Do not proceed with coating application until after submitting to the Engineer a letter signed by paint manufacturer certifying that submitted products are suitable for application in accordance with paint manufacturer's printed instructions.

3.02 PREPARATION:

A. Basic Steps:

1. Prepare and paint surfaces in heated enclosure unless the ambient weather conditions ensure still, dry air above 50 degree F temperature, and humidity above manufacturer's printed recommended level. Do not apply paints to surfaces in direct sunlight. Conform to manufacturer's printed instructions for safety requirements.
2. Coordinate cleaning and painting operations to eliminate contamination of one by the other.
3. Maintain coating materials at manufacturer's recommended mixing and application temperatures for not less than 24 hours before use. Have clean containers, spray equipment, applicators and accessory items ready for use before decanting or mixing paint materials.
4. Coordinate materials to be applied with previous coatings on affected surfaces. Obtain, in all cases, manufacturer's written directions, and follow them strictly, except where otherwise specified.
5. Coordinate preparation and material compatibility requirements with the work specified in Sections 09 91 10 and 40 23 19.05.

B. Before any paint application, clean new surfaces to be coated of dust, dirt, grease, white rust, paint unsuitable for top coating, efflorescence, oil, moisture, foreign matter or similar conditions detrimental to coating bond and durability.

1. Following cleaning, apply preparatory treatment in strict accordance with manufacturer's written instructions.
2. Fill imperfections and holes in surfaces to be painted with material recommended by paint manufacturer.

C. Metals to Receive Paint Finishes:

1. Prepare ferrous metals, including field welds and unprimed shop welds, without shop prime coats as follows:
 - a. Near White blast cleaned (SSPC-SP-10), for submerged components.

- b. Commercial blast cleaned (SSPC-SP-6), for non-submerged components.
 - c. Use needle gun for field welds and shop welds which occur in narrow, unprimed areas in an otherwise shop primed surface, followed by SSPC-SP1-solvent wipe.
- 2. Clean previously shop primed ferrous metals in accordance with manufacturer's printed recommendations prior to field painting.
- 3. Non-ferrous and galvanized metal surfaces scheduled for paint finish:
 - a. Clean in accordance with manufacturers recommendations prior to field painting (SSPC-SP-1 including power washing).
 - b. Brush blast all exterior and interior exposures above constant 35% relative humidity or treat with Oakite LTS or equal etching solution. Brush blasted galvanized metal surfaces to receive a uniform profile of 0.75-1.25 mils.
 - c. For interior galvanized and non-ferrous metals not exposed to wet environments apply in accordance with manufacturers written instructions.

D. Concrete to Receive Paint Finishes:

- 1. Clean thoroughly of form oil, release agents, dirt, dust, grease, paint, loose material and foreign matter. Remove laitance, roughen smooth surfaces by brush sand blasting, remove fins and projections, fill voids and honeycombs with material recommended by paint manufacturer.
- 2. Prime after concrete has dried in strict accordance with manufacturer's printed instructions.
- 3. Concrete in Immersion: Brush blast all surfaces to receive coating to achieve profile of 2.0-4.0 mils. Previously coated surfaces shall be inspected and evaluated prior to commencing work.

E. Concrete unit masonry for paint finishes:

- 1. Clean thoroughly by brushing, scraping and sanding or grinding slick areas. Remove loose or projecting mortar, solvent wash oil, grease, paint spots before applying block filler.

F. Provide higher degree of cleaning for acceptable equivalent paint products when paint manufacturer recommends in their printed surface preparation recommendations.

G. Delay painting of areas which will be damaged by heat from welding, until welding is complete. Reclean and recoat substrate as specified for original coats, when coated areas

have been damaged by welding or have not been painted to allow welding.

H. PVC Pipe:

1. Sand all surfaces with 60-80 grit paper to provide profile to adhere coatings.

3.03 TOUCH-UP:

- A. Before applying field coat, touch-up abraded areas of shop coats with paint of the same type. Apply an entire coat to abraded area. Touch-up coats are in addition to, and not a substitute for first field coat. Clean deteriorated surfaces as specified herein and in accordance with manufacturer's recommendations before applying touch-up coat.
- B. Equipment, motors, pumps, instrumentation panels, electrical switchgear, and similar items with shop coats, paint filler, enamel or other treatment customary with manufacturer; after installation, touch-up scratches and blemishes before applying field coats.

3.04 APPLICATION:

- A. Refer 3.06 for coating requirements. Provide additional prime, undercoat, and finish coats as specified, indicated, and recommended by coating manufacturer's printed instructions.
- B. Conditions:
 1. Do not apply paints or other finish to wet or damp surfaces, except in accordance with instructions of manufacturer. Do not apply exterior paint during cold, rainy, or frosty weather, or when temperature is likely to drop to freezing. Do not apply paints to surfaces in direct sunlight.
 2. Paint surfaces which have been cleaned, pretreated, or otherwise prepared for painting with first field coat as soon as practicable after such preparation has been completed, but in any event prior to deterioration of prepared surface.
 3. Coat blast cleaned metal surfaces in accordance with SSPC guidelines, before any rusting or other deterioration or contamination of the surface occurs. Do not coat blast cleaned surfaces later than 8 hours after cleaning.
- C. Methods:
 1. Spraying with apparatus may be substituted for brush application of paints in locations approved for spraying.
 2. Prepare surfaces, mix and apply paint materials in strict accordance with manufacturer's printed instructions and recommendations. Control temperature of

materials upon mixing and application, surface temperature and condition, thinning and modifying.

3. Protect surfaces to be coated, before, during and after application.

D. Workmanship:

1. Apply coating materials to meet manufacturer's spreading rate and dry film thickness recommendations. Dry film thicknesses specified are constant for brush, spray, roller or other form of application.
 - a. Control thinning in accordance with V.O.C. regulations for spray use and to manufacturer's printed instructions, and produce specified dry film thickness on level surfaces, interior and exterior angles.
2. Apply paints and coatings using painters continuously employed in the painting profession for no less than five (5) years, brushed or rolled out carefully to a smooth, even coating without runs or sags. Curing time in accordance with manufacturer's printed instructions.
3. Finish surfaces: Uniform in finish and color, and free from flash spots and brush marks.

3.05 PROTECTION AND CLEAN-UP:

A. Protect new surfaces to be painted or coated under this Section as follows:

1. Arrange for preparation and coating activities to be performed in areas and during times when no continuous traffic and no dust generating activity will be present.
2. During time between preparation and coating, protect work from dust and dirt with dropcloth. Do not allow contact with surfaces in this time period.
3. During painting activity, clearly mark the area being used by painters to prevent interference with painting being applied as specified.
4. After painting, clearly barricade painted surfaces with cones, plastic barrier tape, or other visible barrier. Locate "WET PAINT" signs near painted surfaces. Do not remove barriers and signs until paint surface dries throughout entire film thickness.

- B. Remove or completely mask existing and new accessory items, finish hardware, lighting fixtures, escutcheon plates, trim and similar finish items not to be painted before painting adjacent surfaces. Carefully replace and reposition upon completion of adjacent painting and cleaning work.

- C. Upon completion of the work, clean up paint spots, oil, and stains from floors, glass, hardware, and similar finished items and remove tape.

3.06 SCHEDULE OF PAINTING:

- A. Coordinate and schedule the various cleaning, touch-up and finishing operations. Transmit and coordinate the transmission of materials data, color selections and coating system methods between the coating applicators. Do not exceed exposure and recoat time limits.
- B. Follow color and identification recommendations from Chapter 50 of the Recommended Standards for Wastewater Facilities from the Great Lakes - Upper Mississippi River Board.

3.07 FINAL TOUCH-UP:

- A. Prior to final completion and acceptance, examine painted and finished surfaces and retouch or refinish areas to leave touched-up areas with same appearance as and even with the surrounding finish specified.
- B. After doors have been fitted and hung, refinish edges, tops and bottoms.

3.08 TESTING:

- A. Conduct field testing in the presence of the Engineer for specified mil thickness in accordance with SSPC-PA-2.
- B. Test results shall meet requirements of SSPC-PA-2. Failure of test results shall require that surfaces be repainted until approved results of testing have been obtained for the specified mil thickness.

3.09 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01 77 00.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Connectors and splices.

B. Related Requirements:

1. Section 26 05 23 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.

1.02 ACTION SUBMITTALS

A. Product Data:

1. Copper building wire.
2. Connectors and splices.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 COPPER BUILDING WIRE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Encore Wire Corporation.
2. Service Wire Co.
3. Southwire Company, LLC.

B. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductor Insulation:

1. Type THHN and Type THWN-2. Comply with UL 83.
2. Type XHHW-2. Comply with UL 44.

2.02 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M Electrical Products
2. O-Z/Gedney: brand of Emerson Electric Co., Automation Solutions, Appleton Group.
3. Service Wire Co.

B. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: One hole with standard barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

1. Copper:
 - a. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- C. ASD Output Circuits: Type XHHW-2 in metal conduit.

3.03 INSTALLATION, GENERAL

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points in accordance with Section 26 05 33.13 "Conduits for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inch of slack.

3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors for compliance with requirements.
 - 2. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.

- h. Uniform resistance of parallel conductors.
- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 05 19

SECTION 26 05 23

CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Control cable.
 - 2. Control-circuit conductors.

1.02 ACTION SUBMITTALS

- A. Product Data:
 - 1. Control cable.
 - 2. Control-circuit conductors.

1.03 INFORMATIONAL SUBMITTALS

- A. Source quality-control reports.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 CONTROL CABLE

- A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - 1. Multi-pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 - 2. PVC insulation.
 - 3. Unshielded.
 - 4. PVC jacket.

5. Flame Resistance: Comply with NFPA 262.

2.03 CONTROL-CIRCUIT CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Encore Wire Corporation.
 2. Service Wire Co.
 3. Southwire Company, LLC.
- B. Class 1 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- C. Class 2 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- D. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.

2.04 SOURCE QUALITY CONTROL

- A. Cable will be considered defective if it does not pass tests and inspections.
- B. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Test cables on receipt at Project site.

3.02 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 26 05 33.13 "Conduits for Electrical Systems" for raceway selection and installation requirements for conduits as supplemented or modified in this Section.
- B. Comply with requirements in Section 26 05 33.16 "Boxes and Covers for Electrical Systems" for raceway selection and installation requirements for boxes as supplemented or modified in this Section.
 1. Outlet boxes must be no smaller than 2 inch wide, 3 inch high, and 2-1/2 inch deep.

2. Outlet boxes for cables must be no smaller than 4 inch square by 2-1/8 inch deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
3. Flexible metal conduit must not be used.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.
- D. Raceway Installation in Equipment Rooms:
 1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
 2. Install cable trays to route cables if conduits cannot be located in these positions.
 3. Secure conduits to backboard if entering the room from overhead.
 4. Extend conduits 3 inch above finished floor.
 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 1. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
 2. Secure and support cables at intervals not exceeding 30 inch and not more than 6 inch from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 3. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
 4. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
 5. Support: Do not allow cables to lie on removable ceiling tiles.
 6. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
 7. Provide strain relief.

8. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
9. Ground wire must be copper, and grounding methods must comply with IEEE C2. Demonstrate ground resistance.

C. Installation of Control-Circuit Conductors:

1. Install wiring in raceways.
2. Use insulated spade lugs for wire and cable connection to screw terminals.

3.04 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified with a tag for future use.

3.05 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.06 GROUNDING

- A. For control-voltage wiring and cabling, comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.07 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire must have a unique tag.

3.08 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

2. Test cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination, but not after cross-connection.
 - a. Test instruments must meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in its "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in its "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- B. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 26 05 23

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Grounding and bonding conductors.
 - 2. Grounding and bonding clamps.
 - 3. Grounding and bonding bushings.
 - 4. Grounding and bonding connectors.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Field quality-control reports.

1.03 INFORMATIONAL SUBMITTALS

- A. Manufacturer's published instructions.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.02 GROUNDING AND BONDING CONDUCTORS

- A. Equipment Grounding Conductor:
 - 1. Standard Features: 600 V, THHN/THWN-2, wire or cable, green color, in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- B. ASTM - Bare Copper Grounding and Bonding Conductor:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ERICO; brand of nVent Electrical plc.
 - b. Harger Lightning & Grounding; business of Harger, Inc.
2. Standard Features: Complying with one or more of the following:
 - a. Soft or Annealed Copper Wire: ASTM B3.
 - b. Concentric-Lay Stranded Copper Conductor: ASTM B8.
 - c. Tin-Coated Soft or Annealed Copper Wire: ASTM B33.
 - d. 19-Wire Combination Unilay-Stranded Copper Conductor: ASTM B787/B787M.

2.03 GROUNDING AND BONDING CLAMPS

- A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications.
- B. UL KDER and KDSH - Hex-Fitting-Type Pipe and Rod Grounding and Bonding Clamp:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - b. ERICO; brand of nVent Electrical plc.
 - c. Harger Lightning & Grounding; business of Harger, Inc.
 2. Source Limitations: Obtain products from single manufacturer.
 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 4. Standard Features:
 - a. Two pieces with zinc-plated bolts.
 - b. Clamp Material: Silicon bronze.

- c. Listed for outdoor use.

C. UL KDER and KDSH - Strap-Type Pipe and Rod Grounding and Bonding Clamp:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - b. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - c. ERICO; brand of nVent Electrical plc.
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
4. Standard Features:
 - a. Clamp Material: Copper.
 - b. Listed for outdoor use.

2.04 GROUNDING AND BONDING BUSHINGS

- A. Description: Bonding bushings connect conduit fittings, tubing fittings, threaded metal conduit, and unthreaded metal conduit to metal boxes and equipment enclosures, and have one or more bonding screws intended to provide electrical continuity between bushing and enclosure. Grounding bushings have provision for connection of bonding or grounding conductor and may or may not also have bonding screws.
- B. UL KDER - Bonding Bushing:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - b. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - c. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.

2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
4. Standard Features: Threaded bushing with insulated throat.

C. UL KDER - Grounding Bushing:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - b. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - c. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
4. Standard Features: Threaded bushing with insulated throat and mechanical-type wire terminal.

2.05 GROUNDING AND BONDING CONNECTORS

A. UL KDER - Pressure-Type Grounding and Bonding Busbar Cable Connector:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB Electrification Installations Products.
 - b. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:

- a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
4. Standard Features: Copper or copper alloy, for compression bonding of one or more conductor directly to copper busbar. Listed for direct burial.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

3.02 SELECTION OF GROUNDING AND BONDING PRODUCTS

- A. Grounding and Bonding Conductors:
 1. Provide solid conductor for 8 AWG and smaller, and stranded conductors for 6 AWG and larger unless otherwise indicated.
 2. Custom-Length Insulated Equipment Bonding Jumpers: 6 AWG, 19-strand, Type THHN.
 3. Bonding Cable: 28 kcmil, 14 strands of 17 AWG conductor, 1/4 inch in diameter.
 4. Bonding Conductor: 4 AWG or 6 AWG, stranded conductor.
 5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.
 6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.
- B. Grounding and Bonding Connectors:
 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 2. Connections to Structural Steel: Welded connectors.

3.03 INSTALLATION OF GROUNDING AND BONDING

- A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Electrical Construction: ICC IBC, ICC IFB, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Maintenance: NFPA 70B.
3. Electrical Safety: NFPA 70E.
4. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.

C. Special Techniques:

1. Grounding and Bonding Conductors:
 - a. Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
 - b. Underground Grounding Conductors:
 - 1) Bury at least 30 inch below grade.
 - 2) Duct-Bank Grounding Conductor: Bury 12 inch above duct bank when indicated as part of duct-bank installation.
2. Grounding and Bonding Connectors: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
 - a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - b. Make connections with clean, bare metal at points of contact.
 - c. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
 - d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
 - f. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

- 1) Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate adjacent parts.
 - 2) Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3) Use exothermic-welded connectors for outdoor locations; if disconnect-type connection is required, use bolted clamp.
3. Equipment Grounding and Bonding:
- a. Install insulated equipment grounding conductors with feeders and branch circuits.
 - b. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1) Feeders and branch circuits.
 - 2) Lighting circuits.
 - 3) Single-phase motor and appliance branch circuits.
 - 4) Three-phase motor and appliance branch circuits.
 - 5) Flexible raceway runs.

3.04 FIELD QUALITY CONTROL FOR GROUNDING AND BONDING

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench in accordance with manufacturer's published instructions.

B. Nonconforming Work:

1. Grounding system will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective components and retest.

C. Collect, assemble, and submit test and inspection reports.

1. Report measured ground resistances that exceed the following values:

- a. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 Ω .

3.05 PROTECTION

- A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 26 05 26

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Support systems.
2. Mounting, anchoring, and attachment components.
3. Installation of fabricated metal supports.
4. Installation of concrete bases.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Sockets.
 - e. Eye nuts.
 - f. Fasteners.
 - g. Anchors.
 - h. Saddles.
 - i. Brackets.
2. Include rated capacities and furnished specialties and accessories.

1.03 INFORMATIONAL SUBMITTALS

A. Welding certificates.

PART 2 - PRODUCTS

2.01 SUPPORT SYSTEMS

A. Steel Slotted Support Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; Atkore International.
 - b. CADDY; brand of nVent Electrical plc.
 - c. Cooper B-line; brand of Eaton, Electrical Sector.
 - d. Unitstrut; Atkore International.
2. Standard Features: Preformed steel channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.
 - a. Referenced Standard: MFMA-4 factory-fabricated components for field assembly.
 - b. Material for Channel, Fittings, and Accessories: Galvanized steel.
 - c. Channel Width: 1-5/8 inch.
 - d. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - e. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - f. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - g. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices:

1. Standard Features: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit:

1. Standard Features: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping

pieces as required to suit individual conductors or cables supported. Body must be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints:

1. Standard Features: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

2.02 MOUNTING, ANCHORING, AND ATTACHMENT COMPONENTS

A. Powder-Actuated Fasteners:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - c. MKT Fastening, LLC.
2. Standard Features: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - c. MKT Fastening, LLC.
2. Standard Features: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

C. Concrete Inserts:

1. Standard Features: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.

D. Clamps for Attachment to Steel Structural Elements:

1. Standard Features: MSS SP-58 units are suitable for attached structural element.

E. Through Bolts:

1. Standard Features: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.

F. Toggle Bolts:

1. Standard Features: All Stainless steel springhead type.

G. Hanger Rods:

1. Standard Features: Threaded steel.

PART 3 - EXECUTION

3.01 SELECTION OF HANGERS AND SUPPORTS

- A. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT and ERM as scheduled in NECA NEIS 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size must be 1/4 inch in diameter.
- B. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.02 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:
 1. Electrical Construction: ICC IBC, ICC IFB, NFPA 1, NFPA 70, and NECA NEIS 1.
 2. Hot Work: NFPA 51B.
 3. Work in Confined Spaces: NFPA 350.
 4. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
 5. Installation of Steel Conduit: NECA NEIS 101.
 6. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Raceway Support Methods: In addition to methods described in NECA NEIS 1, EMT and ERM C may be supported by openings through structure members, in accordance with NFPA 70.
2. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination must be weight of supported components plus 200 lb.
3. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - a. To Wood: Fasten with lag screws or through bolts.
 - b. To New Concrete: Bolt to concrete inserts.
 - c. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - d. To Existing Concrete: Expansion anchor fasteners.
 - e. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 - f. To Light Steel: Sheet metal screws.
 - g. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
4. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

D. Interfaces with Other Work:

1. Touchup Finishes:
 - a. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1) Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

- b. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.
- 2. Installation of Fabricated Metal Supports:
 - a. Provide site-fabricated metal supports.
 - b. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
 - c. Field Welding: Comply with AWS D1.1/D1.1M. Submit welding certificates.
- 3. Installation of Concrete Bases:
 - a. Provide concrete bases of dimensions indicated, but not less than 4 inch larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
 - b. Use 3000 psi, 28-day compressive-strength concrete.
 - c. Anchor equipment to concrete base as follows:
 - 1) Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2) Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3) Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION 26 05 29

SECTION 26 05 33
CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Type EMT duct raceways and elbows.
2. Type ERMC duct raceways, elbows, couplings, and nipples.
3. Type FMC duct raceways.
4. Type LFMC duct raceways.
5. Type PVC duct raceways and fittings.
6. Type RTRC duct raceways and fittings.
7. Joint compounds.

B. Related Requirements:

1. Section 26 05 19 "Low-Voltage for Electrical Power Conductors and Cables" specifies nonmetallic underground conduit with conductors (Type NUCC).
2. Section 26 05 29 "Hangers and Supports for Electrical Systems" specifies conduit hangers and supports referenced by this Section.
3. Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems" specifies exterior duct banks, manholes, and underground utility construction.
4. Section 26 05 53 "Identification for Electrical Systems" specifies electrical equipment labels.

1.02 REFERENCES

A. Abbreviations and Acronyms for Electrical Raceway Types:

1. EMT-S: Steel electrical metallic tubing.
2. ERMC-S: Steel electrical rigid metal conduit.
3. ERMC-S-G: Galvanized-steel electrical rigid metal conduit.

4. ERM-C-S-PVC: PVC-coated-steel electrical rigid metal conduit.
5. FMC-S: Steel flexible metal conduit.
6. LFMC-S: Steel liquidtight flexible metal conduit.
7. LFMC-SS: Stainless steel liquidtight flexible metal conduit.
8. RGS: See ERM-C-S-G.
9. RMC: See ERM-C.

B. Definitions:

1. Conduit: A structure containing one or more duct raceways.
2. Duct Raceway: A single enclosed raceway for conductors or cable.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Field quality-control reports.

1.04 INFORMATIONAL SUBMITTALS

- A. Manufacturer's published instructions.

PART 2 - PRODUCTS

2.01 TYPE EMT DUCT RACEWAYS AND ELBOWS

- A. UL FJMX - Steel Electrical Metal Tubing (EMT-S) and Elbows:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; Atkore International.
 - b. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
 - c. Topaz Lighting & Electric.
 - d. Wheatland Tube; Zekelman Industries.
 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:

- a. UL CCN FJMX; including UL 797.
- 3. Standard Features:
 - a. Material: Steel.
 - b. Exterior Coating: Zinc.
 - c. Interior Coating: Zinc with organic top coating.
 - d. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.02 TYPE ERM C DUCT RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

- A. UL DYIX - Galvanized-Steel Electrical Rigid Metal Conduit (ERM C-S-G), Elbows, Couplings, and Nipples:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; Atkore International.
 - b. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
 - c. Topaz Lighting & Electric.
 - d. Wheatland Tube; Zekelman Industries.
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN DYIX; including UL 6.
 - 3. Standard Features:
 - a. Exterior Coating: Zinc.
 - b. Interior Coating: Zinc with organic top coating.
 - c. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.03 TYPE FMC DUCT RACEWAYS

- A. UL DXUZ - Steel Flexible Metal Conduit (FMC-S):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Anaconda Sealtite; Anamet Electrical, Inc.
 - b. Electri-Flex Company.
 - c. Topaz Lighting & Electric.
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
- a. UL CCN DXUZ; including UL 1.
3. Standard Features:
- a. Material: Steel.
 - b. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.04 TYPE LFMC DUCT RACEWAYS

A. UL DXHR - Steel Liquidtight Flexible Metal Conduit (LFMC-S):

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB Electrification Installations Products.
 - b. Anaconda Sealtite; Anamet Electrical, Inc.
 - c. Electri-Flex Company.
- 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN DXHR; including UL 360.
- 3. Standard Features:
 - a. Material: Steel.
 - b. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.05 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. UL DWTT - Fittings for Type ERM C Raceways:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Appleton; Emerson Electric Co., Automation Solutions.
 - b. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - c. Topaz Lighting & Electric.
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN DWTT; including UL 514B.
 - 3. Standard Features:
 - a. Material: Steel.
 - b. Coupling Method: Compression coupling.
 - c. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.
- B. UL FKAV - Fittings for Type EMT Duct Raceways:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; Atkore International.
 - b. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - c. Topaz Lighting & Electric.
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN FKAV; including UL 514B.
 - 3. Standard Features:
 - a. Material: Steel.
 - b. Coupling Method: Compression coupling.
 - c. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.
- C. UL ILNR - Fittings for Type FMC Duct Raceways:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Fittings Corp. (AMFICO).
 - b. Liquid Tight Connector Co.
 - c. Southwire Company, LLC.
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN ILNR; including UL 514B.

2.06 JOINT COMPOUNDS

- A. UL FOIZ - Electrically Conductive Corrosion-Resistant Compound for Threaded Conduit:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB Electrification Installations Products.
 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN FOIZ; including UL Subject 2419.

PART 3 - EXECUTION

3.01 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Unless more stringent requirements are specified in the Contract Documents or manufacturer's published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.
- B. Outdoors:
 1. Exposed and Subject to Severe Physical Damage: ERM C.
 2. Exposed and Subject to Physical Damage: ERM C.
 3. Exposed and Not Subject to Physical Damage: ERM C.
 4. Concealed Aboveground: ERM C.

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

C. Indoors:

1. Hazardous Classified Locations: ERM C.
2. Exposed and Subject to Severe Physical Damage: ERM C.
3. Exposed and Subject to Physical Damage: ERM C.
4. Exposed and Not Subject to Physical Damage: EMT.
5. Concealed in Ceilings and Interior Walls and Partitions: EMT.
6. Damp or Wet Locations: ERM C.
7. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

D. Duct Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.

1. ERM C: Provide threaded-type fittings unless otherwise indicated.

3.02 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Safety: NFPA 70E.
3. Commissioning of Active and Passive Fire Protection Features: NFPA 3 and NFPA 4.
4. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
5. Work in Confined Spaces: NFPA 350.
6. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
7. Type EMT-S: Article 358 of NFPA 70 and NECA NEIS 101.
8. Type ERM C-S: Article 344 of NFPA 70 and NECA NEIS 101.

9. Type FMC-S: Article 348 of NFPA 70 and NECA NEIS 101.
10. Type FMT: Article 360 of NFPA 70 and NECA NEIS 101.
11. Type LFMC: Article 350 of NFPA 70 and NECA NEIS 101.
12. Expansion Fittings: NEMA FB 2.40.
13. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. General Requirements for Installation of Duct Raceways:
 - a. Complete duct raceway installation before starting conductor installation.
 - b. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft above finished floor.
 - c. Install no more than equivalent of three 90-degree bends in conduit run except for control wiring conduits, for which no more than equivalent of two 90-degree fewer bends are permitted. Support within 12 inch of changes in direction.
 - d. Make bends in duct raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
 - e. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
 - f. Support conduit within 12 inch of enclosures to which attached.
 - g. Install duct sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed duct raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install duct sealing fittings in accordance with NFPA 70.
 - h. Install devices to seal duct raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of duct raceways at the following points:
 - 1) Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2) Conduit extending from interior to exterior of building.

- 3) Where otherwise required by NFPA 70.
 - i. Do not install duct raceways or electrical items on "explosion-relief" walls or rotating equipment.
 - j. Do not install conduits within 2 inch of the bottom side of a metal deck roof.
 - k. Keep duct raceways at least 6 inch away from parallel runs of flues and steam or hot-water pipes. Install horizontal duct raceway runs above water and steam piping.
 - l. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
 - m. Install pull wires in empty duct raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground duct raceways designated as spare above grade alongside duct raceways in use.
 - n. Install duct raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
 - 1) Termination fittings with shoulders do not require two locknuts.
 - o. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts. **[Install insulated throat metal grounding bushings on service conduits].**
2. Types ERM C:
 - a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of duct raceway and fittings before making up joints. Follow compound manufacturer's published instructions.
3. Type ERM C-S-PVC:
 - a. Follow manufacturer's installation instructions for clamping, cutting, threading, bending, and assembly.
 - b. Provide PVC-coated sealing locknut for exposed male threads transitioning into female NPT threads that do not have sealing sleeves, including transitions from PVC couplings/female adapters to Type ERM C-S-PVC

elbows in direct-burial applications. PVC-coated sealing locknuts must not be used in place of conduit hub. PVC-coated sealing locknut must cover exposed threads on Type ERM-C-S-PVC duct raceway.

- c. Coat field-cut threads on PVC-coated duct raceway with manufacturer-approved corrosion-preventing conductive compound prior to assembly.
- 4. Types FMC:
 - a. Provide a maximum of 72 inch of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 5. Duct Raceway Terminations at Locations Subject to Moisture or Vibration:
 - a. Provide insulating bushings to protect conductors, including conductors smaller than 4 AWG..
 - 6. Duct Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.
 - a. ERM-C-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - b. EMT: Provide compression, steel fittings. Comply with NEMA FB 2.10.
 - c. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.
 - 7. Expansion-Joint Fittings:
 - a. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F and that have straight-run length that exceeds 25 ft. Install in runs of aboveground ERM-C conduit that are located where environmental temperature change may exceed 100 deg F and that have straight-run length that exceeds 100 ft.
 - b. Install type and quantity of fittings that accommodate temperature change listed for the following locations:
 - 1) Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - 2) Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - 3) Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

- 4) Attics: 135 deg F temperature change.
- c. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
- d. Install expansion fittings at locations where conduits cross building or structure expansion joints.
- e. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's published instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- 8. Duct Raceways Penetrating Rooms or Walls with Acoustical Requirements: Seal duct raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.
- 9. Identification: Provide labels for conduit assemblies, duct raceways, and associated electrical equipment.
 - a. Provide warning signs.

D. Interfaces with Other Work:

- 1. Firestop penetrations of fire-rated floor and wall assemblies.
- 2. Provide conduit hangers and supports.

3.03 FIELD QUALITY CONTROL OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Tests and Inspections:

- 1. Perform manufacturer's recommended tests and inspections.
- 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide minimum 12 inch long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
- 3. Conduit Placement:
 - a. Verify that center-line location and offsets are in accordance with the Drawings.
 - b. Verify that hangers and supports for conduits are attached to structure as directed by qualified structural engineer.

- c. Verify that nuts on bolts or hanger rods are secure.
 - d. Verify that space between raceways and cored holes are filled with non-shrinking grout or other approved material indicated on the Drawings and the Specifications.
 - e. Verify that expansion devices are installed at locations indicated on the Drawings and the Specifications.
 - f. Verify that ends are cut square to provide flush-butting surfaces when spliced and inside edges are free of burrs that could impede installation of cables.
 - g. Verify minimum separation of utilities, or that approved mechanical protection has been provided to surrounding conduit(s) where minimum separation cannot be achieved.
4. Document all changes on Record Drawings.
- B. Nonconforming Work:
- 1. Conduit will be considered defective if it does not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- C. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.
- 3.04 CLEANING
- A. Verify that bentonite or other drilling fluids are contained and removed, and site is restored to its original or improved condition.
- 3.05 PROTECTION
- A. Protect coatings, finishes, and cabinets from damage and deterioration.
- 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 36

BOXES AND COVERS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metallic outlet boxes, device boxes, rings, and covers.
2. Junction boxes and pull boxes.

B. Related Requirements:

1. Section 26 05 26 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding referenced by this Section.
2. Section 26 05 53 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.

1.02 DEFINITIONS

A. Enclosure: The case or housing of an apparatus, or the fence or wall(s) surrounding an installation, to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. Types of enclosures and enclosure covers include the following:

1. Cabinet: An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.
2. Concrete Box: A box intended for use in poured concrete.
3. Conduit Body: A means for providing access to the interior of a conduit or tubing system through one or more removable covers at a junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
4. Conduit Box: A box having threaded openings or knockouts for conduit, EMT, or fittings.
5. Cover Plate: A cover designed for protecting wiring devices installed in flush-mounted device boxes while permitting their safe operation; also called a faceplate or wallplate.

6. Cutout Box: An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure.
7. Extension Ring: A ring intended to extend the sides of an outlet box or device box to increase the box depth, volume, or both.
8. Floor-Mounted Enclosure: A floor box and floor box cover assembly with means to mount in the floor that is sealed against the entrance of scrub water at the floor level.
9. Junction Box: A box with a blank cover that joins different runs of raceway or cable and provides space for connection and branching of the enclosed conductors.
10. Outlet Box: A box that provides access to a wiring system having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for the entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting an outlet box cover, but without provisions for mounting a wiring device directly to the box.
11. Pull Box: A box with a blank cover that joins different runs of raceway and provides access for pulling or replacing the enclosed cables or conductors.
12. Ring: A sleeve, which is not necessarily round, used for positioning a recessed wiring device flush with the plaster, concrete, drywall, or other wall surface.
13. Ring Cover: A box cover, with raised center portion to accommodate a specific wall or ceiling thickness, for mounting wiring devices or luminaires flush with the surface.
14. Termination Box: An enclosure designed for installation of termination base assemblies consisting of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors, or both.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.02 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

- A. UL QCIT - Metallic Outlet Boxes and Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Appleton; Emerson Electric Co., Automation Solutions.
 - b. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - c. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Pass & Seymour; Legrand North America, LLC.
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN QCIT; including UL 514A.
3. Standard Features:
 - a. Box having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
 - b. Material: Sheet steel.
 - c. Sheet Metal Depth: Minimum 2 inch.

B. UL QCIT - Metallic Conduit Bodies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Appleton; Emerson Electric Co., Automation Solutions.
 - b. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - c. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Pass & Seymour; Legrand North America, LLC.
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN QCIT; including UL 514A.

3. Standard Features: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.

C. UL QCIT - Metallic Extension Rings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Appleton; Emerson Electric Co., Automation Solutions.
 - b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - c. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Pass & Seymour; Legrand North America, LLC.
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN QCIT; including UL 514A.
3. Standard Features: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.

2.03 JUNCTION BOXES AND PULL BOXES

A. UL BGUZ - Indoor Sheet Metal Junction and Pull Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Appleton; Emerson Electric Co., Automation Solutions.
 - b. Hoffman; brand of nVent Electrical plc.
 - c. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:

- a. UL CCN BGUZ; including UL 50 and UL 50E.
- 3. Standard Features:
 - a. Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
- B. UL BGUZ - Outdoor Sheet Metal Junction and Pull Boxes:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Appleton; Emerson Electric Co., Automation Solutions.
 - b. Hoffman; brand of nVent Electrical plc.
 - c. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN BGUZ; including UL 50 and UL 50E.
 - 3. Standard Features:
 - a. Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - b. Degree of Protection: Type 4X.

PART 3 - EXECUTION

3.01 SELECTION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.
- B. Degree of Protection:
 - 1. Outdoors:
 - a. Locations Exposed to Hosedown: Type 4X.

- b. Locations in-Ground or Exposed to Corrosive Agents: Type 4X.
 - 2. Indoors:
 - a. Type 1 unless otherwise indicated.
 - b. Surface Mounted in Other Locations Exposed to Oil or Coolants: Type 12.
 - c. Locations Exposed to Corrosive Agents: Type 4X.
 - C. Exposed Boxes Installed Less Than 2.5 m (8 ft) Above Floor:
 - 1. Boxes with knockouts or unprotected openings are prohibited.
 - 2. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.
- 3.02 INSTALLATION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS
- A. Comply with manufacturer's published instructions.
 - B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
 - 1. Electrical Construction: ICC IBC, ICC IFB, NFPA 1, NFPA 70, and NECA NEIS 1.
 - 2. Electrical Safety: NFPA 70E.
 - 3. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
 - 4. Life Safety and Means of Egress Work: NFPA 101.
 - 5. Work in Confined Spaces: NFPA 350.
 - 6. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
 - 7. Outlet, Device, Pull, and Junction Boxes: Article 314 of NFPA 70.
 - 8. Consult Architect for resolution of conflicting requirements.
 - C. Special Installation Techniques:
 - 1. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
 - 2. Locate boxes so that cover or plate will not span different building finishes.

3. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
4. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
5. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
 - a. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
 - b. Provide gaskets for cover plates and covers.

D. Interfaces with Other Work:

1. Identification: Provide labels for boxes and associated electrical equipment.
 - a. Identify field-installed conductors, interconnecting wiring, and components.
 - b. Label each enclosure with engraved metal or laminated-plastic nameplate.
 - c. Provide warning signs and arc-flash hazard warning labels for electrical equipment.

3.03 FIELD QUALITY CONTROL OF BOXES AND COVERS

A. Tests and Inspections:

1. Perform manufacturer's recommended tests and inspections.
2. Perform tests and inspections recommended by standards listed in "Reference Standards for Installation" Paragraph.

B. Nonconforming Work:

1. Boxes and covers will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

C. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.04 CLEANING

- A. Remove construction dust and debris from boxes before installing cover plates, covers, and hoods.

3.05 PROTECTION

- A. After installation, protect boxes from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 26 05 36

SECTION 26 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Type PVC raceways and fittings.
2. Solvent cements.
3. Duct accessories.
4. Handholes and boxes for exterior underground wiring.
5. Duct sealing.

1.02 DEFINITIONS

- A. Duct: A single raceway or multiple raceways, installed singly or as components of a duct bank.
- B. Duct Bank: Two or more ducts installed in parallel, direct buried or with additional casing materials such as concrete.
- C. Handhole: An underground chamber containing electrical cables, sized such that personnel are not required to enter in order to access the cables.
- D. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.03 ACTION SUBMITTALS

A. Product Data:

1. Duct-bank materials, including spacers and miscellaneous components.
2. Ducts, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Accessories for manholes, handholes, boxes, and other utility structures.
4. Underground-line warning tape.

B. Shop Drawings:

1. Electric Utility Duct Banks and Structures:
 - a. Include plans, elevations, sections, and details, including attachments to other Work.
 - b. Indicate locations of private property boundaries and utility easements.
 - c. Include information required for approval by electric utility and for obtaining public space utility work permits.
2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
 - a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
 - b. Include duct entry provisions, including locations and duct sizes, and methods and materials for waterproofing duct entry locations.
 - c. Include cover design.
 - d. Include grounding details.
 - e. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and other accessories.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

1.04 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Submittals:

1. Source quality-control reports.

PART 2 - PRODUCTS

2.01 TYPE PVC RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 651 and UL CCN DZYR.

B. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Calconduit; Atkore International.
 - b. JM Eagle; J-M Manufacturing Co., Inc.
 - c. NAPCO; Westlake Chemical Corp.
 - d. Opti-Com Manufacturing Network, Inc (OMNI).
 2. Dimensional Specifications: Schedule 40.
 3. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Markings: For use with maximum 90 deg C wire.
- C. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:
1. Dimensional Specifications: Schedule 80.
 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Markings: For use with maximum 90 deg C wire.

2.02 SOLVENT CEMENTS

- A. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics: As recommended by conduit manufacturer in accordance with UL 514B and UL CCN DWTT.

2.03 DUCT ACCESSORIES

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
- B. Underground-Line Warning Tape: In accordance with Section 26 05 53 "Identification for Electrical Systems."

2.04 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics:
 - a. ASTM C858 for design and manufacturing processes.
 - b. SCTE 77.

B. Source Quality Control:

1. Precast Concrete Utility Structures: Test and inspect in accordance with ASTM C1037.
2. Polymer Concrete and Nonconcrete Handhole and Pull-Box Prototypes: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests must be for specified tier ratings of products supplied. Testing machine pressure gages must have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.
 - a. Strength tests of complete boxes and covers must be by independent testing agency or manufacturer. Qualified registered professional engineer must certify tests by manufacturer.

C. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover:

1. Description: Molded of sand, concrete, and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or combination.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. NewBasis.
 - b. Oldcastle Infrastructure Inc.; CRH Americas.
 - c. Quazite; brand of Hubbell Utility Solutions; Hubbell Incorporated.
3. Configuration: Units must be designed for flush burial and have open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and installed location.

- a. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
- b. Cover Legend: Molded lettering, "ELECTRIC".

5. Options:

- a. Color: Gray.

2.05 DUCT SEALING

- A. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Compound must be capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals. Duct sealing compound must be removable without damaging ducts or cables.
- B. Inflatable Duct-Sealing System: Wraparound inflatable bladder that seals ducts that are empty or containing conductors against air and water infiltration. System is suitable for use in steel, plastic, or concrete ducts and penetrations.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in field. Notify Architect if there is conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.

3.02 SELECTION OF UNDERGROUND DUCTS

- A. Duct for Electrical Feeders 600 V and Less: PVC-40, direct buried unless otherwise indicated.
- B. Duct for Electrical Branch Circuits: PVC-40, direct buried unless otherwise indicated.
- C. Underground Ducts Crossing Paved Paths Walks and Driveways: PVC-40 direct buried.
- D. Underground Ducts Crossing Roadways: PVC-40, encased in reinforced concrete.

- E. Stub-ups: Concrete encased, PVC-40.

3.03 SELECTION OF UNDERGROUND ENCLOSURES

A. Handholes and Boxes:

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete, AASHTO HB 17, H-20 structural load rating.
2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
3. Units in Sidewalk and Similar Applications with Safety Factor for Nondeliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 8 structural load rating.
4. Cover design load must not exceed load rating of handhole or box.

3.04 INSTALLATION OF DUCTS AND DUCT BANKS

A. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NEMA TCB 2 for installation of underground ducts and duct banks.
2. Consult Architect for resolution of conflicting requirements.

B. Special Techniques:

1. Where indicated on Drawings, install duct, spacers, and accessories into duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
2. Slope: Pitch duct minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from high point between two manholes to drain in both directions.
3. Expansion and Deflection Fittings: Install expansion and deflection fitting in each duct in area of disturbed earth adjacent to manhole or handhole.
4. Install expansion fitting near center of straight line duct with calculated expansion of more than 3/4 inch.
5. Curves and Bends:

- a. Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with minimum radius of 48 inch, both horizontally and vertically, at other locations unless otherwise indicated.
 - b. Duct must have maximum of 180 degrees of bends between pull points.
- 6. Joints: Use solvent-cemented joints in nonmetallic duct and fittings and make watertight in accordance with manufacturer's published instructions. Stagger couplings so those of adjacent duct do not lie in same plane. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with minimum 3 inch of concrete for minimum of 12 inch on each side of coupling.
- 7. Building Wall Penetrations: Make transition from underground duct to steel raceway at least 10 ft outside building wall, without reducing duct line slope away from building and without forming trap in line. Use fittings manufactured for transition to steel raceway type installed. Install steel raceway penetrations of building walls as specified in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- 8. Install manufactured steel raceway elbows for stub-ups at poles unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
 - a. Couple steel elbows to ducts with adapters designed for this purpose, and encase coupling with minimum 3 inch of concrete for minimum of 12 inch on each side of coupling.
- 9. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15 psig hydrostatic pressure.
- 10. Pulling Cord: Install 200 lbf test nylon cord in empty ducts.
- 11. Concrete-Encased Ducts and Duct Bank:
 - a. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 31 20 00 "Earth Moving" for pipes 6 inch or less in nominal diameter.
 - b. Width: Excavate trench 3 inch wider than duct on each side.
 - c. Depth: Install so top of duct envelope is at least 30 inch below finished grade unless otherwise indicated. Install so top of duct envelope is below local frost line.
 - d. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

- e. **Spacer Installation:** Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 ft of duct. Place spacers within 24 inch of duct ends. Stagger spacers approximately 6 inch between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
- f. **Minimum Space between Ducts:** 3 inch between edge of duct and exterior envelope wall, 2 inch between ducts for like services, and 4 inch between power and communications ducts.
- g. **Elbows:**
 - 1) Use manufactured duct elbows for stub-ups and at changes of direction in duct unless otherwise indicated. Extend encasement throughout length of elbow.
- h. **Stub-ups to Outdoor Equipment:** Extend concrete-encased steel raceway horizontally minimum of 60 inch from edge of equipment base.
 - 1) Stub-ups must be minimum 4 inch above finished floor and minimum 3 inch from conduit side to edge of slab.
- i. **Stub-ups to Indoor Equipment:** Extend concrete-encased steel raceway horizontally minimum of 60 inch from edge of wall. Install insulated grounding bushings on terminations at equipment.
 - 1) Stub-ups must be minimum 4 inch above finished floor and no less than 3 inch from conduit side to edge of slab.
- j. **Reinforcement:** Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
- k. **Forms:** Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
- l. **Concrete Cover:** Install minimum of 3 inch of concrete cover between edge of duct to exterior envelope wall, 2 inch between duct of like services, and 4 inch between power and communications ducts.
- m. **Place minimum 6 inch of engineered fill above concrete encasement of duct.**
- n. **Concreting Sequence:** Pour each run of envelope between manholes or other terminations in one continuous operation.

- 1) Start at one end and finish at other, allowing for expansion and contraction of duct as its temperature changes during and after pour. Use expansion fittings installed in accordance with manufacturer's published instructions, or use other specific measures to prevent expansion-contraction damage.
 - 2) If more than one pour is necessary, terminate each pour in vertical plane and install 3/4 inch reinforcing-rod dowels extending minimum of 18 inch into concrete on both sides of joint near corners of envelope.
- o. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 03 30 00 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

12. Direct-Buried Duct and Duct Bank:

- a. Excavate trench bottom to provide firm and uniform support for duct.
- b. Width: Excavate trench 3 inch wider than duct on each side.
- c. Depth: Install top of duct at least 36 inch below finished grade unless otherwise indicated.
- d. Set elevation of top of duct bank below frost line.
- e. Place minimum 3 inch of sand as bed for duct. Place sand to minimum of 6 inch above top level of duct.
- f. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
- g. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 ft of duct. Place spacers within 24 inch of duct ends. Stagger spacers approximately 6 inch between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
- h. Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

- i. Install manufactured steel elbows for stub-ups, at building entrances, and at changes of direction in duct.
 - 1) Couple RNC duct to steel raceway with adapters designed for this purpose, and encase coupling with minimum 3 inch of concrete.
 - 2) Stub-ups to Outdoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inch from edge of base. Install insulated grounding bushings on terminations at equipment.
 - a) Stub-ups must be minimum 4 inch above finished base and minimum 3 inch from conduit side to edge of base.
 - 3) Stub-ups to Indoor Equipment: Extend concrete-encased steel raceway horizontally on exterior of wall minimum of 60 inch from edge of wall. Install insulated grounding bushings on terminations at equipment.
 - 4) Stub-ups through interior floors must be minimum 4 inch above finished floor and no less than 3 inch from conduit side to edge of equipment pad or floor slab.
- j. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inch over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 31 20 00 "Earth Moving" for installation of backfill materials.

13. Underground-Line Warning Tape: Bury conducting underground line specified in Section 26 05 53 "Identification for Electrical Systems" no less than 12 inch above concrete-encased duct and duct banks. Align tape parallel to and within 3 inch of centerline of duct bank. Provide additional warning tape for each 12 inch increment of duct-bank width over nominal 18 inch. Space additional tapes 12 inch apart, horizontally across width of ducts.

14. Ground ducts and duct banks in accordance with Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.05 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Special Techniques:

1. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.
2. Unless otherwise indicated, support units on level bed of crushed stone or gravel, graded from 1/2 inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
3. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.
 - a. Concrete: 3000 psi, 28-day strength, complying with Section 03 30 00 "Cast-in-Place Concrete," with troweled finish.
 - b. Dimensions: 10 inch wide by 12 inch deep.
4. Ground handholes and boxes in accordance with Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.06 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

B. Tests and Inspections:

1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide minimum 12 inch long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.

C. Nonconforming Work:

1. Underground ducts, raceways, and structures will be considered defective if they do not pass tests and inspections.
2. Correct deficiencies and retest as specified above to demonstrate compliance.

D. Assemble and submit test and inspection reports.

3.07 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION 26 05 43

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Round sleeves.
2. Rectangular sleeves.
3. Grout.

B. Related Requirements:

1. Section 07 84 13 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 ROUND SLEEVES

A. Pipe Sleeves, PVC:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CCI Piping Systems.
 - b. GPT; an EnPro Industries company.
 - c. Metraflex Company (The).
2. Description: ASTM D1785, Schedule 40.

B. Molded Sleeves, PVC:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ABB, Electrification Business.
 - b. Arlington Industries, Inc.
 - c. Reliance Worldwide Corporation.
 - 2. Description: With nailing flange for attaching to wooden forms.
- C. Molded Sleeves, PE or PP:
- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Crete-Sleeve.
 - 2. Description: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- D. Sheet Metal Sleeves, Galvanized Steel, Round:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Benefast.
 - b. Specified Technologies, Inc.
 - 2. Description: Galvanized-steel sheet; thickness not less than 0.0239 inch; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.02 RECTANGULAR SLEEVES

- A. Sheet Metal Sleeves, Galvanized Steel, Rectangular:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Abesco Fire LLC.
 - b. Specified Technologies, Inc.
 - c. Wiremold; Legrand North America, LLC.
 - 2. Description:
 - a. Material: Galvanized sheet steel.
 - b. Minimum Metal Thickness:

- 1) For sleeve cross-section rectangle perimeter less than 50 inch and with no side larger than 16 inch, thickness must be 0.052 inch.
- 2) For sleeve cross-section rectangle perimeter not less than 50 inch or with one or more sides larger than 16 inch, thickness must be 0.138 inch.

2.03 GROUT

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. W.R. Meadows, Inc.
- B. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
 1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
 2. Design Mix: 5000 psi, 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 92 00 "Joint Sealants."
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide 1/4 inch annular clear space between sleeve and raceway or cable, unless sleeve seal system is to be installed.

4. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inch above finished floor level. Install sleeves during erection of floors.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for wall assemblies.
- C. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- 3.02 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS
- A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.
 - B. Install conduits and cable with no crossings within the sleeve.
 - C. Fill opening around conduits and cables with expanding foam without leaving voids.
 - D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.

END OF SECTION 26 05 44

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Labels.
 - 2. Tapes and stencils.
 - 3. Tags.
 - 4. Signs.
 - 5. Miscellaneous identification products.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with 29 CFR 1910.144 for color identification of hazards; 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs and tags; and the following:
 - 1. Fire-protection and fire-alarm equipment, including raceways, must be finished, painted, or suitably marked safety red.
 - 2. Ceiling-mounted hangers, supports, cable trays, and raceways must be finished, painted, or suitably marked safety yellow where less than 7.7 ft above finished floor.

- C. Signs, labels, and tags required for personnel safety must comply with the following standards:
 - 1. Safety Colors: NEMA Z535.1.
 - 2. Facility Safety Signs: NEMA Z535.2.
 - 3. Safety Symbols: NEMA Z535.3.
 - 4. Product Safety Signs and Labels: NEMA Z535.4.
 - 5. Safety Tags and Barricade Tapes for Temporary Hazards: NEMA Z535.5.
- D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
 - 1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
 - 2. Colors for 240/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - 3. Colors for 480-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.

4. Color for Neutral: White for 240/120-V circuits.
5. Color for Equipment Grounds: Bare copper.

C. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

D. Equipment Identification Labels:

1. Black letters on a white field.

2.03 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Marking Services, Inc.
 - c. Panduit Corp.
 - d. Seton Identification Products; a Brady Corporation company.

B. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Marking Services, Inc.
 - c. Panduit Corp.
 - d. Seton Identification Products; a Brady Corporation company.

2.04 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP.
 - b. Marking Services, Inc.
 - c. Panduit Corp.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. Marking Services, Inc.
- C. Tape and Stencil: 4-inch wide black stripes on 10-inch centers placed diagonally over orange background and are 12 inches mm) wide. Stop stripes at legends.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. LEM Products Inc.
 - b. Marking Services, Inc.
 - c. Seton Identification Products; a Brady Corporation company.

2.05 TAGS

- A. Write-on Tags:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP.
 - b. LEM Products Inc.

- c. Seton Identification Products; a Brady Corporation company.
- 2. Polyester Tags: 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment.
- 3. Marker for Tags:
 - a. Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.06 SIGNS

A. Baked-Enamel Signs:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP.
 - b. emedco.
 - c. Marking Services, Inc.
- 2. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
- 3. 1/4-inch grommets in corners for mounting.
- 4. Nominal Size: 7 by 10 inches.

B. Laminated Acrylic or Melamine Plastic Signs:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. Marking Services, Inc.
- 2. Engraved legend.
- 3. Thickness:
 - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
 - b. For signs larger than 20 sq. in., 1/8 inch thick.

- c. Engraved legend with black letters on white face.
- d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
- e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.07 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.02 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- I. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- J. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
1. "EMERGENCY POWER."
- K. Vinyl Wraparound Labels:
1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- L. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- M. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- N. Self-Adhesive Labels:
1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- O. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- P. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- Q. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- R. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- S. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- T. Write-on Tags:
 1. Place in a location with high visibility and accessibility.
 2. Secure using plenum-rated cable ties.
- U. Baked-Enamel Signs:
 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.
- V. Laminated Acrylic or Melamine Plastic Signs:
 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.

3.03 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.
- D. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

- F. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- G. Workspace Indication: Apply floor marking tape or tape and stencil to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- H. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Controls with external control power connections.
- J. Arc Flash Warning Labeling: Self-adhesive labels.
- K. Operating Instruction Signs: Self-adhesive labels.
- L. Emergency Operating Instruction Signs: Self-adhesive labels with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- M. Equipment Identification Labels:
 - 1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
 - 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.

- d. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
- e. Emergency system boxes and enclosures.
- f. Enclosed circuit breakers and switches, including CBs for MCCs.
- g. Remote-controlled switches, dimmer modules, and control devices.
- h. Monitoring and control equipment.

END OF SECTION 26 05 53

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Lighting and appliance branch-circuit panelboards.

1.03 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. MCCB: Molded-case circuit breaker.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
 - 1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
 - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details.
 - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
 - 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
 - 4. Detail bus configuration, current, and voltage ratings.
 - 5. Short-circuit current rating of panelboards and overcurrent protective devices.

6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Key interlock scheme drawing and sequence of operations.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or ISO 9002 certified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle and prepare panelboards for installation according to NEMA PB 1.

1.07 FIELD CONDITIONS

- A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).

- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Construction Manager's written permission.
3. Comply with NFPA 70E.

1.08 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
 - 1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PANELBOARDS COMMON REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.
- D. Enclosures: Surface-mounted, dead-front cabinets, unless otherwise noted on panel schedules.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Height: 84 inches (2.13 m) maximum.
 - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
 - 4. Finishes:
 - a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
- E. Incoming Mains:
 - 1. Location: Convertible between top and bottom.
 - 2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.
- F. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
 - a. Plating shall run entire length of bus.
 - b. Bus shall be fully rated the entire length.
2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

G. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

H. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.02 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Electrification Business.

2. Eaton.
 3. Square D; Schneider Electric USA.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only, Refer to Panel Schedules for each main type.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.
- F. Standard Features:
1. Main Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
 2. Branch Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
 3. Factory-Installed, Integral SPD:
 - a. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase may not be less than 200 kA. Peak surge current rating must be arithmetic sum of ratings of individual MOVs in given mode.
 - b. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits may not exceed the following:
 - 1) Line to Neutral: 1200 V for 480Y/277 V.
 - 2) Line to Ground: 1200 V for 480Y/277 V.
 - 3) Neutral to Ground: 1200 V for 480Y/277 V.
 - 4) Line to Line: 2000 V for 480Y/277 V.
 - c. SCCR: Equal to or exceed 200 kA.
 - d. Inominal Rating: 20 kA.

2.03 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB, Electrification Business.

2. Eaton.
3. Square D; Schneider Electric USA.
- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
 1. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.
 - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - e. Application Listing: Appropriate for application.
 - f. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.04 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NEMA PB 1.1.
- D. Equipment Mounting:
 - 1. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- E. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- F. Mount panelboard cabinet plumb and rigid without distortion of box.
- G. Mount surface-mounted panelboards to steel slotted supports 5/8 inch (16 mm) in depth. Orient steel slotted supports vertically.
- H. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- I. Install filler plates in unused spaces.

3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems" identifying source of remote circuit.

3.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 26 24 16

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:
 - a. Control circuits.
 - b. Enclosed switches.
 - c. Enclosed controllers.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 2. Coordination charts and tables and related data.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 77 00 "Closeout Procedures," Section 01 78 23 "Operation and Maintenance Data," include the following:
 1. Ambient temperature adjustment information.
 2. Current-limitation curves for fuses with current-limiting characteristics.
 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit in electronic format suitable for use in coordination software and in PDF format.

4. Coordination charts and tables and related data.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Bussmann; Eaton, Electrical Sector.
 2. Littelfuse, Inc.
 3. Mersen USA.
- B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.02 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
 1. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
 2. Type CC: 600-V, zero- to 30-A rating, 200 kAIC.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. Feeders: Class RK1, time delay.
 - 2. Motor Branch Circuits: Class RK1, time delay.
 - 3. Control Transformer Circuits: Class CC, time delay, control transformer duty.
 - 4. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

3.03 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s) in location shown on the Drawings or as indicated in the field by Construction Manager.

3.04 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 28 13

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

- B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

1.06 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- C. Comply with NFPA 70.

2.02 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB, Electrification Business.
 - 2. Eaton.
 - 3. Square D; Schneider Electric USA.
- B. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 240-V ac.
4. 200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
2. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.03 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Electrification Business.
2. Eaton.
3. Square D; Schneider Electric USA.

B. Type HD, Heavy Duty, Three Pole, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
2. Lugs: Mechanical type, suitable for number, size, and conductor material.
3. Service-Rated Switches: Labeled for use as service equipment.

2.04 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1).

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.02 PREPARATION

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without Construction Manager's written permission.
 - 4. Comply with NFPA 70E.

3.03 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: UL 50E, Type 4X.

3.04 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Install fuses in fusible devices.
- D. Comply with NFPA 70 and NECA 1.

3.05 IDENTIFICATION

- A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.06 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.
 - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

- a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Verify correct phase barrier installation.
 - i. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
2. Electrical Tests:
- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
- C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.
- 1. Test procedures used.
 - 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
 - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 26 28 16

SECTION 31 10 00

SITE CLEARING AND PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Clearing and grubbing.
2. Tree and shrub protection and removal.
3. Removal of debris related to clearing and grubbing operations.

B. Contractor shall perform a field investigation in the locations identified on the drawings to understand the extent of effort associated with site clearing. Contractor shall use this field investigation as a basis for bidding, and no additional costs will be approved by Owner for clearing or disposal of additional debris from the Site.

C. No tree over a 4 inch caliper shall be removed without the prior written approval of Owner, unless it is indicated to be removed on the Drawings. Wherever and whenever possible, trees shall be protected and saved, and only those trees which are directly in the line of construction (as shown on the drawings), shall be removed.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals and the Contract Documents.

1. Certificates

- a. Copy of herbicide label bearing EPA registration number.
- b. Copy of Arborist Certification.

B. If Contractor desires to remove trees that are not marked on the Contract Drawings for removal, he shall survey and mark all trees over a 4 inch caliper that he proposes to remove and submit a Removal Plan. Such Removal Plan shall include a listing of trees proposed to be removed, their location, species, and size. Trees so marked shall not be removed until Owner approves the Removal Plan. If trees that are not marked for removal are damaged or removed, whether purposefully or accidentally, the Contractor shall replace the trees or be liable for damages.

1.03 QUALITY ASSURANCE

- A. Comply with the requirements specified in Section 01 43 00 – Quality Requirements and the Contract Documents.
- B. Certifications:
 - 1. Certified Arborist: All tree pruning, tree repair, and tree removal shall be performed by competent workers, under the supervision of an arborist holding certification from the International Society of Arboriculture (ISA) or equivalent education and experience.

1.04 DELIVERY STORAGE AND HANDLING

- A. Comply with the requirements specified in the Contract Documents and Specifications.
- B. Herbicide: Comply with Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) – Title 7 U.S.C. Section 136. Submit copy of herbicide label, bearing EPA registration number to Owner.

1.05 SITE CONDITIONS

- A. Existing facilities, structures, and utilities are shown in accordance with available surveys and records. The indicated locations of underground utilities and structures are approximate. Other utilities may exist which are not indicated.

1.06 DEFINITIONS

- A. Tree Caliper: Trunk caliper (trunk diameter) is measured 6 inches from the ground on trees up to and including 4 inches in caliper, and 12 inches above the ground for larger trees.
- B. Clearing: Removal and disposal of above-ground items defined herein.
- C. Grubbing: Removal and disposal of below-ground items defined herein.

PART 2 - PRODUCTS

2.01 ACCESSORIES

- A. Herbicide: Registered EPA Pesticide.
- B. Tree Wound Paint: Bituminous based paint formulated for tree wounds.
- C. Accessories shall comply with local, state, and federal rules and regulations.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify survey benchmarks and intended elevations for the Work are as indicated.
- B. Verify temporary erosion and sediment control measures are installed before commencing with any other work at the site.
- C. Verify location and existence of all underground utilities and structures by contacting Ohio Utilities Protection Service, as required by law. Access this information by dialing 811 or 1-800-362-2764 at least 48 hours but no more than 10 working days (excluding weekends and legal holidays) before beginning any digging.
- D. Provide 72-hour notice to existing utility owners, prior to beginning construction.
- E. Contact utility companies and authorities to make arrangements for handling and disposal of utilities encountered during construction.

3.02 PREPARATION

- A. Install project signage as required in the Contract Documents and Specifications upon mobilization at the site.
- B. Protect bench marks, survey control points, and existing structures to remain from damage or displacement.
- C. Protect trees and vegetation to remain. Do not cut or injure trees and vegetation outside easement lines and outside designated clearing areas.
- D. Protect all underground utilities and structures that are to remain. If damage occurs, immediately notify the utility owner within the hour.
- E. Protect site features to remain from damage by construction equipment and vehicular traffic.
- F. Identify waste and salvage areas for stockpiling of removed materials.

3.03 RESTORATION

- A. Existing surfaces, features, utilities, or structures that are to remain but are damaged during construction shall be restored to at least the condition in which they were found immediately before work began, unless noted otherwise.
- B. Restore damaged utilities to the satisfaction of the utility owner.
- C. Restore damaged private property to the satisfaction of the property owner.

3.04 EXISTING STRUCTURES AND PROPERTY

- A. Remove and reset existing signs, posts, catch basin frames and grates, manhole frames and covers, and concrete curbing within construction path unless directed otherwise.
- B. Store items as indicated in Contract Drawings and Specifications, at a site designated by Owner.

3.05 CLEARING

- A. Remove and dispose of offsite:
 - 1. Trees, snags, brush, shrubs, downed timber, decayed wood and other vegetative growth.
 - 2. Rocks, tiles, lumps of concrete, trash piles, debris, refuse and rubbish, and fencing. Remove all evidence of their presence from the surface.
- B. Clear ground as indicated in Contract Drawings, unless otherwise noted.
- C. Manual cutting of trees, stumps, and stubs during clearing shall be as close to ground surface as practicable but no higher than 6 inches above ground for small trees (8 inches or less), and not higher than 12 inches above ground for larger trees (greater than 8 inches).
- D. Obey all federal, state and local regulations and guidance regarding the cutting and disposal of diseased trees and vegetation.

3.06 GRUBBING

- A. Remove and dispose of all stumps, buried logs, matted roots, roots larger than 2 inches, and organic materials off site.
- B. Roots larger than 2 inches in diameter shall be removed to a depth of 12 inches, and roots larger than 1/2 inches in diameter to a depth of 6 inches.
- C. Areas designated to receive pavement or structures shall be grubbed a depth of 18 inches. Measure depths of grubbing from existing ground surface or proposed finished grade, whichever is lower.
- D. Apply herbicide to remaining roots and vegetation to inhibit growth.
- E. Depressions made by grubbing shall be filled with suitable material and compacted to conform to original adjacent grade as specified in the Contract Documents.
- F. Do not grub areas within drip line of trees to remain to avoid damage to roots.

3.07 TREE REMOVAL

- A. Remove trees within clearing limits as indicated on Contract Drawings by felling or cutting individual vegetation and grubbing.

3.08 TREE PROTECTION

- A. Protect designated trees within the clearing limits. Trees protection measures shall extend to the drip line of the tree.

3.09 PRUNING

- A. Trim dead branches 1-1/2-inches or more in diameter and branches to heights and in a manner as indicated. Neatly cut limbs and branches close to the bole of the tree or main branches. Paint cuts more than 1-1/4-inches in diameter with tree wound paint.

3.10 BURNING

- A. Burning is not permitted on site.

3.11 CLEANING

- A. Promptly dispose of excess and unsuitable material off site.
- B. Remove debris, junk, and trash from site.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris caused by construction activities within the public way, easement limits, or adjacent private property.

3.12 CLOSEOUT ACTIVITIES

- A. Provide in accordance with Section 01 77 00 - Contract Closeout and the Contract Documents.

END OF SECTION 31 10 00

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SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Excavating and backfilling for buildings and structures.
3. Subsurface drainage backfill for walls and slabs-on-grade.
4. Base course for concrete walks and pavements.
5. Base course for asphalt paving.
6. Excavating and backfilling for utility trenches.

B. Related Requirements:

1. Section 01 32 33 "Construction Photographs" for recording pre-excavation and earth-moving progress.
2. Section 31 10 00 "Site Clearing" for site stripping, grubbing, stripping topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 31 50 00 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
4. Section 31 63 29 "Drilled Concrete Piers and Shafts" for excavation of shafts and disposal of surplus excavated material.
5. Section 32 90 10 "Site Restoration and Landscaping" for finish grading, site restoration and landscaping requirements.

1.02 UNIT PRICES

- A. Work of this Section is affected by unit prices for earth moving specified in Section 01 22 00 "Unit Prices."
- B. Quantity allowances for earth moving are included in Section 01 21 00 "Allowances."

1.03 DEFINITIONS

- A. Backfill: Satisfactory soil material or controlled low-strength material used to fill an excavation.
- B. Base Course: Course placed between the subgrade and the pavement. The base material should comply with ASTM D 2940 “Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports”, and have a maximum of 5% fines, material passing the #200 sieve. All pavement base material shall use a modified ODOT #304 aggregate stone meeting the above requirement of having a maximum of 5% fines passing the #200 sieve.
- C. Wall drainage material: Aggregate placed between all walls and the soil to be retained. The drainage material should consist of a nonreactive, clean, free draining, open-graded coarse-grained material, with less than 5% passing the #200 sieve.
- D. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- E. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Owner’s representative. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Owner’s representative. Unauthorized excavation, as well as remedial work shall be without additional compensation.
 - a. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom.
 - b. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket.
- G. Engineered Fill: Satisfactory soil material placed onsite in a controlled manner for either drainage media or structural support.

- H. General Fill: Satisfactory soil materials used to raise existing grades in areas of landscaping.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed bby excavating equipment equivalent to a Caterpillar 320CL hydraulic excavator equipped with a rock bucket and without systematic drilling or ram hammering.
- J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- M. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other fabricated stationary features constructed above or below the ground surface.
- N. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- O. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct pre-excavation conference at Project site.
 - 1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
 - a. Personnel and equipment needed to make progress and avoid delays.
 - b. Coordination of Work with utility locator service.
 - c. Field quality control.

1.05 INFORMATIONAL SUBMITTALS

- A. Product Data: For the following:
 - 1. Geotextile.

- 1.06 Controlled low-strength material, including design mixture (if applicable).
1. Modified ODOT #304 aggregate base material showing a maximum of 5% fines passing the #200 sieve.
- B. Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
 2. Plasticity Index (PI) and the Liquid Limit (LI) determined by Atterberg Limit testing per ASTM D 4318.
 3. Laboratory compaction curve according to ASTM D 698 for each cohesive (lean clay) on-site and borrow soil material proposed for fill and backfill.
 4. Laboratory compaction curve according to ASTM D 1557 for each coarse-grained on-site and borrow soils material proposed for fill and backfill. This would include silty sand (SM).
- 1.07 Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.
- 1.08 FIELD CONDITIONS
- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
1. Do not proceed with work on adjoining property until directed by Architect.
- C. Verify all underground utilities prior to performing any excavation work in accordance with the Contract Documents. Request in writing that all underground utility lines are marked by the authority having jurisdiction over them. Maintain all markings throughout the duration of this contract.

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

1.09 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations on-site.
- B. Satisfactory Soils: SP, SW, SM, SC, GP, or GW (according to the USCS classification) materials from excavations may be satisfactory soils for fill. Satisfactory Soils from on-site excavation may also include Lean Clay (CL) or silty sand (SM) material. Satisfactory borrow soils include SP, SW, SM, SC, GP, or GW, (according to the USCS classification). Satisfactory borrow soils can also include clay provided that it is classified as low plasticity clay (CL) as defined by ASTM D-2487 and has a plasticity index which does not exceed 15. Satisfactory borrow soil should be capable of producing a maximum dry density of not less than 110 pounds per cubic foot using the Standard Proctor method (ASTM-D698). All satisfactory soils shall be free of material larger than 6 inches in any direction, and managed such that they are placed at acceptable moisture contents.
- C. Unsatisfactory Soils: Excavated rock spoils, topsoil or organic material, clays with high plasticity (CH), rubble, construction materials, rubbish and other objectionable foreign materials may not be used for engineered or general fill.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
 2. Frozen soils may not be used may not be utilized as backfill. Backfill should be placed on subgrades free of mud, frost, snow or ice.
- D. Base Course: The base material shall be crushed gravel or limestone and comply with the requirements of ODOT 703.17.
- E. Fill/Backfill: Satisfactory soils.
- F. Bedding Course, Pipe Cover, Drainage Fill: Narrowly graded mixture of washed crushed stone, or crushed gravel; #57 size aggregate as specified in ODOT Section 703.01.

1.10 GEOTEXTILES

- A. Nonwoven, needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50

percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf ; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf ; ASTM D 4632.
4. Tear Strength: 56 lbf ; ASTM D 4533.
5. Puncture Strength: 56 lbf ; ASTM D 4833.
6. Apparent Opening Size: No. 70 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.1 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

1.11 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Low-density, self-compacting, flow able concrete material as follows:
 1. Portland Cement: ASTM C 150, Type I or II.
 2. Fly Ash: ASTM C 618, Class C or F.
 3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch nominal maximum aggregate size.
 4. Foaming Agent: ASTM C 869.
- B. Water: ASTM C 94/C 94M.

PART 2 - EXECUTION

2.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

2.02 DEWATERING

- A. Surface drainage of the site should be properly maintained during construction such that subgrades are kept free of standing water. Up to the time of subgrade preparation, elevations of areas to be excavated should remain several inches above the final bearing elevation to minimize potential exposure to wet weather and softening of the bearing-soils. Since construction traffic and wet weather conditions can cause the subgrade soils to soften, traffic patterns in areas of exposed subgrade should be varied to avoid rutting.
- B. Based on the subsurface exploration, limited groundwater is expected on the site, likely concentrated in the natural silty sand and sandy clay deposits or near the soil-bedrock interface. Limited groundwater may be expected during construction activities. Drainage trenches and sumps are expected to be sufficient to control inflows of surface and groundwater. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

2.03 EXPLOSIVES

- A. Explosives: The use of explosives will not be permitted.

2.04 EXCAVATION, GENERAL

- A. Excavations will be required for construction of basements, foundations, and utilities. The soils on-site can likely be excavated with a moderate size hydraulic excavator or backhoe. Bedrock excavation may also be required on this project. All unsupported excavation sidewalls should be sloped back or shored to permit safe working conditions, in accordance with OSHA requirements for protective systems (29 CFR 1926.652).
- B. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

2.05 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

2.06 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the clearance on each side of pipe or conduit per the plan details. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

- C. Trench Bottoms: Excavate trenches 6 inches deeper than bottom of pipe elevation, or as indicated on the plans, to allow for bedding course. Hand excavate for bell of pipe. Remove projecting stones and sharp objects along trench subgrade.

2.07 SUBGRADE COMPACTION AND PROOF ROLLING

- A. Exposed subgrade should be proof rolled to locate and evaluate unsuitable subgrade soils. Proof rolling shall proceed in general accordance with ODOT 204.06 using a heavy pneumatic tire roller, such as a fully loaded tandem-axle dump truck or other equivalent equipment, with a minimum of three overlapping passes. The equipment used for proof rolling should weigh a minimum of 25 tons.
- B. Areas that yield, i.e. rut or pump under the weight of the proof roll, should be mitigated.
- C. If the Owner's representative determines that unsatisfactory soil is present, the unsatisfactory soil shall be removed and replaced with approved material or stabilized in a manner approved by the Owner's representative. Revise minimum weight or type of vehicle in first subparagraph below if required.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Owner's representative, without additional compensation.

2.08 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
 - 1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Cut and protect roots according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection."

2.09 SUBGRADE INSPECTION

- A. Geotechnical evaluations have been performed and are included in the Project documents. They include a Geotechnical Exploration Report. The contractor shall carefully review and is required to follow all recommendations contained within the report
- B. Suitable subgrade materials may exist on site. If it is the intent of the Contractor to use the excavated material for engineered fill, the Contractor should identify the intended methods and procedures to follow. These methods and procedures should be approved by the Owner's representative. If it is the intent of the Contractor to use the excavated material for engineered fill, steps should be taken by the Contractor to segregate the material in proper stockpiles, i.e. separate stockpiles of surficial materials (i.e., topsoil, etc.) and soil intended for use as engineered fill. Failure to do so may result in unusable material.
 1. Shale spoils collected from onsite excavations may not be suitable for engineered fill due to potential expansion.
- C. Other than the design requirements provided in the Geotechnical Exploration Report for the subject project, the Bidder is solely responsible for all conclusions drawn from the information provided in the report. There is no guarantee that the subsurface conditions indicated in the boring logs will be consistent in other areas on the site. Should the successful bidder encounter soils (other than those described in the report) that will affect the design recommendations, he shall immediately notify the Owner.

2.10 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 1. Do not proceed with work on adjoining property until directed by Architect.
- C. Verify all underground utilities prior to performing any excavation work in accordance with the Contract Documents. Request in writing that all underground utility lines are

marked by the authority having jurisdiction over them. Maintain all markings throughout the duration of this contract.

- D. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Owner not less than two weeks in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- E. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of **2500 psi (17.2 MPa)**, may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

2.11 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

2.12 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, damp proofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Removing concrete formwork.
 - 4. Removing trash and debris.
 - 5. Removing temporary shoring and bracing, and sheeting.
 - 6. Installing permanent or temporary bracing to support walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

2.13 ENGINEERED FILL

2.14 Place and compact engineered fill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, damp proofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Removing concrete formwork.
4. Removing trash and debris.
5. Removing temporary shoring and bracing, and sheeting.
6. Installing permanent or temporary bracing to support walls.

B. Place backfill on subgrades free of mud, frost, snow, ice or standing water.

2.15 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, ice, or standing water.

B. Place bedding course and cover in trenches where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the utility pipe or conduit. Place final backfill of controlled low-strength material to final subgrade elevation.

D. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

E. Place and compact satisfactory soil to final subgrade elevation.

2.16 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use general fill material.
2. Under walks and pavements, use engineered fill material.
3. Place soil fill on subgrade free of mud, frost, snow, ice or standing water.

2.17 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

2.18 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- C. Any low plasticity clay used as engineered fill material shall be compacted at a moisture content within 2 percent of the optimum moisture content, and to a density not less than 95 percent of the maximum dry density, as established by the Standard Proctor compaction test per ASTM D 698. However, the coarse-grained soils, SP, SW, GP or GW as well as any in-situ silty sands used as an engineered fill material shall be compacted at a moisture content within 2 percent of the optimum moisture content, and to a density not less than 98 percent of the maximum dry density, as established by the Modified Proctor compaction test per ASTM D 1557. Appropriate laboratory and field-testing shall be performed to verify that the engineered fill has been placed to the required density.
- D. If the engineered fill is of a variable nature that cannot be represented in a laboratory compaction test, a test strip (or test strips) may be constructed in the field in order to determine the maximum achievable density of the material at the approval of the Owner's representative (samples and laboratory testing of the material may be required as necessary for approval). The test strip shall be achieved by constructing a short control strip of the material on a firm foundation, at suitable moisture content, under the inspection of a qualified geotechnical engineer or engineering technician. The test strip should be compacted by vibratory or other proven effective rollers or tampers, until no further increase in density results. The compaction requirement for material represented by the test strip is 98% of the maximum dry density achieved in the test strip. Additional test strips should be performed if changes in the material or placement techniques occur.
- E. When placing engineered fill within five feet of basement walls or any other retaining walls, only lightweight compaction equipment should be used. Engineered fill in this area should be spread in lifts not exceeding 6 inches, and compacted with small hand-manipulated machines such as "jumping jacks", walk-behind vibratory compactors, or

other similar equipment suitable to the material type and approved by a qualified geotechnical engineer or engineering technician.

2.19 GRADING

- A. General: 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: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1/2 inch.
 - 3. Pavements: Plus or minus 1/2 inch.

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

2.21 BASE COURSE

- A. Place base course on approved subgrades free of mud, frost, snow, ice or standing water.
- B. On prepared subgrade, place base course for pavements, slabs and walks as follows:
 - 1. Shape base course to required crown elevations and cross-slope grades.
 - 2. Place base course of 6 inches or less in compacted thickness in a single layer.
 - 3. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 4. Compact base course in accordance with ODOT Item 304.

2.22 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Subdrainage Specification (334600).
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place bedding course and cover material above and below the conduit, as

indicated on the plans. Wrap in subsurface drainage geotextile, overlapping sides and ends at least 12 inches.

2.23 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineer/testing agency to perform field quality-control testing and assessment of subgrade conditions. Contractor to coordinate work with testing agency.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements. Required testing will be determined by the Owner's representative prior to construction.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by the Owner's representative.
- D. Testing agency will test compaction of soils in place according to ASTM D 2922. Tests will be performed at the following locations and frequencies:
 - 1. Paved Areas or Structural Fill: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 5000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
 - 2. Trench Backfill: At each compacted backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.
 - 3. Structure Backfill: At each compacted backfill layer, at least 1 test for each 150 feet or less of structure length, but no fewer than 2 tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved the degree of compaction specified, scarify and moisten or aerate, or remove and replace to depth required; recompact and retest until specified compaction is obtained.

2.24 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by the Owner's representative; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration.

2.25 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus soil, waste material, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 20 00

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SECTION 31 50 00

EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes temporary excavation support and protection systems.

1.3 PERFORMANCE REQUIREMENTS

- A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
 - 1. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 4. Monitor vibrations, settlements, and movements.

1.4 SUBMITTALS

- A. Informational Submittals:
 - 1. Photographs or Videotape: Show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems. Submit before Work begins.
 - 2. Record Drawings: Identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.5 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to excavation support and protection system including, but not limited to, the following:
 - a. Geotechnical report.
 - b. Existing utilities and subsurface conditions.
 - c. Proposed excavations.
 - d. Proposed equipment.
 - e. Monitoring of excavation support and protection system.
 - f. Working area location and stability.
 - g. Abandonment or removal of excavation support and protection system.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - 1. Notify Construction Manager or Owner no fewer than two days in advance of proposed interruption of utility.
 - 2. Do not proceed with interruption of utility without Construction Manager's or Owner's written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
 - 2. The geotechnical report is referenced elsewhere in the Project Manual.
- C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 - 1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify

Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
- C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.
 - 1. Corners: Site-fabricated mechanical interlock or Roll-formed corner shape with continuous interlock.
- D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.
- E. Shotcrete: Comply with Division 03 Section "Shotcrete" for shotcrete materials and mixes, reinforcement, and shotcrete application.
- F. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
- G. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- H. Tiebacks: Steel bars, ASTM A 722/A 722M.
- I. Tiebacks: Steel strand, ASTM A 416/A 416M.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
 - 1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.
- D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 SOLDIER PILES AND LAGGING

- A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.3 SHEET PILING

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

- A. Tiebacks: Drill, install, grout, and tension tiebacks. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.
2. Maintain tiebacks in place until permanent construction is able to withstand lateral soil and hydrostatic pressures.

3.5 BRACING

- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
 1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
 2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
 3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
 1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlaying construction and abandon remainder.
 2. Fill voids immediately with approved backfill compacted to density specified in Division 31 Section "Earth Moving."
 3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.
- B. Leave excavation support and protection systems permanently in place.

END OF SECTION 315000

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SECTION 31 63 29

DRILLED CONCRETE PIERS AND SHAFTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Dry-installed or slurry displacement-installed drilled piers at Contractor's choice.

1.02 UNIT PRICES

A. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length and shaft diameter may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments are made on net variation of total quantities, based on design dimensions for shafts.

1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft, extended through the bell, if applicable, and the diameter of shaft.
2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing and inspecting, and other items for complete drilled-pier installation.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to drilled piers including, but not limited to, the following:
 - a. Review geotechnical report.
 - b. Discuss existing utilities and subsurface conditions.
 - c. Review coordination with temporary controls and protections.
 - d. Review measurement and payment of unit prices.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

- B. Design Mixtures: For each concrete mixture. Submit alternative design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

- 1. Indicate amounts of mixing water to be withheld for later addition at Project site.

- C. Shop Drawings: For concrete reinforcement, detailing fabricating, bending, supporting, and placing.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, land surveyor, professional engineer, and testing agency.

- B. Material Certificates: From manufacturer, for the following:

- 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Steel reinforcement and accessories.

- C. Material Test Reports: For each material below, by a qualified testing agency:

- D. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Record drawings.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in drilled-pier work.

1.08 FIELD CONDITIONS

- A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.

- 1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.

- B. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Owner no fewer than two weeks in advance of proposed interruption of utility.
 2. Do not proceed with interruption of utility without Owner's written permission.
- C. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.
1. Make additional test borings and conduct other exploratory operations necessary for drilled piers.
 2. The geotechnical report is included elsewhere in the Project Manual.
- D. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.
1. Record and maintain information pertinent to each drilled pier and indicate on record Drawings. Cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Drilled-Pier Standard: Comply with ACI 336.1 except as modified in this Section.

2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed.

2.03 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C150, Type I or Type I/II.
 - a. Fly Ash: ASTM C618, Class F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
 2. Blended Hydraulic Cement: ASTM C595, Type IL, Portland-limestone Cement

- a. When identified otherwise, blended hydraulic cement (ASTM C595, Type IL) will be considered equivalent to Portland Cement (ASTM C150, Type I or II).
 - B. Normal-Weight Aggregate: ASTM C33, graded, maximum 1-inch nominal coarse-aggregate size.
 - 1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
 - C. Water: ASTM C94.
 - D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C494, Type A.
 - 2. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
 - 3. High-Range, Water-Reducing and Retarding Admixture: ASTM C494, Type G.
 - 4. Plasticizing and Retarding Admixture: ASTM C1017, Type II.
- 2.04 STEEL CASINGS
- A. Steel Pipe Casings: ASTM A283, Grade C, or ASTM A36, carbon-steel plate, with joints full-penetration welded according to AWS D1.1.
 - B. Corrugated-Steel Pipe Casings: ASTM A929, steel sheet, zinc coated.
 - C. Liners: Comply with ACI 336.1.
- 2.05 SLURRY
- A. Slurry: Pulverized bentonite, pulverized attapulgite, or polymers mixed with water to form stable colloidal suspension; complying with ACI 336.1 for density, viscosity, sand content, and pH.
- 2.06 CONCRETE MIXTURES
- A. Reference 03 30 00.
- 2.07 REINFORCEMENT FABRICATION
- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.08 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

3.02 EXCAVATION

- A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
 - 1. Obstructions: Unclassified excavated materials may include removal of unanticipated boulders, or other subsurface obstructions. Payment for removing obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work is according to Contract provisions for changes in the Work.
- B. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.
- C. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.
 - 1. Excavate the bottom of drilled piers to level plane within 1:12 tolerance.
 - 2. Remove water from excavated shafts before concreting.
 - 3. Excavate rock sockets of dimensions indicated.
- D. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Engineer of Record.
 - 1. Do not excavate shafts deeper than elevations indicated unless approved by Engineer of Record.

2. Payment for additional authorized excavation is according to Contract provisions for changes in the Work.
- E. Excavate shafts for closely spaced drilled piers and for drilled piers occurring in fragile or sand strata only after adjacent drilled piers are filled with concrete and allowed to set.
- F. Slurry Displacement Method: Stabilize excavation with slurry maintained a minimum of 60 inches above ground-water level and above unstable soil strata to prevent caving or sloughing of shaft. Maintain slurry properties before concreting.
 1. Excavate and complete concreting of drilled pier on same day, or redrill, clean, and test slurry in excavation before concreting.
- G. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.
 1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete or leave temporary casings in place.
- H. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.
 1. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit corrective construction proposals to Architect for review before proceeding.

3.03 PERMANENT STEEL CASING INSTALLATION

- A. At Contractor's Option, install permanent steel casings of minimum wall thickness indicated and of diameter not less than diameter of drilled pier.
 1. Install casings as excavation proceeds, to maintain sidewall stability.
 2. Fabricate bottom edge of lowest casing section with cutting shoe capable of penetrating rock and achieving water seal.
 3. Connect casing sections by continuous penetration welds to form watertight, continuous casing.
 4. Remove and replace or repair casings that have been damaged during installation and that could impair strength or efficiency of drilled pier.
 5. Fill annular void between casing and shaft wall with grout.
- B. Corrugated-Steel Casings: Provide corrugated-steel casings formed from zinc-coated steel sheet.
 1. Corrugated casings may be delivered in sections or panels of convenient length and field connected according to manufacturer's written instructions.

3.04 STEEL REINFORCEMENT INSTALLATION

- A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.
- C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.
- D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover over reinforcement.
- E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.
- F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.05 CONCRETE PLACEMENT

- A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by a qualified Special Inspector.
- B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
 - 1. Where concrete cannot be directed down shaft without striking reinforcement, place concrete with chutes, tremies, or pumps.
 - 2. Vibrate top 60 inches of concrete.
- C. Slurry Displacement Method: Place concrete in slurry-filled shafts by tremie methods or pumping. Control placement operations to ensure that tremie or pump pipe is embedded no less than 60 inches into concrete and that flow of concrete is continuous from bottom to top of drilled pier.
- D. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing.
 - 1. Vibrate top 60 inches of concrete after withdrawal of temporary casing.
- E. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.

- F. Protect concrete work, according to ACI 301, from frost, freezing, or low temperatures that could cause physical damage or reduced strength.
 - 1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.
- G. If hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no more than 90 deg F.
 - 1. Place concrete immediately on delivery. Keep exposed concrete surfaces and formed shaft extensions moist by fog sprays, wet burlap, or other effective means for a minimum of seven days.

3.06 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Drilled piers.
 - 2. Excavation.
 - 3. Concrete.
 - 4. Steel reinforcement welding.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.
 - 1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities are determined by testing and inspecting agency. Final evaluations and approval of data are determined by Engineer of Record.
 - a. Bearing Stratum Tests: Testing agency takes undisturbed rock core samples from drilled-pier bottoms; tests each sample for compression, moisture content, and density; and reports results and evaluations.
- D. Concrete Tests and Inspections: ASTM C172 except modified for slump to comply with ASTM C94.

1. Slump: ASTM C143; one test at point of placement for each compressive-strength test but no fewer than one test for each concrete load.
2. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F and below and 80 deg F and above, and one test for each set of compressive-strength specimens.
3. Compression Test Specimens: ASTM C31; one set of four standard cylinders for each compressive-strength test unless otherwise indicated. Mold and store cylinders for laboratory-cured test specimens unless field-cured test specimens are required.
4. Compressive-Strength Tests: ASTM C39; one set for each drilled pier but not more than one set for each truck load. Test one specimen at seven days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.
5. Strength of each concrete mixture is satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
6. Report test results in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. List Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests in reports of compressive-strength tests.
7. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but not be used as sole basis for approval or rejection of concrete.
8. Additional Tests: Testing and inspecting agency to make additional tests of concrete if test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by Architect.
 - a. Continuous coring of drilled piers may be required, at Contractor's expense, if temporary casings have not been withdrawn within specified time limits or if observations of placement operations indicate deficient concrete quality, presence of voids, segregation, or other possible defects.
9. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
10. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

- E. An excavation, concrete, or a drilled pier will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports for each drilled pier as follows:
 - 1. Actual top and bottom elevations.
 - 2. Actual drilled-pier diameter at top and bottom.
 - 3. Top of rock elevation.
 - 4. Description of soil materials.
 - 5. Description, location, and dimensions of obstructions.
 - 6. Final top centerline location and deviations from requirements.
 - 7. Variation of shaft from plumb.
 - 8. Shaft excavating method.
 - 9. Design and tested bearing capacity of bottom.
 - 10. Depth of rock socket.
 - 11. Levelness of bottom and adequacy of cleanout.
 - 12. Properties of slurry and slurry test results at time of slurry placement and at time of concrete placement.
 - 13. Ground-water conditions and water-infiltration rate, depth, and pumping.
 - 14. Description, purpose, length, wall thickness, diameter, tip, and top and bottom elevations of temporary or permanent casings. Include anchorage and sealing methods used and condition and weather tightness of splices if any.
 - 15. Description of soil or water movement, sidewall stability, loss of ground, and means of control.
 - 16. Date and time of starting and completing excavation.
 - 17. Inspection report.
 - 18. Condition of reinforcing steel and splices.
 - 19. Position of reinforcing steel.
 - 20. Concrete placing method, including elevation of consolidation and delays.

21. Elevation of concrete during removal of casings.
22. Concrete volume.
23. Concrete testing results.
24. Remarks, unusual conditions encountered, and deviations from requirements.

3.07 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 63 29

SECTION 32 90 10

SITE RESTORATION AND LANDSCAPING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Restore all surfaces within the work limits that are damaged or disturbed by construction operations.
- B. Replace or repair all pavements, roadways, curbing, gutters, guardrails, culverts, sidewalks, structures and appurtenances, fencing, mailboxes, and other like items, which were damaged or removed during the work.
- C. Replace or repair all pavements, roadways, curbing, gutters, curb ramps, etc. per City requirements.
- D. Grade all disturbed ground to original contours or to contours as directed by Owner. Grading shall be performed in accordance with the requirements elsewhere in these Specifications.
- E. Furnish and install topsoil, fertilizer, seed, mulch, and related items necessary to complete work shown or specified.
- F. Contractor shall seed and mulch all vegetated areas cleared, damaged or destroyed during construction work. All areas that previously supported vegetation or trees shall be seeded and mulched.
- G. Culverts, sewers, and drainage ditches shall be repaired immediately to restore flows.
- H. Upon completion of work, remove all temporary facilities, sheds, offices, barricades, tree protection, signs, fences and other facilities and restore ground to original contours.
- I. Replace any ornamental shrubbery destroyed or damaged by Contractor's operations. Use approved nursery for this work.
- J. Replace any vegetation, including trees, hedges, or shrubbery being used as a visual barrier, that is damaged or removed during the work to provide a visual barrier equivalent to the barrier damaged or removed.
- K. Notify Owner 30 days prior to commencing restoration work on City properties or within City rights-of-way.

1.02 QUALITY ASSURANCE AND QUALITY CONTROL

- A. Comply with the requirements specified in Section 01 43 00 – Quality Requirements and the Contract Documents.

- B. Quality and size of replaced items shall be equal or better than that which existed prior to construction.
- C. Unless otherwise shown or specified, pavement and sidewalk replacement must be of the same type material and construction as the original work.
- D. Where joints are made in existing work they shall be straight, neat, and sealed.
- E. All work must meet the approval of Owner.

1.03 SUBMITTALS

- A. Comply with the requirements specified in Section 01 33 00 – Submittals and the Contract Documents.
- B. Submit the following:
 - 1. Manufacturer's Certificate of Compliance certifying compliance with applicable standards and specifications.
 - 2. Prior to placement of any mulch, deposit, at a location on the site suitable to Owner, 1/2 cubic yard sample of mulch for examination. After mulch sample is reviewed by Owner, provide mulch conforming to accepted sample.
 - 3. Submit vendor's certified analysis for soil amendments and fertilizer materials. Submit other data substantiating that materials comply with specified requirements.
 - 4. Submit seed vendor's certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight and crop year identification, and percentages of purity, germination and weed seed for each grass seed species.
 - 5. Prior to end of maintenance period, furnish 2 copies of written maintenance instructions for maintenance and care of installed lawn areas.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Comply with the requirements specified in Section 01 66 10 – Delivery, Storage, and Handling and the Contract Documents.
- B. Contractor shall be responsible for the delivery, storage, and handling of fencing products, in accordance with these specifications.
- C. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

- D. Deliver packaged materials in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark, weight and conformance to state law. Protect materials from deterioration during delivery and while stored at site.
- E. Do not drop materials.

1.05 SITE CONDITIONS

- A. Seed between March 15 and June 1 and/or between September 1 and November 15. Do not sow seed during adverse weather conditions. Do not broadcast seed during high wind. Do not sow seed when the moisture content of the soil is too low or too high for seed germination.
- B. Prepare a proposed planting schedule. Schedule dates for each type of landscape work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. Once accepted, revise dates only as approved in writing, after documentation or reasons for delays.

1.06 WARRANTY

- A. Guarantee new material through one full growing season after planting is completed.
- B. Guarantee materials replaced under this for one full growing season from date of replacement.
- C. Repair damage to plants or lawns during plant replacement.
- D. Guarantee lawn areas for duration of one full year after seeding to be alive and in satisfactory growth at end of guarantee period.
- E. For purpose of establishing an acceptable standard, scattered bare spots, none of which is larger than 1 square foot will be allowed up to a maximum of 3% of lawn area.

PART 2 - PRODUCTS

2.01 QUALITY ASSURANCE

- A. Ability to deliver:
 - 1. Investigate sources of supply and make assurances that material will be supplied as indicated in planting schedule in sizes, variety and quality noted and specified before submitting BID.
 - 2. Failure to take this precaution will not relieve responsibility for furnishing and installing material in accordance with Contract requirements and without additional expense to Owner.

B. Inspection:

1. Upon delivery and before planting, Owner will inspect materials. Plant no material prior to inspection by Owner.

C. General:

1. Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.
2. Check material prior to commencing of planting operations. Notify Owner at least 48-hours in advance of all planned planting operations and identify specific material and its location.
3. Furnish suitable quantities of water, hose and appurtenances.
4. Use loam having prior vegetative growth that did not contain toxic amounts of either acid or alkaline elements.
5. Begin maintenance immediately after each portion of lawn is seeded and continue for minimum of 60 days.
6. Repair or replace seeded areas, plants, shrubs, and trees which, in judgment of Owner, have not survived and grown in a satisfactory manner, for a period of one year after acceptance.
7. Provide, as specified, seedings or plantings replacements of the same type and size.
8. Dry loam test samples to constant weight at temperature of 230 degrees Fahrenheit, plus or minus 9 degrees.

2.02 TOPSOIL

- A. Topsoil will be stockpiled for re-use in landscape work. If quantity of stockpiled topsoil is insufficient, provide additional topsoil as required to complete landscape work.
- B. Provide new topsoil which is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 1-1/2 inches in any dimension and other extraneous or toxic matter harmful to plant growth.
- C. Obtain topsoil from local sources or from areas having similar soil characteristics to that found at project site. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 4-inches; do not obtain from bogs or marshes.

2.03 LAWN PRODUCTS

- A. Limestone shall be agricultural grade with a minimum total neutralizing power of 90. At least 40% of the limestone shall pass a No. 100 sieve, and at least 90% shall pass a No. 8 sieve.
- B. Fertilizer shall be 12-12-12 grade.
- C. Grass seed mix for all areas shall be as shown on the plans.
 - 1. Seed shall not contain more than 5% inert matter. Seed shall not contain objectional weeds.
 - 2. Mulch shall be straw, grass, hay, pine needles, or wood fiber. Straw shall be threshed straw of cereal grain such as oats, wheat, barley, rye, and rice. Mulch shall not contain objectional weed seeds or other material that might be detrimental to the planting being established.
- D. Asphalt adhesive shall be emulsified asphalt. Adhesive shall meet the requirements of ASTM D977 for Grade SS-1.

2.04 TREES

- A. Existing trees to be removed within City rights-of-way are identified on the drawings. The replacement tree species type are shown on the drawings.

PART 3 - EXECUTION

3.01 GRADING

- A. Fine grade all non-paved areas disturbed during construction. Areas shall be smooth and uniform. Finish elevations and grades shall be the same as elevations and grades prior to construction, unless otherwise shown on the drawings.

3.02 PREPARATION OF SEEDED AREAS

- A. Prior to preparation of areas to be seeded, remove existing grass, vegetation, and turf. Dispose of such materials outside of the project sites. Do not turn over any removed material into the soil being prepared for seeding.
- B. Loosen subgrade of areas to be seeded to a minimum depth of 4-inches. Remove stones over 1-1/2-inches in any dimension and sticks, roots, rubbish and other extraneous matter. Limit preparation to areas, which will be planted promptly after preparation.
- C. Place 6-inches of topsoil over area to be seeded.
 - 1. Spread planting soil mixture to minimum depth required to meet lines, grades and elevations shown, after light rolling and natural settlement.

2. Place approximately one-half of total amounts of planting soil required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil.
3. Grade areas to be seeded to smooth, even surface with loose, uniformly fine texture. Roll and rake and remove ridges and fill depressions as required to meet finish grades. Limit fine grading to areas, which can be planted immediately after grading.
4. Moisten prepared areas to be seeded before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.
5. Restore areas to be seeded to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.

3.03 SEEDING

- A. Loosen the seed bed, if not loose, to a depth of from 1- to 2-inches below finished grade.
- B. Apply fertilizer in the amount of 20 pounds per 1,000 square feet.
- C. Sow grass seed at the rate of not less than 2-1/2 pounds per 1,000 square feet in each of two directions at right angles to each other. Total seed rate shall be 5 pounds per 1,000 square feet.
- D. Apply agricultural grade limestone in the amount of 25 pounds per 1,000 square feet.
- E. Seeds and fertilizers can be sown with standard agricultural drills. Grass seeds may be sown broadcast or with a special seeder attachment on agricultural drills, but shall not be covered with more than 1/2-inch of soil, whether drilled or raked in. If not covered by the drill, all uncovered seed shall, immediately after sowing, be slightly raked or harrowed to cover the seed.

3.04 MULCHING

- A. Apply mulching material following seeding.
- B. Apply mulching material, except wood fiber, at a rate of 46 pounds per 1,000 square feet. Apply wood fiber at a rate of 35 pounds per 1,000 square feet.
- C. Punch mulching material into the soil so the mulch is partially covered. The punching operations shall be performed longitudinally with a mulch tiller. Use proper mulch tilling equipment. Evenly distribute mulch.
- D. Unless otherwise noted, hold the mulch in place with tackifier when the seeded area has a slope steeper than 4-feet horizontal to 1-foot vertical. Apply tackifier immediately after the mulch is placed. Apply tackifier at manufacturers recommended rate.

3.05 TREES

- A. Notify Owner 30 days prior to removing existing trees within a right-of-way, so the Owner can coordinate with the City

3.06 WATERING

- A. Thoroughly water seed and trees immediately after planting.
- B. Water grass and trees as necessary to establish and maintain growth until project is completed.

3.07 MAINTENANCE

- A. Maintain landscaped areas for not less than 60 days after planting.
- B. Maintain lawn areas and other seed areas at maximum height of 2-1/2 inches by mowing at least three times. Weed thoroughly once and maintain until time of final acceptance. Reseed and re-fertilize with original mixtures, watering or whatever is necessary to establish over entire area of lawn and other seeded areas a close stand of grasses specified and reasonably free of weeds and undesirable coarse native grasses.
- C. Begin maintenance immediately after each planting and continue until final acceptance of work. Water, mulch, weed, prune, spray, fertilize, cultivate and otherwise maintain and protect all plants.
- D. Reset settled plants to proper grade and position, and restore planting saucers and remove dead material. Tighten and repair guys. Correct defective work as soon as possible within guarantee period.

3.08 PROTECTION

- A. Provide protection against traffic and construction operations by erecting barricades immediately after landscaping is completed and by placing warning signs.
- B. If landscaping is damaged or destroyed, the affected landscaping shall be repaired or replaced to the satisfaction of Owner at Contractor's expense.
- C. Protect work until accepted.

3.09 CLEAN-UP

- A. Remove soil or similar material, which has been brought onto paved areas, keeping these areas clean.
- B. Upon completion of planting, remove excess soil, stones, and debris which have not previously been cleaned up; legally dispose of off-site.
- C. Prepare lawns and planting areas for final inspection.

- D. Protect slopes and embankments against erosion until work is accepted. Repair eroded portions of seeded or sodded areas by refilling, re-sodding, re-mulching and reseeding as required by condition and to satisfaction of Owner. Protection may be by installation of sod strips or other methods.

3.10 INSPECTION AND ACCEPTANCE OF SEEDED AREAS

- A. Seeded areas will be inspected at completion of installation and accepted subject to compliance with specified materials and installation requirements.
- B. Inspection to determine acceptance will be made by Owner upon Contractor's request. Provide notification at least 10 working days before requested inspection date.
- C. Inspections shall be scheduled by Contractor to take place immediately after a maintenance occurrence.
- D. Seeded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, uniform, close stand of the specified grass is established free of weeds, undesirable grass species, disease, insects, and surface stones.
 - 1. Scattered bare spots, none of which is larger than one square foot, will be allowed up to a maximum totaling 3% of the individual lawn areas.
 - 2. Where inspected seeded areas do not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by Owner and until the work is found acceptable.

END OF SECTION 32 90 10

SECTION 33 01 35

MAINTENANCE, SUPPORT, AND RESTORATION OF UTILITY FACILITIES

PART 1 - GENERAL

1.01 SUMMARY

- A. This section provides for the protection, support, maintenance, and reconstruction or relocation of existing underground and above ground utility facilities if affected by reasons of construction operations. The existing utility facilities include gas, electric, water, telephone, cable television, sewer, and storm drainage, in addition to others shown on the drawings and specified in the Specifications.
- B. Working methods and procedures that might, in the opinion of Owner, cause damage to any underground utility facility will not be acceptable. However, Owner's acceptance of construction methods and procedures does not relieve Contractor of his responsibilities regarding the protection and preservation of the utilities.
- C. For the purpose of establishing the exact location of subsurface utilities, Owner may direct the excavation of test pits. Failure of Owner to direct the digging of test pits will not be considered as relieving Contractor of his responsibilities regarding the protection and preservation of utilities.

1.02 SUBMITTALS

- A. Shop and Work Drawings:
 - 1. Prepare and submit, to the Utility owner and to Owner, working drawings and shop drawings showing the plan and scheduling for performance of the work.
 - 2. Show on the drawings the actual location of existing facilities, any interference which these facilities present to the new work, proposed construction, and details of proposed support system.
 - 3. Start work only after approval in writing has been received from the Utility owner and Owner.
- B. Notification of Utilities
 - 1. Pursuant to Section 153.64 of the Ohio Revised Code, Owner has contacted owners of underground facilities for information relating to the existence and location of underground utility facilities within the construction area.
 - a. There are utility companies which are not members of an underground utility protection service. Contractor must contact Owner for a listing of the non-member utilities.

2. Within ten (10) calendar days of the award of this Contract, Owner will give notice by certified mail of the award of this Contract and the name and address of Contractor to all owners of underground utility facilities known to be located in the construction area.
3. Contractor shall be responsible for all losses costs and expenses, direct or indirect, arising out of or in any way related to damage or injury to any underground utility facility in the following circumstances:
 - a. Contractor fails to comply with the above paragraph hereof and the damage or injury could have been prevented or mitigated, in whole or in part, if Contractor had complied with such paragraph hereof.
 - b. The underground utility facility was located as marked by Owner of the underground utility facility or Contractor had actual notice of the location of the underground utility facility.
 - c. Contractor hereby agrees to indemnify and save harmless Owner from and against all liabilities, claims, or demands arising out of or in any way related to such damage or injury and further from and against any judgment, settlement, penalty, loss, costs, expenses, liability, or damages that Owner may directly or indirectly sustain, suffer, or incur as a result thereof.
4. Contractor shall immediately alert the occupants of nearby premises as to any emergency that Contractor may create or discover at or near such premises. Contractor shall report immediately to Owner or operator of the underground utility facility any break or leaks on its lines or any dent, gouge, groove, or other damage to such lines or to their coating or cathodic protection, made or discovered in the course of their excavation.
5. In the event of a dispute as to the application of Section 153.64 of the Ohio Revised Code, the dispute shall be resolved in accordance with the provisions of this Contract.

1.03 SITE CONDITIONS

A. Location of Facilities:

1. Owner has relied upon the utility owners to provide information about the existence and location of underground facilities. Reasonable diligence has been made by Owner to reflect the information obtained from the utility companies on the Contract Drawings; however, the locations are not guaranteed correct. Owner accepts no responsibility for and makes no representation or warranty as to the accuracy or completeness of the utility information provided on the Contract Drawings.
2. Verify by field investigation the locations of facilities within and adjacent to the limits of the project which may be affected by construction operations, as herein

specified, and that may adversely affect the construction operations. Avoid damage or disruption of facilities during this operation.

3. Whenever an existing facility is encountered which is not shown on the Drawings, or when a facility is determined to differ from that indicated, determine ownership, use, and disposition of such facility, and perform all necessary work approved by Owner and the Utility owner. Payment for such work will be made in accordance with the General Terms and Conditions.

B. Responsibilities:

1. For work not shown on the drawings, Contractor shall pay Utility directly if the Utility performs work not shown on the Drawings as an aid to Contractor's construction. Obtain and pay for all necessary permits. If Contractor elects to remove, replace, or relocate any poles, utilities, or structures, he shall be responsible to make all arrangements and obtain all necessary utility engineering, design, permits, and approvals from the Utility and Owner.
2. Contractor shall be responsible to restore any damaged or displaced property to the pre-existing condition all with the full knowledge and approval of Owners of the property. This applies equally to all above and below ground properties, utilities, structures, and appurtenances involved. Where the damaged item involves public health and safety, it must be repaired within 24 hours or Owner may have the repairs made at the expense of Contractor. Contractor shall repair all other items expeditiously.

C. Location of Buried Utilities and Structures:

1. It is Contractor's responsibility to accurately locate all utilities, structures, and appurtenances in the field. Contractor shall also make all arrangements and liaisons necessary with the Utility companies concerned to mark their lines, structures, and appurtenances by coded symbols on the pavement or marked stakes. All of the above shall be done in advance of any construction, and notification shall be given to the Utility and Owner six (6) weeks prior to utility field markings.
2. Contractor shall perform subsurface investigations as necessary and sufficiently in advance of trenching or excavation to enable adequate planning of construction.
3. Subsurface investigations shall be performed as necessary to field verify the locations, depth of bury, diameter, and pipe material of existing underground utilities at crossings and at tie-in points before ordering materials or commencing excavation. Immediately notify Owner if conflicts are encountered.
4. The cost of subsurface investigations shall be incidental to the work being performed.

D. Coordination with Utilities:

1. Establish through Owner direct and continuous contact with the respective Utilities and cooperate with them in all phases of the work.
2. Contact the Utility early enough to allow sufficient time to accomplish the work they are required to perform, giving special consideration to the lead times required for cable work. Provide the Utility with the schedule of utility relocation to coordinate with the sequence of construction.
3. To locate buried telephone cables, call the local telephone company's "buried cable location service" at least 48-hours prior to starting any excavation.
4. Prior to disconnecting any water service, notify the Utility owner 48-hours in advance for permission. Coordinate as required.
5. Power poles shall be supported at the expense of the Contractor.

PART 2 - MATERIALS (Not Used)

PART 3 - EXECUTION

3.01 SETTLEMENT OR MOVEMENT

- A. In case of settlement or other movement, which might cause damage, take immediate remedial measures to correct the conditions and damages caused by the settlement.

3.02 EXCAVATION AND BACKFILLING OF UTILITY TRENCHES

- A. Excavate and backfill utility facility trenches in accordance with the Specifications. Proceed with caution in the areas of utility facilities and expose them by hand or other excavation methods acceptable to the facility owner.

3.03 REPLACEMENT OR RELOCATION OF EXISTING UTILITIES

- A. All existing utility systems which conflict with the construction of the work herein shall be relocated or temporarily removed and replaced, as required. Such relocating or temporary removal and replacement shall be accomplished by Contractor. Any relocated utility that is not removed and remains in-place shall be plugged or bulkheaded at its upstream and downstream ends to prevent loss of ground and infiltration of cementitious materials (cement concrete, grout, CLSM, etc.) into the remaining void space and beyond.
- B. It shall be Contractor's responsibility to liaison with all Utility companies, and replacements and relocations shall be completed in compliance with their requirements. In all cases existing utility service shall be maintained until the new lines are completed and ready for use. Homeowners shall have 48-hour prior notice of any interruption of service necessary to affect changeover to the new lines.

- C. Permit Owners of the utilities and their agents access to the site of the work at all times during relocation or protection of their facilities, and cooperate with them in performing this work.
- D. Cooperate with the Utility owners concerned and notify Owner not less than thirty (30) days in advance, unless noted otherwise, of the time scheduled to perform any work that will endanger or affect their facilities.
- E. Any public utility facilities being constructed under this Contract shall be subject to inspection by the Utility owner during construction, and the Utility owner shall be given the opportunity to inspect material to be used in reference to the specifications and plan details applying to such materials.
- F. No additional compensation will be allowed for any delays, inconvenience, or damage sustained by Contractor for the relocation and replacement of permanent and temporary utilities due to interference from said utility appurtenances or the operation of moving them either by the utility company or by Contractor.
- G. Notify Owner at least thirty (30) days in advance of any utility mark out required.

END OF SECTION 33 01 35

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SECTION 33 26 15

FRPMP OPEN CUT SEWER PIPE

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide and test Fiberglass Reinforced Polymer Mortar Pipe (FRPMP) as indicated and specified. This Section specifies FRPMP Sewer Pipe for use in open cut construction.
- B. Perform leakage acceptance test in accordance with approved submittals.
- C. Perform video inspection survey in accordance with approved submittals.

1.02 SUBMITTALS

- A. All products, materials and equipment to be incorporated in the Work shall be submitted as a shop drawing and/or product data as specified in Section 01 33 00 - Submittals.
- B. Shop and Working Drawings:
 - 1. Piping layouts in full detail
 - 2. Large scale details of all special castings
- C. Manufacturer's Literature:
 - 1. Catalog cuts and technical data for joints, couplings, gaskets, other accessories and handling instructions.
 - 2. Pipe test reports per requirements of ASTM D3262.
- D. Leakage Test Program to include procedure, schematic, equipment and layout. This test shall be in accordance with requirements as contained herein.
- E. Video Inspection Survey Program to include procedure, equipment, and coverage. Provide sample video in terms of clarity, quality and coverage.
- F. Testing Log prior to final acceptance. Testing Log to include the results of Leakage Test Program, video, visual inspection, and any other inspections or analyses conducted.

1.03 QUALITY ASSURANCE

- A. Pipes shall be stamped bearing manufacture's name, date, applicable ASTM and/or AWWA numbers followed by type, liner, grade, and pipe stiffness.

- B. All materials to be incorporated in the Work shall be tested or inspected in accordance with the following schedule. Sampling, testing and inspection shall be made in accordance with the latest applicable ASTM standards.
- C. Laboratory Testing: The following materials shall be inspected and tested at the expense of Contractor, by a local bureau, laboratory or other agency. Contractor shall furnish all such samples of materials as may be required, and such materials shall be approved before permission is given to incorporate same in the Work. It is the responsibility of Contractor to arrange for laboratory testing and the cost of such samples shall be included in the unit prices bid for the various items of Work.
 - 1. FRPMP Pipe, furnish one pipe section for each diameter of a type, liner, grade, and pipe stiffness for each 2,000 feet or fraction thereof to be supplied. The requirements for each item to be tested shall be as per ASTM D3262
 - ~~2.~~ Joints, perform one test for each diameter of a type, liner, grade, and pipe stiffness for each 2,000 feet or fraction thereof to be supplied. The requirements for each item to be tested shall be as per ASTM D4161
 - 3. Owner reserves the right to engage independent testing laboratory to perform additional inspection or tests of any or all pipe units at manufacture's plant or elsewhere. Such additional inspections or tests are at Owner's expense and become test results of record.
- D. Visual Inspections: pipe shall be subject to visual inspection by Owner or Owner Representative for acceptance or rejection after delivery to the site. Rejected materials shall immediately be removed from the site.
- E. After the pipe has been installed, perform the leakage acceptance tests in accordance with approved submittals.
- F. After the pipe has been installed, perform a video inspection survey with high resolution equipment to record the condition of the pipe from manhole to manhole. This inspection shall also document the condition of the installed pipeline at each of the pipe joints.
- G. After the pipe has been installed, sewers 48-inch in diameter or larger shall also be subjected to a visual inspection walk through in conjunction with Owner.

1.04 DELIVERY AND STORAGE AND HANDLING

- A. Delivery, Storage, and Handling shall be in accordance with the requirements established in Section 01610 – Delivery, Storage, and Handling.
- B. Transport and handle items in accordance with manufacturer's instructions.
- C. Schedule delivery to reduce long-term on-site storage prior to installation. Coordinate delivery with installation to ensure minimum holding.

- D. All items delivered to the site shall be unloaded and placed in a manner which will not hamper Contractor's normal construction operations and will not interfere with the flow of traffic.
- E. Provide necessary equipment and personnel to unload all items delivered to the site. Use textile slings or a forklift for handling piping. Do not use chains or cables, which may damage the piping.
- F. Promptly inspect shipment to verify that products comply with requirements, quantities are correct and items are undamaged.
- G. Store and protect products in accordance with the manufacturer's instructions. Storage instructions shall be studied by Contractor and reviewed with Owner. Instructions shall be carefully followed and a written record of storage shall be maintained by Contractor.
- H. Stacking of the pipe shall not be allowed.
- I. Each standard and random length of pipe and fittings shall be clearly marked with the information outlined in paragraph 1.3.A

1.05 REFERENCES

A. American Society of Testing and Materials (ASTM), Latest Edition for each standard:

- 1. ASTM D638 – Standard Test Method for Tensile Properties of Plastics
- 2. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- 3. ASTM D2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
- 4. ASTM D3262 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe
- 5. ASTM D3681 - Chemical Resistance of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe In Deflected Condition
- 6. ASTM D4161 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals
- 7. ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

B. American Water Works Association:

- 1. AWWA M45 - Fiberglass Pipe Design

- C. Ohio Department of Transportation (ODOT), "Construction and Materials Specifications", Latest Edition.
- D. "Uniform Standards for Sewerage Improvements", Latest Edition.

PART 2 - MATERIALS

2.01 PIPE MATERIALS

- A. Pipe Material shall be manufacture pipe to result in a dense, nonporous, corrosion-resistant, consistent composite structure in accordance with ASTM 3262.
- B. Pipes shall be Type 1, Liner 2, Grade 3 or *Type 1, Liner 1, Grade 1* per ASTM D3262.
- C. The interior surface of the pipes shall be manufactured using a resin with a 50% elongation (minimum) when tested in accordance with D638, suitable for sanitary sewer service conditions.
- D. The interior surface shall provide crack resistance and abrasion resistance.
- E. The exterior surface of the pipes shall be comprised of a sand and resin layer which provides UV protection to the exterior.
- F. Sewer pipe shall have a stiffness class which will satisfy all design requirements, but in no case be less than pipe stiffness of 46 psi when tested in accordance with ASTM D2412.
- G. The extrapolated 50 year strain corrosion value shall be in accordance with ASTM D3681 and ASTM D3262.
- H. Wall thickness measured at the bottom of the spigot gasket groove shall be determined by the maximum load anticipated under all installation conditions.
- I. Pipe ends shall be true and square to the pipe axis with a maximum tolerance of 1/8".
- J. Glass reinforcing fibers shall be of the highest quality commercial grade E-glass filaments with binder and sizing compatible with the impregnating resin system.
- K. Silica sand shall be a minimum of 98% by weight silica, with moisture content less than or equal to 0.2%.
- L. Additives shall be of a proven result and of a nature which shall not degrade the finished product performance.
- M. Pipe diameters shall conform to the Ohio EPA's Pipe Specification List (July 7th, 2011) and/or ASTM C-76 whichever is more stringent.

2.02 JOINTS, FITTINGS AND CONNECTIONS

2.03 Joints:

- A. Joints shall be a fiberglass sleeve coupling that utilize elastomeric sealing gaskets and meet the performance requirements of ASTM D4161.
 - 1. Elastomeric sealing gaskets shall meet ASTM F477 and be suitable for the intended service. Gaskets shall be produced and supplied by a manufacturer typically engaged in the manufacture of such materials.
- B. Fittings, Miters, and Specials:
 - 1. Changes in pipe alignment not located at manholes shall be made with manufactured fittings or contact molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays.
 - 2. Any pipe fittings, miters, and specials shall be provided by the pipe manufacturer.
- C. Connections:
 - 1. Connections made to existing service laterals, side sewers, or manholes from within the pipe shall be made in accordance with the drawings and manufacturer's recommendations.
- D. Connection or closure details for the aforementioned conditions shall be submitted to Owner for review and approval. Connection or closure details shall be in accordance with industry standards, and material manufacture specifications.

PART 3 - EXECUTION

3.01 HANDLING AND CUTTING

- A. Use textile slings, other suitable materials or a forklift. Use of chains or cables is not recommended.
- B. Mark pipe and fitting "Rejected" and remove from site when damaged.
- C. Cut, if permitted, on sound barrel at point at least 12 inches from visible limit of damage, at Contractor's expense.
- D. Machine cut with saws. Snap cutters, hammer and chisel NOT ALLOWED. Examine for possible cracks.

3.02 PIPE INSTALLATION

- A. General

1. Only one (1) type and strength of pipe shall be used between any two (2) consecutive manholes, unless otherwise shown on the contract drawings.
2. Where ASTM, AWWA or other national organizations have published recommended practices for installation, such recommendations shall be followed. Where more than one standard is referenced the more stringent shall be followed.
 - a. As specified by ASTM D3839.
 - b. As specified by AWWA M45
 - c. Bedding and burial of pipe and fittings as specified by ASTM D2321 and shall be in accordance with the contract drawings and the manufacturer's requirements as approved by Owner.

B. Construction

1. Previous to being lowered into the trench carefully inspected each pipe and those not meeting the specified requirements shall be rejected, clearly marked and immediately removed from the site of the work.
2. After the trench has been excavated and the pipe bedded as specified elsewhere in these Specifications, the pipe shall be laid to the line and grade as specified on the contract drawings. Joints shall be made as hereinafter specified. In no case shall material, except bedding material, be placed under the pipe to secure proper grade.
3. Satisfactory means shall be used to hold the pipe in line while the pipe is being jointed.
4. New sanitary and storm sewer service connections or stubs shall be a minimum of six (6") inches I.D. and installed at a minimum of 1% grade, unless otherwise shown on the contract drawings.
5. No pipe shall be laid within ten (10) feet of the machine excavating the trench nor within 40 feet of any place where blasting is being done. In no case shall more than 200 feet of trench be opened in advance of the pipe laying operations.
6. No storm water which accumulates in excavated areas is to be discharged into the newly laid pipe, unless approved by Owner and treated prior to discharge as specified in the Stormwater Pollution Prevention Plan.
7. Sewers shall be tightly sealed at open ends at the completion of each day's work.
8. Trenches and excavations shall, in general, be backfilled as soon as possible after the pipe is laid and jointed. The method employed in depositing the backfill shall be such as to prevent damage to the sewer or other structures.

3.03 PIPE JOINTS AND COUPLINGS

A. General

1. The pipes shall be very carefully stored and handled to prevent damage and no pipes shall be connected if the jointing rings have been deformed or damaged from any cause. Unless otherwise directed or indicated on the contract drawings, the joints specified above in this Specification shall be used.

B. Installation

1. Install all joints and couplings in accordance with manufacturer's directions.
2. Clean ends of pipe and joint and coupling components.
3. Apply joint lubricant to the bell interior surface and the elastomeric seals. Use only lubricants approved by the pipe and gasket manufacturers.
4. Use suitable equipment and end protection to push or pull the pipes together.
5. Do not exceed forces recommended by the manufacturer for coupling pipe.
6. Join pipes in straight alignment then deflect to required angle. Do not allow the deflection angle to exceed the deflection permitted by the manufacturer.

3.04 INSPECTION AND TESTING

A. Service Markings

1. Whenever a stone or concrete sidewalk or curb exists, service connections shall be indicated by witness signs cut into the sidewalk or curb. Each riser, slant or "Y" connection, left plugged at the sewer, shall be evidenced by a triangle and each sewer curb connection, plugged at the curb, shall be evidenced by an arrow.

B. Line Acceptance Testing for Sewers

1. Sanitary sewers 24 inches in diameter and under shall be tested for leakage by Low-Pressure Air Test Method.
 - a. Low-Pressure Air Test Method
 - (1) Air testing shall be performed by a certified independent agency in general accordance with ASTM C924 and in the following manner:

- (a) After completing a reasonable section of sewer and the manholes have been completed, contractor shall furnish all equipment, material and personnel to conduct a "line acceptance" test using low pressure air. The equipment to be used shall have prior approval and the test shall be conducted under the supervision of Owner or Owner Representative. The line acceptance test shall be conducted after backfilling has been completed.
- (b) All wyes, tees or end of lateral stubs shall be suitably capped to withstand the internal test pressures. Such caps shall be a type which is easily removable for future lateral connections or extensions.
- (c) After a manhole-to-manhole section of the line has been cleaned, it shall be plugged at each manhole with pneumatic plugs inflated to 35 psig internal pressure or minimum bladder pressure needed to affect a seal as recommended by the pipe manufacturer. The design of the plugs shall be such that they will hold against the line test pressure without requiring external blocking or bracing. External blocking or bracing may be used for extra protection. Each pneumatic plug shall have a sealing length equal to or greater than the diameter of the pipe in which it is to be used so that effective sealing will take place around any nodule or lump that may be on the inner surface of the pipe.
- (d) Before actual line testing starts, the pneumatic plugs shall pass the following qualifying test in the presence of the responsible agency: one (1) length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked; air shall be introduced into the pipe until the pipe pressure reaches 15 psig. The pneumatic plugs being checked shall hold against this pressure without bracing being needed and without movement of the plugs out of the pipe. All pneumatic plugs shall pass the aforementioned qualifications before being used to test the actual installation.

- (e) One (1) pneumatic plug used in this testing procedure shall have two (2) factory equipped hose connections in addition to that hose connection used only for the inflation of the pneumatic plug. One (1) of the additional hose connections shall be used for continuously reading the air pressure rise in the sealed line. The second additional hose connection shall be used only for introducing low pressure air into the sealed line.
- (f) There shall be a minimum three inch (3) diameter, 0-36 psig gauge supplied for reading the internal pressure of the line being tested.
- (g) Calibrations from the 0-10 psig range shall be in tenths of pounds and this 0-10 portion shall cover 90% of the complete dial range.
- (h) Low pressure air shall be introduced into the sealed line until the internal pressure reaches 4.0 psig greater than the average back pressure of any ground water pressure that may be over the pipe. At least two (2) minutes shall be allowed for the air pressure to stabilize. After the stabilization period, the hose for introducing low pressure air into the sealed line shall be disconnected from the air source in such a manner as to retain the pressure in the sealed line. The starting pressure shall not exceed 5.0 psi. In that event the infiltration test shall be used.
- (i) The portion of the line being tested shall be accepted by performing the test as follows: The time required in minutes for the pressure to decrease from 3.5 to 2.5 psig greater than the average back pressure of any ground water that may be over the pipe shall not be less than the time shown for the given diameter in the following table:

Nominal Pipe Size (Inches)	T(time) min/100ft
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1

Nominal Pipe Size (Inches)	T(time) min/100ft
18	2.4
21	3.0
24	3.6

- (j) Where high ground water is known to exist, the height in feet of ground water above the invert of the sewer shall be divided by 2.3 to establish the pounds of pressure that will be added to the internal air pressure used for the line acceptance test in determining the time in minutes for the air pressure to decrease 1.0 psig.

b. Infiltration test:

- (1) Infiltration Test shall be performed in general accordance with ASTM C969.
- (2) The test shall be modified to allow a maximum permissible leakage of 100 gallons/per inch of diameter/per mile/per day.

2. Sanitary sewers in pipe sizes 27 inches in diameter and larger shall perform Infiltration or Exfiltration testing in accordance with ASTM C 969. The Contractor has the option to use a portable Joint Tester at 5 psig per manufacturer's instructions.

a. Infiltration Test:

- (1) The Infiltration Test shall be used when the groundwater elevation is a minimum of 2 feet above the crown of the pipe for the entire length of the sewer. Where low ground water conditions exist, exfiltration tests shall be used.
- (2) The test shall be modified to allow a maximum permissible leakage not including manholes of 100 gallons/per inch of diameter/per mile/per day.

b. Exfiltration Test:

- (1) The test shall be modified to allow a maximum permissible leakage not including manholes of 100 gallons/per inch of diameter/per mile/per day.

3. Deflection Test

- a. All plastic pipe (sanitary and storm) having a pipe stiffness less than 200 psi shall be tested for proper installation by means of deflection attainment. Deflection testing is not required for plastic pipe with a pipe stiffness of 200 psi or greater. In addition to material tests, construction compaction and leakage tests required elsewhere in these Standards, Contractor is required to install the pipe in such a manner that the diametric deflection shall not exceed five percent (5%). To attain this requirement, the backfill materials surrounding the pipe shall be compacted to the required Standard Densities called out in ASTM D2321. The sectors requiring compaction shall include the bed and side fill material, as well as the material placed above the pipe for a distance of 12 inches.
 - b. Deflection tests shall be performed no sooner than 60 days following completion of backfill. Final deflection tests shall be performed by the responsible agency of an accredited, independent testing laboratory that shall submit verification records of results and dates tested. Maximum ring deflection of the pipe under load shall be limited to five percent (5%) of the base inside diameter listed in Manufacturer specifications.
 - c. Pipe failing to maintain the five percent (5%) maximum deflection diameter or larger shall be considered to have been improperly installed and shall be relaid or replaced by Contractor at no cost to Owner.
 - d. Deflection testing shall be accomplished by using an electronic deflectometer which produces a continuous record of diameter readings or by pulling a go, no-go gage through the pipe. Go, no-go gages may be mandrels, spheres, pin-sleds, or other device approved by Owner prior to testing.
- 4. If the installation fails to meet the requirements of this test, Contractor shall determine at his own expense the source of leakage. Contractor shall repair or replace all defective materials and/or Work and then re-test the installation for compliance with these Specifications for the line acceptance test.
 - 5. Owner shall reserve the right to require air test, infiltration test, or exfiltration test on separate storm sewers. The additional cost of such added inspections or tests shall be approved by Owner prior to commencing tests.

- C. Following any repairs and/or cleaning, the lines shall be retested and re-inspected.
- D. Contractor will be permitted to use a joint tester on field joints and test at 5 psig.

END OF SECTION 33 26 15

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SECTION 40 05 90.02

STAINLESS STEEL SLIDE GATES AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide and test stainless steel slide gates and appurtenances as indicated and in compliance with Contract Documents.

1.02 REFERENCES:

- A. American Society for Testing and Materials International (ASTM):
 - 1. A240: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 - 2. A276: Standard Specifications for Stainless Steel Bars and Shapes.
 - 3. B584: Standard Specification for Copper Alloy Sand Castings for General Applications.
 - 4. D2000: Standard Classification System for Rubber Products in Automotive Applications.
 - 5. D4020: Standard Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials
- B. American Welding Society Code.
- C. American Water Works Association (AWWA):
 - 1. C561: Fabricated Stainless Steel Slide Gates

1.03 SUBMITTALS:

- A. Submit the following shop drawings in accordance with Section 01 33 00:
 - 1. Certified shop and erection drawings. Contractor shall submit electronic files of the proposed equipment in the capacity, size, and arrangement as indicated and specified.
 - 2. Data for gate and actuator characteristics and performance.
 - 3. Complete description of all materials, material thicknesses of all components.

4. Maximum bending stress and deflection of the slide under design head specified and indicated.
5. Installation drawings showing the details required for installation, dimensions, clearances and anchor bolt locations.
6. Shop drawing data for accessory items.
7. Certified setting plans, with tolerances, for anchor bolts.
8. Manufacturer's literature as needed to supplement certified data.
9. Operating and maintenance instructions and parts lists.
10. For manufacturers not named provide a listing of reference installations as specified with contact names and telephone numbers.
11. Certified results of gate shop testing, including shop leakage test results of each gate at the design unseating head specified and indicated.
12. Certified results of actuator shop testing from the actuator manufacturer.
13. List of recommended spare parts other than those specified.
14. Shop and field inspection reports.
15. Qualifications of field service engineer.
16. Recommendations for short and long-term storage.
17. Shop and field testing procedures and set up.
18. Special tools.
19. Manufacturer's product data, specifications and color charts for shop painting.
20. Motor shop test results.
21. The latest ISO 9001 series certification or quality system plan.
22. Material Certification:
 - a. Provide certification from the equipment manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in

operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.

- b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.
 - B. A copy of the contract mechanical process, structural, electrical and instrumentation drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with “No changes required” or provide a statement that no changes are required.
 - 1. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.
 - C. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
 - 1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
 - 2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.
- 1.04 SPARE PARTS:
- A. Comply with the requirements specified in Section 01 61 00.
 - 1. One set of all special tools is required.
- 1.05 QUALITY ASSURANCE:
- A. Comply with the requirements specified in Section 01 43 00.
 - B. Gates shall be the product of one manufacturer.
 - C. Gates shall be manufacturer’s standard cataloged product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.

- D. Welding: In accordance with latest applicable American Welding Society Code, ASME Welding Code, or equivalent.
- E. Shop tests as specified, including shop leakage testing of each gate at the design unseating head to confirm compliance with the leakage rate specified and indicated.
- F. The Contractor shall obtain the gates, actuators and appurtenances from the gate manufacturer, as a complete and integrated package to insure proper coordination and compatibility and operation of the system.
- G. Provide services of factory-trained Service Technician, specifically trained on type of equipment specified:
 - 1. Service Technician must be present on site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.
 - 2. Installation: Inspect completed installation including grouting, location of anchor bolts; setting, leveling, alignment, field erection; coordination of electrical connection:
 - a. 1 person-days.
 - 3. Functional Testing: Calibrate, check alignment and perform a functional test. Tests to include all items specified.
 - a. 1/3 person-days.
 - 4. Field Performance Testing: Field performance test equipment specified.
 - a. 1/3 person-days.
 - 5. Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classroom sessions.
 - a. 1/3 person-days.
 - 6. Credit to the Owner, all unused service person-days specified above, at the manufacturer's published field service rate.
 - 7. Any additional time required of the factory trained service technician to assist in placing the equipment in operation, or testing or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.
- H. Manufacturer of gates shall have a minimum of five (5) operating installations with gates of the size specified and in the same service as specified operating for not less

than five (5) years or manufacturer of gates shall utilize a Project Manager that is experienced in stainless steel gate design and construction. The Project Manager shall be an employee of the gate manufacturer and shall have designed a minimum of five (5) operating installations with gates of the size specified and in the same service as specified operating for not less than five (5) years.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Comply with the requirements specified in Section 01 66 10.
- B. Electric actuators are to be shipped separate from the gate assembly.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION:

- A. Gate sizes and operating data are indicated in the Slide Gate Schedule in the Contract Drawings.

2.02 MANUFACTURERS:

- A. Stainless Steel Slide Gates:
 - 1. Golden Harvest
 - 2. RW Gate Co.
 - 3. Whipps

2.03 SEISMIC DESIGN REQUIREMENTS:

- A. The Contractor shall conform to the seismic design requirements for this project and for the work of this specification section.
- B. Provide all equipment bases, anchorage, supports and foundations designed in accordance with the seismic requirements indicated and specified.
- C. Additionally, provide with the Certificate of Unit Responsibility, certification for all equipment signed by a registered structural engineer stating that computations were performed and that all components have been sized for the seismic forces specified and indicated.

2.04 SLIDE GATE CONSTRUCTION:

- A. Provide all gates produced by a single manufacturer and designed for installation in the channels and structures as specified and indicated.
- B. Gate Configuration: As indicated in the Slide Gate Schedule.

- C. Provide all gates in conformance with AWWA C561 and as specified.
- D. Self contained, rising or non-rising stem, flush bottom type with self-adjusting seals.
- E. Gates with adjustable wedges or wedging devices are not acceptable.
- F. Provide all structural components 1/4-inch minimum thickness.
- G. Gate assemblies shall be media blasted or passivated in accordance with ASTM A380 prior to shipment to remove all mill scale, weld splatter, discoloration, or other surface imperfections.
- H. Leakage Rate:
 - 1. Seating head and unseating head conditions: Leakage not to exceed 0.05 gpm per foot of seating perimeter.
 - a. Assembly to consist of the following:
 - 2. Frame
 - 3. Slide
 - 4. Stem
 - 5. Seals
 - 6. Benchstand with operator type as indicated in the Slide Gate Schedule.
 - b. Materials:
 - 7. Frame Assembly and Retainers: ASTM A240 Type 316L stainless steel.
 - 8. Slides and Stiffeners: ASTM A240 Type 316L stainless steel.
 - a. 1/4-inch minimum thickness.
 - 9. Seat, seals and facing: ASTM D4020 UHMW (Ultra-high Molecular Weight Polyethylene
 - 10. Invert Seal for upward acting gates only: ASTM D2000 Neoprene or EPDM
 - 11. Stems: ASTM A276 Type 316 stainless steel.
 - a. Minimum diameter: 1-1/2-inch.
 - 12. Lift Nuts: ASTM B584 Bronze
 - 13. Floorstand and Wall Brackets: ASTM A276 Type 316L stainless steel.

14. Gear Operator Housing: Cast aluminum or ductile iron.
15. Hardware, studs and nuts: ASTM A276 Type 316 stainless steel.
16. Anchor bolts: Type 316 stainless steel. Minimum diameter of 1/2-inch.

I. Slide:

1. Slide and reinforcing stiffeners welded to the slide.
 - a. Stainless steel plate, minimum 1/4-inch.
 - b. Reinforcement: Provide a minimum of two horizontal stiffeners welded to the slide and two vertical stiffeners welded to outside of the horizontal stiffeners.
 - c. Provide slide to engage the guide a minimum of 1 inch on each side and have a minimum material thickness of 1/2 inch where it engages the guide.
 - (1) When the width of the gate in feet multiplied times the differential head in feet acting on the invert of the gate exceeds 120, provide a minimum thickness of 3 inches of slide edge engaging the guide.
 - d. Provide the stem connector constructed of two angles or plates welded to the slide. Provide a minimum of two bolts connecting the stem to the stem connector.
2. Deflection: Maximum of 1/720 of the span or 1/16 inch whichever is smaller, under design head specified.

J. Seals:

1. Provide a self-adjusting seal system suitable for the leakage, frequent cycling and velocities specified herein, and mounted such that there is no obstruction to the specified gate opening size.
2. Provide gates equipped with UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the frame and slide.
3. Extend the seat/seals to accommodate the 1.50 x the slide height with the gate in the fully open or fully closed position.
4. Provide all upward opening gates with a resilient flush bottom seal for sealing the invert of the gate.
5. Provide all seals mechanically fastened to the frame or slide, force fit seals or seals attached with adhesive are not acceptable.

6. Provide all seats and seals to be field replaceable without the need to remove grout or concrete and without the need to remove the frame from the wall or wall thimble.

K. Frames:

1. Provide frame assembly including guide members, invert members and yoke members constructed of formed stainless steel plate with a minimum thickness of 1/4-inch.
2. Provide gussets to support the guide members for unseating gates as required by the design head specified and indicated.
 - a. Provide gussets extended to support the outer portion of the guide assembly and positioned to transfer the load to the anchor bolts or the wall thimble studs.
3. Provide frames for mounting type as indicated in the Slide Gate Schedule.
 - a. Wall mounted with stainless steel anchor bolts and non-shrink, non-metallic grout or EPDM gasket.
 - b. Thimble mounted with stainless steel mounting studs and mastic gasket.
4. Provide all mounted and wall thimble mounted frames with a minimum guide weight of 13 lbs/ft and a minimum guide extension weight of 6.5 lbs/ft. The portion of the wall mounted guide where the anchors or wall thimble studs penetrate, shall have a minimum thickness of 1/2-inch.
5. Provide guide extensions constructed of C-channel shape or similar. Angles are not acceptable guide extensions.
6. Frame Guides and Invert Members: Provide frames as a one-piece, fully welded assembly.
 - a. Bolt-on yokes are acceptable when necessary to facilitate slide removal.
 - b. Frames that require field assembly are not acceptable unless the overall frame size exceeds a size suitable for shipment on a standard flat bed truck.
7. Provide the frame guides extending to accommodate the entire height of the slide when the slide is in the fully opened position on upward opening slide gates or downward opening weir gates.
8. For self-contained gates, provide a yoke across the top of the frame guides with the yoke formed by two structural members fixed to the top of the guides to provide a one-piece rigid frame.

- a. Provide the yoke designed to allow removal of the slide.
- 9. Provide a rigid stainless steel invert member across the bottom of the opening.
 - a. Invert member: Flush bottom type on upward opening gates with a minimum weight as specified.
- 10. Provide a rigid stainless steel top seal member across the top of the opening on gates designed to cover submerged openings.

L. Stems:

- 1. Provide a threaded operating stem to connect the operating mechanism to the slide.
- 2. For rising stem gates provide the threaded portion engaging the operating nut in the manual operator or motor actuator.
- 3. For non-rising stem gates provide the threaded portion engaging the nut on the slide.
- 4. Minimum stem outside diameter of 1-1/2 inches.
- 5. Stem extension pipes are not acceptable.
- 6. Provide the stem constructed of solid stainless steel bar for the entire length.
- 7. Tensile strength: Not less than 60,000 psi for stems.
- 8. Provide the stem threaded to allow full travel of the slide unless otherwise specified or indicated.
- 9. L/R: Not to exceed 200.
- 10. Motor Operators: Design stems to withstand in compression 1.30 x stalled output.
- 11. Provide the stem, in tension, designed to withstand a load caused by a 40 pound effort on the crank or handwheel without exceeding 1/5 of the ultimate tensile strength of the stem material.
- 12. Provide the threaded portion of the stem machined rolled or cut full depth ACME type threads with 16 micro-inch or better finish. Stub threads are not acceptable.
- 13. Provide stems of more than one piece joined by bronze or stainless steel couplings with the coupling bolted to the stem.
- 14. Provide dual stems for upward opening gates wider than 60-inch when the opening width is 2 x greater or more than the height of the slide. Provide dual

stems for downward opening gates wider than 48 inch when the opening width is 2 x greater or more than the height of the slide.

15. Provide stems on manually operated gates with an adjustable stop collar to prevent over closing of the gate.
16. For rising stem gates, provide clear plastic covers with 1-inch graduations. Provide vent holes to prevent condensation.

2.05 STEM GUIDES:

- A. Provide stem guides where required to maintain L/R of 200 or less for the unsupported length of the stem.
- B. Provide stem guides and brackets of Type 316L stainless steel.
 1. Adjustable in two directions
 2. Minimum Thickness: 1/4-inch.
 3. Bushings: UHMW or bronze

2.06 WALL THIMBLES:

- A. Provide a gasket or mastic to seal between the gate frame and the wall thimble.
- B. For mounting to existing cast iron and ductile iron thimbles provide new slide gates suitable for bolting to existing thimbles. Contractor to verify thimble dimensions and bolting pattern and submit with shop drawings.
 1. Clean existing thimbles and provide 1/4-inch thick elastomeric gasket.

2.07 ELECTRIC MOTOR ACTUATORS:

- A. Provide in accordance with Section 40 23 13.03

2.08 SHOP PAINTING:

- A. Primer and Finish Paint: Shop apply to all exterior ferrous surfaces, high solids epoxy.
- B. Ferrous surfaces which are not to be painted shall be given a shop applied coat of grease or rust resistant coating.
- C. Provide additional shop paint coating for touch-up to all surfaces after installation and testing is completed and equipment accepted.

2.09 SHOP TESTING:

- A. Assemble each gate and inspect for proper seating.

1. Check clearance between frame and disc seating surfaces.
- B. Fully open and close each gate in guide system to insure gates operate freely as recommended by the gate manufacturer.
- C. Conduct a shop leakage test at the design unseating head on each gate to confirm leakage as specified and indicated for Field Testing.
- D. Operate floorstands and benchstands to insure proper assembly and operation.
- E. Repeat tests until specified results are obtained.
- F. Correct or replace promptly all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install items in accordance with shop drawings, manufacturer's printed instructions and as indicated.
- B. Clean debris, dirt, and gravel, from inside of gates and channels before placing gates.
- C. Install slide gates in completely assembled condition.
- D. Erect and support slide gates in positions free from distortion and strain on appurtenances during handling and installation.
- E. Inspect material for defects in workmanship and material.
- F. Clean out debris and foreign material from gate opening and seats, test operating mechanisms to check proper functioning, and check nuts and bolts for tightness. Repair gates and other equipment which do not operate easily or are otherwise defective.
- G. Set floorstand operators and stem guides so stems run smoothly in true alignment. Anchor guides firmly to walls. Check distances from centerlines of gates to operating level or base of floorstand and adjust if necessary to suit actual conditions of installation.

3.02 FIELD TESTING:

- A. Comply with the requirements specified herein.
- B. Field testing will not be conducted without a procedure accepted by the Engineer calibration certificates for all testing equipment, gauges and flow meters and a completed and signed pretesting check list. See Division 1 for checklist.

- C. After installation of gates, and after inspection, operation, testing and adjustment have been completed by the manufacturer's field service technician, conduct operating and leakage test for each gate in presence of the Engineer to determine its ability to operate as specified, and to operate smoothly without jamming under specified conditions.
 - D. Test all operators.
 - E. Leakage Test: Leakage not to exceed 0.05 gpm per foot of seal perimeter.
 - 1. Conduct tests at design heads shown in the slide gate schedule.
 - F. Immediately correct or replace all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.
 - G. Repeat tests until specified results are obtained.
 - H. Contractor to provide all water labor, piping, testing equipment for conducting tests.
 - I. Make all adjustments necessary to place equipment in specified working order at time of above tests.
 - J. Remove and replace equipment at no additional cost to the Owner with equipment that will meet all requirements specified and indicated if unable to demonstrate to the satisfaction of the Engineer that equipment will perform the service specified, indicated and as submitted.
- 3.03 FIELD TOUCH-UP PAINTING:
- A. After installation and testing accepted by the Engineer, apply touch-up paint to all scratched, abraided and damaged shop painted surfaces. Coating type and color shall match original painting.
- 3.04 CONTRACT CLOSEOUT:
- A. Provide in accordance with Section 01 77 00.

END OF SECTION 40 05 90.02

SECTION 40 23 13.01

PROCESS VALVES AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide and process valves and appurtenances as indicated and in compliance with Contract Documents.

- 1. Provide sizes and capacities as indicated or specified.

1.02 REFERENCES:

- A. American Society of Mechanical Engineers (ASME):

- 1. B1.20.7: Hose Coupling Screw Threads.
 - 2. B16.1: Standard for Cast Iron Pipe Flanges and Flanged Fittings, 125 lb.
 - 3. B16.4: Cast-Iron Threaded Fittings, Class 125 and 250.
 - 4. B16.10: Face-to-Face and End-to-End Dimensions of Ferrous Valves.

- B. ASTM International (ASTM):

- 1. A48: Standard Specification for Gray Iron Castings.
 - 2. A126: Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - 3. A536: Standard Specification for Ductile Iron Castings.

- C. American Water Works Association (AWWA):

- 1. C500: Metal-Seated Gate Valves for Water Supply Service.
 - 2. C504: Rubber-Seated Butterfly Valves.
 - 3. C509: Standard Specifications for Resilient-Seated Gate Valves for Water and Sewage Systems.
 - 4. C516: Large Diameter Rubber-Seated Butterfly Valves. 78-inch (2000 mm) and Larger
 - 5. D102: Coating Steel Water-Storage Tanks.

1.03 SUBMITTALS:

A. Submit the following in accordance with Section 01 33 00:

1. Data, regarding valve characteristics and performance including Cv.
2. Shop drawing data for accessory items.
3. Manufacturer's literature as needed to supplement certified data.
4. Operating and maintenance instructions and parts lists.
5. Listing of reference installations as specified with contact names and telephone numbers.
6. Valve factory test results.
7. Qualifications of field service technician.
8. Shop and Field inspections reports.
9. List of recommended spare parts other than those specified.
10. Recommendations for short and long term storage.
11. Special tools.
12. Shop and field testing procedures and equipment to be used.
13. Number of service technician days provided and per diem field service rate.
14. Manufacturer's product data and specifications for shop painting.
15. Provide a layout drawing, plan and section showing orientation of plug, gate, check, ball valves and actuators and nearest obstructions for each valve.
16. Manufacturer's product data and specifications for shop painting.
17. Provide a listing of the materials recommended for each service specified and indicated. Provide documentation showing compatibility with process fluid and service specified and indicated.
18. The latest ISO 9001 series certification or quality system plan.
19. Material Certification:
 - a. Provide certification from the equipment manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated. If materials other than those specified are

proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.

- b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.

B. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations and clarifications from the specified requirements.

- 1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
- 2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specification and justification are resubmitted with the entire package.

1.04 SPARE PARTS:

- A. Comply with requirements specified in Section 01 61 00.

1.05 QUALITY ASSURANCE:

- A. Comply with the requirements specified in Section 01 43 00.
- B. Provide enclosures for the area classifications specified and indicated.
- C. Contractor responsible for verifying outside diameter of pipe to be tapped.
- D. Services of Manufacturer's Representative as stated in Section 01 43 00 and specified herein.
- E. Manufacturer of valve shall have a minimum of five (5) operating installations with pumps of the size specified and in the same service as specified operating for not less than five (5) years.
- F. If equipment proposed is heavier, taller, different laying length or requires more operating space than specified and indicated; provide all structural, architectural, mechanical, electrical and plumbing revisions at no additional cost to the Owner.

1. If equipment is heavier than specified, the Contractor shall provide all hoisting equipment sized to maintain the minimum safety factor between the specified maximum equipment weight and the lifting capacity of the hoisting equipment indicated and specified.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Comply with the requirements specified in Section 01 66 10 and as specified.

PART 2 - MATERIALS

2.01 RESILIENT SEAT GATE VALVES 12-INCH AND SMALLER:

- A. Resilient Seat Gate Valves:

1. Manufacturers-OS&Y and NRS Type Valves:

- a. J&S
- b. Kennedy
- c. Clow

- B. General:

1. Provide valves that conform to NSF Standard 61.
2. Non-potable water service: Provide resilient seat gate valves for all sizes indicated. If resilient seat valves are not available provide solid wedge gate valves.
3. Potable water service: Provide resilient seat gate valves for all sizes indicated. If resilient seat valves are not available provide double revolving disc gate valves.
4. Provide metallic seated valves conforming to AWWA C500 except as herein modified.
5. Provide resilient seated valves conforming to AWWA C509 except as modified herein.

- C. Materials:

1. Body and Bonnet: ASTM A536 ductile iron.
2. Wedge: ASTM A536 ductile iron encapsulated with EPDM.
3. Provide all other materials as specified in AWWA C500 and C509. Working water pressure:

Valve Size	Pressure Rating
inch	psi
3 to 16	250
18 & Larger	150

4. Exposed Valves: Flanged OS&Y valves. Face-to-face dimensions to comply with ANSI B16.10, flanges to comply with ANSI B16.1.
 5. Buried Valves: Mechanical joint or push-on joint ends, non-rising stem valves with operating nut in lieu of hand wheel. Provide gate boxes, steel extension stems or universal-joint operating rods with 2-in square operating nuts at upper end with coupling connected to valve stem to bring to operating nut to within 6 inches of ground surface.
 6. Provide counterclockwise rotation to open valves.
 7. Provide handwheels with arrow and word "open" to indicate open direction.
 8. Provide geared operators where indicated. Gearing shall be steel with enclosed cases.
 - a. Provide spur gears for buried valves with stems vertical
 - b. Provide bevel gears where required by position of valve.
 - c. Provide buried valves with totally enclosed gear cases to enclose both the gears and valve stuffing box and provide gasketed Type 316 stainless steel removable cover plates with Type 316 stainless steel fasteners to allow access to the stuffing box.
 9. Chainwheels: Provide where required as specified herein. Provide beveled gear operator to mount chainwheel in vertical position. Provide valve mounted so that the arrow indicator will be visible from the floor level.
 10. Provide conventional packing in OS&Y valves.
 11. Provide conventional packing or double O rings in non-rising stem valves.
 12. Valves capable of being repacked or O ring replaceable while under pressure.
 13. Provide Type 316 stainless steel bolts and bronze nuts for stuffing box follower.
- D. Provide all gate valves with all internal and external wetted parts coated with a fusion bonded epoxy in accordance with ANSI/AWWA C550.
- 2.02 GATE VALVES - 4-INCH AND SMALLER:
- A. Manufacturers:

1. Aloyco
2. Merit Brass
3. Or approved equal

B. Valves 1/2-inch to 2-inch:

1. Working Pressure: 200 psi.
2. Rising stem type.
3. Ends: Threaded ASME 1.20.1.
4. Materials:
 - a. Body, Bonnet and Disc: ASTM A351 CF8M.
 - b. Stem and Gland: ASTM A276 Type 316 stainless steel.
 - c. Packing and Gaskets: PTFE.
 - d. Handwheel: Aluminum.

C. Valves 1/2-inch to 4-inch:

1. Working Pressure: ANSI Class 150.
2. OS&Y, bolted bonnet, solid or flexible wedge disc type.
3. Ends:
 - a. 1/2-inch to 2-inch: Threaded
 - b. 1/2-inch to 4-inch: Flanged ANSI B16.5.
4. Materials:
 - a. Body, Bonnet and Disc: ASTM A351 CF8M.
 - b. Stem and Gland: ASTM A276 Type 316 stainless steel.
 - c. Packing and Gaskets: PTFE.
 - d. Handwheel: ASTM A536.

2.03 BUTTERFLY VALVES – AERATION SERVICE:

A. Manufacturers:

1. DeZurik
 2. Bray
 3. Flowseal
 4. ABZ
- B. Provide valves rated for 250 degree F continuous operation and 300 degree F intermittent operation.
- C. Body:
1. Wafer-lug type with full-lug body, drilled and tapped for mounting bolts design.
 2. Material:
 - a. Type 316 stainless steel
 - b. ASTM A126 cast or ASTM A536 ductile iron
 3. Provide to mate with 125 pound ANSI B16.1 (Class 125) flanges.
 4. Wafer type valves are not acceptable.
- D. Seat: Dovetail, EPDM, installed in the body with elastomer formed continuously over the ends to provide seal with mating pipe flanges.
- E. Disk: Air profile design, aluminum bronze ASTM B148 Alloy 952 or Type 316 stainless steel. Provide bubble-tight shut off at 25 psi working air pressure.
- F. Stem: One-piece of Type 316 stainless steel with bronze or Teflon bushings and EPDM or Buna-N O rings or self-adjusting packing.
1. Disc stem connection:
 - a. 12-inch and smaller: Type 316 stainless steel torque plug.
 - b. 14-inch and larger: Type 316 stainless steel disc screws.
- G. Valve Operators:
1. Manually operated valves 12-inch and smaller provide lever-type with 10-position lock plate and valve position indicator.
 2. Manually operated valves 14-inch and larger provide geared-type permanently lubricated, totally enclosed operator with stops to prevent over-travel, and with valve position indicator and hand wheel or chain wheel as specified.

3. Provide chainwheel operator where required as specified herein.
4. Electric motor actuators: Provide in accordance with Section 40 23 13.03.

2.04 BUTTERFLY VALVES – HIGH PERFORMANCE:

A. Manufacturers:

1. Bray
2. Flowseal
3. Emerson
4. DeZurik

B. Working Pressure Rating:

1. ANSI Class 150
2. ANSI Class 300

C. Provide bi-directional bubble tight shut-off and suitable for dead-end service with removal of downstream flange.

D. Body: Type 316 stainless steel lug design.

E. Disc: Double offset design with 360 degree uninterrupted spherical edge for sealing and constructed of Type 316 stainless steel.

F. Shaft: Provide blow out proof shaft. The shaft shall be Type 316 stainless steel and positively attached to disc with Type 316 stainless steel wedge pins.

G. Seats: PTFE with encapsulated Viton O-ring creating self-energized sealing capability.

H. Packing: Chevron design TFE to prevent external leakage out of valve neck to full ANSI hydrostatic shell test pressure.

I. Valve Operators:

1. Manual Valves:

- a. Provide valves 6-inch and smaller with ten position latch-lock lever operators.
- b. Provide valves 8-inch and larger with manual gear operator and handwheel.

2. Provide chainwheels where required as specified herein.

3. Electric Actuators: Provide in accordance with Section 40 23 13.03.

2.05 BALL VALVES – GENERAL SERVICE:

A. Manufacturers:

1. Jamesbury
2. KF
3. Inline
4. Kitz
5. Apollo

B. Valves 1/2-inch through 4-inch

1. Materials:

- a. Body and End Cap: Three piece, ASTM A351 Grade CF8M.
- b. Body Seal: PTFE.
- c. Seat: RTFE.
- d. Ball: Type 316 stainless steel.
- e. Stem: Type 316 stainless steel.

2. Pressure Rating:

- a. 1/2-inch through 2-inch: 1000 psi at 100 degrees F
- b. 2-1/2-inch through 4-inch: 800 psi at 100 degrees F

3. Ends:

- a. 2-inch and Smaller: Screwed or flanged.
- b. 3-inch and larger: Flanged.

C. Valves 4-inch through 12-inch.

1. Materials:

- a. Body and Adaptor: Two piece, ASTM A351 Grade CF8M.
- b. Seat: TFE.
- c. Ball: Type 316 stainless steel.

- d. Stem: Type 316 stainless steel.
- 2. Pressure Rating: ANSI Class 150.
- 3. Ends: Flanged.

D. Actuators:

- 1. Manual:
 - a. 4-inch and Smaller: Lever.
 - b. 6-inch and Larger: Gear operator.
 - c. Provide chainwheels where required as specified herein.
- 2. Electric Motor Actuators: Provide in accordance with Section 40 23 13.03.

2.06 FLOORSTANDS-NRS INDICATING TYPE:

A. Manufacturer:

- 1. Trumbull Industries
- 2. Troy Valve

B. Type: Non-Rising Stem (NRS), Indicating.

C. Materials:

- 1. Pedestal: Cast Type 316 stainless steel with a vertical indicating slot.
- 2. Indicator: Bronze. Provide indicator that travels on a threaded stem to indicate the position of the valve.
- 3. Handwheel: Type 316 stainless steel, 12-inch diameter.
- 4. Couplings: Type 316 stainless steel.

D. Provide the word “OPEN” cast in the pedestal at the top of the indicating slot and provide a “CLOSED” tag mounted to the pedestal, to indicate the closed position of the valve.

E. Floorstands fabricated by welding flanges to pipe are not acceptable.

2.07 EXTENSION STEMS:

A. Manufacturer:

- 1. Trumbull Industries

- 2. Troy Valve
- B. Provide where indicated and required for operation of all valves.
- C. Material:
 - 1. Stems: Type 316L solid stainless steel bar or Schedule 40 Type 316L pipe
 - a. Minimum Size: 1.25-inch diameter, Slenderness ration <200
 - 2. Connectors, thrust relief assemblies, torque tube assemblies, universal joints and operating nuts: Type 316 or Type 316L stainless steel
 - 3. Miter gears: Cast Type 316 stainless steel with a 1:1 gear ratio.
 - a. Provide recessed grease fittings and Buna-N O-Rings on each end adaptor.

2.08 FLOOR BOXES-CAST IRON

- A. Manufacturer:
 - 1. Trumbull Industries
 - 2. Troy Valve
- B. Provide floor boxes where indicated to provide support for extension stems for non-rising stem valves and a cover for the operating nut.
- C. Floor Box Depth: 6 inches and capable of use in thicker floors with a 2-1/2-inch or 3-inch schedule 40 steel pipe nipple
- D. Materials:
 - 1. Body and Cover: Cast Iron ASTM A126
 - 2. Bushing: Bronze, NSF 61
 - 3. Hardware: Type 316 stainless steel

2.09 STEM GUIDES:

- A. Manufacturer:
 - 1. Trumbull Industries
 - 2. Troy Valve
- B. Provide valve stem guides where indicated and as required by the valves manufacturer.

C. Stem Guide Spacing: 6 to 8 feet, maximum slenderness ratio of 200.

D. Stem Guides for Stems 2-inch and Smaller:

1. Materials:

- a. Stem Guide: Cast Type 316 stainless steel with 2 to 36-inch adjustment.
- b. Bushing: Bronze, NSF 61
- c. Hardware: Type 316 stainless steel.

E. Stem Guides for Stems 2-1/8-inch to 4-inch:

1. Materials:

- a. Stem Guide: Ductile Iron 65-45-12 with 2-3/4 to 17-1/4-inch adjustment.
- b. Bushing: Split type, Bronze, NSF 61
- c. Hardware: Type 316 stainless steel.

2.10 POSITION INDICATORS:

A. Manufacturer:

- 1. Trumbull Industries
- 2. Troy Valve

B. Provide position indicators installed on all multi-turn valves and quarter turn valves with gear boxes 3 inch and larger.

- 1. Type: Planetary gear design.

C. Materials:

- 1. Provide the sun gear, planet gear, ring gears and scale plate constructed of Delrin.
- 2. Housings of carbon steel or aluminum are not acceptable.
- 3. Hardware and Fasteners: Type 316 stainless steel.

D. Position Indicator Design Features:

- 1. Provide the position indication to show the position of the valve, from fully open to fully closed, identified at ground level.

2. Movement of the indicating arrow must be visible through a window covering a minimum of 300 degrees of the circumference of the indicator.
3. Size of the characters and numerals: minimum 3/16-inch.
4. Provide the top scale plate with markings representing the number of turns, contain the word "CLOSED", and a directional arrow.
5. Provide permanently recessed, embossed or engraved markings in the scale plate. The use of adhesive labels is not acceptable.
6. Provide the "OPEN" line marked on a transparent polycarbonate window, field adjusted for the number of turns of each valve size.
7. Provide the position of the adjustable "OPEN" window secured to the top surface of the scale plate by the outside diameter of three Type 316 stainless button head cap screws.
8. Provide all adapters to secure the position indicator, for installation in either a valve box, floor box or wall bracket as indicated and required.
9. Provide the position indicator and adapter with matching flat sides to prevent rotation of the indicator during operation.

E. Exposed and Submerged Valves:

1. Provide a Type 316 stainless steel extension stem connected to a 2 inch square nut on the valve and extend up through the position indicator, terminating in a 2 inch square nut, operable by a standard waterworks tee-handle wrench.

F. Buried Valves:

1. Provide the position indicator installed in a valve box within 6 inches of grade.

G. Valves Installed Inside a Structure:

1. Provide the position indicator installed in a floor box.
2. Where a floor is not directly over the valve and extension stem, support position indicators with a Type 316 stainless steel wall bracket mounted to a side wall.
3. When installed in a floor, provide the adapter with a bronze bushing to support and center the extension stem with the bronze bushing retained in the cast iron floor adapter by two Type 316 stainless steel screws and drilled to an inside diameter 1/16-inch larger than the outside diameter of the extension stem.

2.11 ELECTRIC ACTUATORS:

- A. Provide in accordance with Section 40 23 13.03.

2.12 SHOP PAINTING:

- A. Coat internal and external ferrous surfaces of valve with NSF Certified Epoxy in accordance with ANSI/NSF Std. 61, and in conformance to AWWA D102 Inside System No. 1 for all valves not specified to have a fusion bonded epoxy coating.
- B. Process Valve Color: In accordance with Section 09 91 10.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Prior to installation, protect stored valves and appurtenances from damage due to exposure to sunlight, heat, dirt, debris, freezing and thawing, vandalism, etc.
- B. Clean all debris, dirt, gravel, etc., from inside of piping before placing valves in place.
- C. Erect and support valves in respective positions free from distortion and strain on appurtenances during handling and installation. Inspect material for defects in workmanship and material. Clean out debris and foreign material from valve openings and seats, test operating mechanisms to check functioning, and check nuts and bolts for tightness. Repair, valves and other equipment which do not operate easily or are otherwise defective at no additional cost to the Owner.
- D. Set plumb and support valves in conformance with instructions of manufacturer. Shim valves mounted on face of concrete vertically and grout in place. Install valves in control piping for access.
- E. Provide bolted split sleeve coupling or flexible type grooved coupling on downstream side of buried valves to assist in valve removal.
- F. Provide chainwheels with chain and chain guides as specified herein for all manually operated valves with centerlines of handwheels or gear operators higher than 6.5 feet above the operating floor level.
- G. Where indicated provide Type 316 stainless steel stem extension to operating floor elevation as shown and provide the bevel gear operator with a fabricated steel floorstand and handwheel.

3.02 GATE VALVES AND KNIFE GATE VALVES:

- A. Install gate valve stem as shown or with stems between vertical and 45 degrees above the horizontal. Valves installed with stems horizontal or below horizontal are not acceptable.

3.03 CHECK VALVES:

- A. Install check valves horizontally in pipelines unless otherwise indicated.

- B. Install ball check valves in the vertical unless otherwise indicated.
- 3.04 PLUG VALVES:
- A. Install valves in horizontal piping with shaft horizontal such that in the open position the plug is located in the upper part of valve body. Orient valves so that in closed position, flow is against the face of the plug and plug location is as indicated.
- 3.05 FLOORSTAND OPERATORS AND STEM GUIDES:
- A. Set floorstand operators and stem guides so stems run smoothly in true alignment. Anchor guides to walls. Check distances from **center**lines of gates to operating level or base of floorstand and adjust if to suit actual conditions of installation.
- 3.06 VALVE BOXES:
- A. Provide valve box for each buried valve and where indicated.
 - B. Set box so top is flush with finished surface and so box does not bear on valve, or pipe.
- 3.07 FIELD TESTING:
- A. Pressure test valves with pipeline pressure testing.
 - B. Test functions of each valve.
 - C. Make all adjustments necessary to place valves in specified working order at time of above tests.
 - D. Remove all replace valves and appurtenances at no additional cost to the Owner with equipment that will meet all requirements specified and indicated if unable to demonstrate to the satisfaction of the Engineer that valves will perform the service specified, indicated and as submitted and accepted.
- 3.08 FIELD TOUCH-UP PAINTING:
- A. After installation and accepted testing by the Engineer, apply touch-up paint to all scratched, abraided and damaged shop painted surfaces. Coating type and color shall match shop painting.
- 3.09 CONTRACT CLOSEOUT:
- A. Provide in accordance with Section 01 77 00.

END OF SECTION

SECTION 40 23 13.03

ELECTRIC MOTOR ACTUATORS AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide electric motor actuators and appurtenances as indicated and in compliance with Contract Documents.

- 1. Actuators for all valves and equipment to be the product of one manufacturer.

1.02 REFERENCES:

- A. ASTM International (ASTM):

- 1. B117: Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - 2. B179: Standard Specification for Aluminum Alloys in Ingot and Molten Forms for Castings from All Casting Processes.

- B. FM Global (FM):

- 1. 3615: Explosionproof Electrical Equipment General Requirements.

- C. Institute of Electrical And Electronics Engineers (IEEE):

- 1. 802.15.4: Standard for Information Technology.

1.03 SUBMITTALS:

- A. Submit the following in accordance with Section 01 33 00:

- 1. Certified shop and erection drawings.
 - a. Drawings shall be in conformance with all other requirements as specified in this specification.
 - 2. Data, regarding actuator and motor characteristics and performance.
 - 3. Actuator and Valve set-up for each application: Position or torque seating
 - 4. Shop drawing data for accessory items.
 - 5. Manufacturer's literature as needed to supplement certified data.
 - 6. Operating and maintenance instructions and parts lists.

7. Listing of reference installations as specified with contact names and telephone numbers.
8. Actuator shop test results.
9. Motor shop test results.
10. Qualifications of field service engineer.
11. Schematic control and power wiring diagrams.
12. Shop and Field inspections reports.
13. Recommended spare parts other than those specified.
14. Recommendations for short and long term storage.
15. Special tools.
16. Shop and field testing procedures and equipment to be used.
17. Torque capability and settings for each actuator.
 - a. Provide a listing of operating torque, safety factor applied and actuator torque capability and actuator safety factor as specified for each valve, gate and equipment.
18. Number of service person days provided and per diem field service rate.
19. Manufacturer's product data and specifications for shop painting including statement of compliance for compatibility with field painting.
20. Provide a listing of the materials recommended for each service specified and indicated.
21. ISO 9001 certification.
22. Material Certification:
 - a. Provide certification from the equipment manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of three (3) years. Provide proposed materials at no additional cost to the Owner.

- b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.
- B. A copy of the contract mechanical process, electrical and instrumentation drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with "No changes required".
 - 1. Failure to include all drawings or a statement application to the equipment specified in this section will result in submittal return without review until a complete package is submitted.
- C. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
 - 1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
 - 2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.04 SPARE PARTS:

- A. Comply with the requirements specified in Section 01 61 00.
- B. Provide for each Actuator:
 - 1. Two fuses of each size
 - 2. Three spare DeviceNet cards.
 - 3. Two complete sets of circuit boards for actuators
- C. Provide spare parts that are identical to and interchangeable with similar parts installed.
 - 1. One set of all special tools
 - 2. Supply each actuator with a start-up kit consisting of installation instructions, electrical wiring diagrams and two sets of cover screws and seals.

1.05 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01 43 00 and as specified herein.

- B. Actuators for all valves, gates and equipment to be the product of one manufacturer.
 - 1. Contractor to coordinate with all valve suppliers.
- C. Actuators to be manufacturer's standard cataloged product and modified to provide compliance with the specifications and the service conditions specified and indicated.
- D. Shop tests as specified.
- E. Provide Services of Manufacturer's Representative as specified herein.
- F. Provide services of factory-trained Service Technician, specifically trained on type of equipment specified:
 - 1. Service Technician must be present on site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.
 - 2. Installation: Inspect setting, alignment, field erection; coordination of electrical and miscellaneous utility connections:
 - a. 1/2 person-day per actuator.
 - 3. Functional Testing: Calibrate, check alignment and perform a functional test. Tests to include all items specified.
 - a. 1/2 person-day per actuator.
 - 4. Field Performance Testing: Field performance test equipment specified.
 - a. 1/2 person-day per actuator.
 - 5. Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classrooms sessions.
 - a. 1/2 person-days, 1 trips.
 - 6. Credit to the Owner, all unused service person-days specified above, at the manufacturer's published field service rate.
 - 7. Any additional time required of the factory trained service engineer to assist in placing the equipment in operation or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.
- G. Manufacturer of actuators must have at least five (5) operating installations with actuators of the type and size specified and in the same service as specified operating for not less than five (5) years.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Provide in accordance with Section 01 66 10 and as specified.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. AUMA

2.02 ELECTRIC ACTUATORS – 3 PHASE:

- A. Each actuator shall include electric motor, reduction gearing, reversing starters, thermal overloads, controls transformer, limit controls, non-intrusive local controls as a complete integrated package to ensure proper coordination, compatibility, and operation of the system.
 - 1. Provide actuators capable of setting of torque, turns, and configuration of indication contacts.
 - 2. Provide actuators with torque capability 150 percent above the maximum operating torque required by each valve, gate or equipment.
 - 3. Enclosure:
 - a. Watertight to IP68, classification. Enclosure must be certified NEMA 6 for all units except those in classified areas.
 - 4. Provide an internal watertight compartment to protect switches, contacts, motor and internal electronics from ingress of moisture and dust when the external terminal cover is removed.
 - 5. Breathers, drains and or heaters are not permitted, enclosure must be totally sealed.
 - 6. Provide each actuator with a handwheel for manual operation. Provide a hammerblow device which permits motor to come up to speed before picking up load and unseating valve.
- B. Motors:
 - 1. Modulating applications: motors, Class H with a 30 minute duty rating.
 - 2. Motor: Low inertia, high torque type, specifically designed for use with motor actuators, to prevent over travel.
- C. Provide internal clutch that cannot engage handwheel operating mechanism and motor-operating mechanism at the same time. Friction type declutching is not acceptable.

1. Provide handwheel with arrow and the word CLOSE or SHUT cast on handwheel to indicate turning direction to close.
2. Handwheel must not rotate during power operation.
3. Provide handwheel and low gear ratio combined to give maximum rate of movement possible with 80 lb. rim pull.

D. Drive Unit:

1. Metal worm wheel and worm shaft type.
2. Provide an oil filled drive housing. Grease lubrication is not acceptable.
3. Worm shaft to operate in ball or roller bearings and be machine cut, ground, and highly polished, hot rolled steel, hardness 50-60 Rockwell Scale C bronze worm wheel with large contact area. Provide mating surfaces of dissimilar metals to prevent galling. Cast metals or gears manufactured from non-metallic materials are not acceptable.
4. Worm and shafts: Heat treated steel and accurately machined. Output or driving shaft to operate in bronze bearing or in ball or roller bearings.
5. Make provisions to take thrust in both directions.
6. Worm and wheel to be oil lubricated at all times.
7. Drive housing: Cast iron or aluminum depending on size of actuator offered, all thrust or torque bearing components shall be ductile iron.
8. Provide drive bushing as part of a detachable thrust base making for easy retrofit.

E. Fully wire electric motor operators at factory and furnish complete with terminal strips for external power and control connections. Wiring: copper with tropical grade PVC cover. Internal wiring to remain in a water tight compartment with external cover removed.

F. Provide manual or automatic control as indicated and specified.

G. Manual Control: Provide the following Control, Status, Alarm and Diagnostic capabilities locally, at the actuator:

1. Control:
 - a. Open/Stop/Close.
 - b. Desired Valve Position Control 0-100 percent.
2. Status:

- a. Motor Running Open Direction.
 - b. Motor Running Close Direction.
 - c. Fully Open.
 - d. Fully Closed.
 - e. Percentage Open 0-100 percent in 1 percent increments.
 - f. Percentage Output Torque 0-100 percent in 1 percent increments.
3. Alarms:
- a. Remote Control Communications Failure.
 - b. Actuator Alarm.
 - c. Valve Alarm.
 - d. Battery Low Alarm.
- H. Provide each actuator fitted with six (6) hard-wired configurable contacts. Each Contact shall be rated at 5A, 250VAC, 30VDC and able to provide any one of the following:
1. Status:
- a. Valve Fully Open.
 - b. Valve Fully Closed.
 - c. Valve Opening or Closing.
 - d. Valve Moving (Continuous or Pulsing).
 - e. Local Stop Selected.
 - f. Local Selected.
 - g. Remote Selected.
 - h. Open or Close Interlock Active.
2. Alarms:
- a. Motor Tripped on Torque in Mid-Travel.
 - b. Motor Tripped on Torque Going Open.
 - c. Motor Tripped on Torque Going Closed.

- d. Pre-Set Torque Exceeded.
 - e. Valve Jammed.
 - f. Actuator Being Operated by Handwheel.
 - g. Lost Main Power Phase.
 - h. Customer 24V DC or 120V AC Supply Lost.
 - i. Battery Low.
 - j. Internal Failure Detected.
 - k. Thermostat Tripped.
- I. Provide a back-up power source or terminal point for a remote power source integral to the actuator to ensure that in the event of a main power supply loss or failure that the indication contacts still function on change of status.
- J. Provide contacts and operating parts made of non-corrodible metal and suitable for a sea atmosphere and for contact with H₂S.
- K. Control
- 1. Provide a two wire control system. The control system shall be DeviceNet conforming to the Open Device Vendor Association, Inc. (ODVA) DeviceNet specification.
 - 2. The Control System shall incorporate the following features:
 - a. Two wire data highway for both Open/Close and modulating service.
 - b. ROM and/or battery RAM memory.
 - c. May be configured with a PC, hand-held module or master station.
 - d. Field unit to be integral to the actuator with parameters stored in EEPROM. The unit shall be powered from the actuator.
 - e. Provide system so that shorts, grounds or breaks in the data highway will not affect operation of the loop.
 - f. Self diagnostics shall pinpoint any breaks, grounds, shorts, or other faults.
 - g. The communication port to the SCADA shall comply with the International D type connection standards.

- L. Starters/transformers: Consists of two relay contactors, 3-pole, mechanically interlocked, reversing with suitable arc suppressors.
1. Electrical Service:
 - a. 460V, 3-phase, 60 Hertz.
 2. Provide inverse time element overload relays.
 3. Provide a control transformer capable of generating either 110VAC (220VAC) or 24VDC.
 4. Provide electromechanical starter capable of OPEN/CLOSE sixty starts per hour or solid state starter for modulating service capable of 1200 starts per hour.
 5. Provide replaceable fuses to protect wiring, fuses must be locally available.
 6. Provide automatic phase correction.
- M. Limit Controls:
1. Type: Positive in action ensuring tight seating and full openings.
 2. Position Setting Range: 2.5 to 100,000 turns, with resolution of 7.5 degrees of one actuator output revolution.
 3. Provide mechanism designed to minimize drift or over-travel and to open or close valve, gate or equipment to fixed, predetermined limits of opening and closing travel.
 4. Provide controls that disconnect driving mechanism from stem. Geared limit or torque type as required capable of predetermined limits of opening and closing travel. Potentiometers for position transmission are not acceptable.
 5. Provide torque switches for both directions of travel.
 - a. Sensing to be independent of voltage fluctuation.
 - b. Provide torque protection to prevent repeated starting in the same direction.
 - c. The initial unseating hammer blow shall not cause overtorque.
 - d. Provide torque switch settings independent of OPEN/CLOSE position switches.
- N. Provide actuator sized to close valve, gate or equipment against differential pressure as specified and indicated. Size actuator motor to seat and unseat valve gate or equipment and ensure torque switch trip at maximum valve torque when supply voltage is 10

percent below normal. Size motor to open or close valve, gate or equipment to satisfy the process dynamics.

O. All fasteners and hardware: Type 316 stainless steel.

P. Secondary Gear Boxes:

1. Provide secondary gearing for multi turn or quarter-turn applications where operating times, thrust or torque considerations require.
 - a. Secondary Gearing: Bevel or spur, totally enclosed in a cast iron housing, fully sealed and lubricated for the service indicated and specified.
2. Provide gear assemblies that are a manufacturer's standard selection or combination of as detailed in published product literature.
 - a. Provide each gearbox with a removable output drive coupling sized for the service specified and indicated.
 - b. Provide quarter-turn gearboxes equipped with adjustable mechanical stops (at 0 and 90 degrees +/- 5 percent) to permit limiting open and closed travel during manual operation.
 - c. Factory prime and finish paint all gear boxes with 2 part high solids epoxy or as specified herein for the actuator.

2.03 SHOP TESTS:

A. Motor Test:

1. Give each motor a standard commercial test in the shop of the motor manufacturer, and submit certified copies of the test results to the Engineer for review prior to installation of the motors.

B. Actuator Testing:

1. Test performance of each actuator. Provide individual test certificates at no additional cost to the Owner simulate a typical valve, gate or equipment load and record the following parameters:
 - a. Current a maximum torque setting.
 - b. Torque at maximum torque setting.
 - c. Test voltage and frequency.
 - d. Flash test voltage.
 - e. Actuator output speed or operating time.

2. Test housing oil tightness, 30 psi for 2 minutes.
 3. Insulation test on motor and control circuit.
 4. In addition, record details of specification on the test certificate, such gear ratios for both manual and automatic drive, closing direction, wiring diagram code number, and when applicable remote transmitter resistance and interposing relay voltage.
- C. In event that specified tests indicate that motor or actuator will not meet specifications, Engineer has the right to require complete witnessed tests for all motors and actuators at no additional cost to the Owner.
1. Repeat tests until specified results are obtained.
 2. Correct or replace promptly all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.

2.04 SHOP PAINTING:

- A. Paint Finish: Baked on polyester powder coating 70 microns thick and must have passed ASTM B117 35 degrees C Salt Spray Test for 1,000 hours.
1. Provide materials for touch-up of all damaged or abraded surfaces due to installation.
 2. Ferrous surfaces obviously not to be painted shall be given a shop applied coat of grease or rust resistant coating.

2.05 DISCONNECT AND LOCAL CONTROL STATION:

- A. Enclosure:
1. NEMA 4X (Ingress Protection Rating IP68) Type 316 stainless steel for all non classified areas.
 2. Mount on a pedestal, or on adjacent structure.
 - a. Hardware and Mounting Supports: Type 316 stainless steel.
- B. Provide each actuator with a primary voltage rated non-fused disconnect.
- C. Provide each actuator mounted in excess of 6.5 feet above the operating level or in a position that cannot be accessed with a single integrated disconnect and local control station. Mount the disconnect and local control station on a wall, column or pedestal 5.0 feet above the operating level.
- D. Provide red, green, and yellow indicating lights as on actuator. GREEN light on when valve, gate or equipment is completely closed, RED light on when valve, gate or

equipment is completely opened, and YELLOW light when valve, gate or equipment is in mid travel.

- E. Control circuits: 24VAC or 120 VAC as required.
- F. LOCAL/STOP/REMOTE switch: Padlockable in all positions. With actuator selector set to “Remote” actuator shall be capable of accepting operation input through separate pushbutton station, that pushbutton station has been selected for remote “SCADA” control.
- G. OPEN/STOP/CLOSE switch: With actuator selector set to “Remote”, actuator shall be capable of accepting operation input from separate pushbutton station, when pushbutton station has been selected for local “Open/Stop/Close” control.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install items in accordance with manufacturer's printed instructions and as indicated and specified.

3.02 FIELD TESTING:

- A. After installation of equipment, and after inspection, operation, testing and adjustment have been completed by manufacturer's field service engineer, conduct running test for each actuator in presence of Engineer determine its ability to operate without vibration or jamming and to operate at the speeds specified.
 - 1. During tests, observe and record, motor inputs.
 - 2. Promptly correct or replace all defects or defective equipment revealed by or noted during tests, at no additional cost to the Owner, and repeat tests until specified results and results acceptable to the Engineer are obtained.
 - 3. Contractor to provide all labor, equipment, and materials necessary for conducting tests.
- B. Make all adjustments necessary to place equipment in specified working order at time of above tests.
- C. Remove and replace equipment at no additional cost to the Owner with equipment that will meet all requirements specified and indicated if unable to demonstrate to satisfaction of the Engineer that units will perform the service specified and indicated.

3.03 FIELD TOUCH-UP PAINTING:

- A. After installation and accepted testing by the Engineer. Contractor shall apply touch-up paint to all scratched, abraded and damaged shop painted surfaces. Coating type and color shall match shop painting.

3.04 CONTRACT CLOSEOUT:

- A. Provide submittals in accordance with Section 01 77 00.

END OF SECTION 40 23 13.03

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SECTION 40 23 13.06

AIR FLOW CONTROL VALVES AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide and test air flow control valves, actuators, and appurtenances as indicated and in compliance with Contract Documents.
 - 1. Provide sizes and capacities as indicated and in compliance with Contract Documents.

1.02 REFERENCES:

- A. American Society of Mechanical Engineers (ASME):
 - 1. B16.1:
 - 2. B16.42: Ductile Iron Pipe Flanges and Flanged Fittings Classes 150 and 300.
- B. ASTM International (ASTM):
 - 1. A48/A48M: Standard Specification for Gray Iron Castings.
 - 2. A276: Standard Specification for Stainless Steel Bars and Shapes.
 - 3. A351/A351M: Standard Specification for Castings, Austenitic, for Pressure-Containing Parts
 - 4. A536: Standard Specification for Ductile Iron Castings.
 - 5. A743/A743M: Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application

1.03 SUBMITTALS:

- A. Submit the following in accordance with Section 01 33 00:
 - 1. Certified shop and erection drawings. Contractor shall submit electronic files of the proposed equipment in the performance size and arrangements as indicated and specified.
 - a. Data, regarding valve characteristics and performance including Cv.
 - b. Provide repeatability lab testing as described herein.

- c. Provide Cv values and repeatability testing based on actual third party test results from a North American testing lab regularly engaged in conducting valve performance testing.
2. Calculations for actuator sizing and design stresses in the major valve components. All calculations stamped by a Professional Engineer.
3. Shop drawing data for accessory items.
4. Certified results of actuator shop testing.
5. Motor shop test results.
6. Number of service person-days provided and per diem field service rate.
7. Control schematics and operating description.
8. Manufacturer's literature as needed to supplement certified data.
9. Operating and maintenance instructions and parts lists.
10. Valve shop test results.
11. Qualifications of field service technician.
12. Shop and Field testing and inspections reports.
13. List of recommended spare parts other than those specified.
14. Recommendations for short and long term storage.
15. Special tools.
16. Shop and field testing procedures and equipment to be used.
17. Number of service technician days provided and per diem field service rate.
18. Manufacturer's product data and specifications for shop painting.
19. Provide a layout drawing, plan and section showing orientation of valve and actuators and nearest obstructions for each valve.
20. Provide a listing of the materials recommended for each service specified and indicated. Provide documentation showing compatibility with process fluid and service specified and indicated.
21. The most recent ISO 9001 series certification or quality system plan.
22. Material Certification:

- a. Provide certification from the equipment manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.
 - b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.
 - B. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations and clarifications from the specified requirements.
 - 1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
 - 2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specification and justification are resubmitted with the entire package.
- 1.04 SPARE PARTS:
- A. Comply with requirements specified in Section 01 61 00.
- 1.05 QUALITY ASSURANCE:
- A. Comply with the requirements specified in Section 01 43 00.
 - B. Provide enclosures for the area classifications specified and indicated.
 - C. Services of Manufacturer's Representative as stated in Section 01 43 00 and specified herein.
 - D. Manufacturer of valves shall have a minimum of five (5) operating installations with valves of the size specified and in the same service as specified operating for not less than five (5) years.
 - E. If equipment proposed is heavier, different laying length or requires more operating space than specified and indicated; provide all structural, architectural, mechanical, electrical and plumbing revisions at no additional cost to the Owner.

1. If equipment is heavier than specified, the Contractor shall provide all hoisting equipment sized to maintain the minimum safety factor between the specified maximum equipment weight and the lifting capacity of the hoisting equipment indicated and specified.
- F. Valves shall be the product of one manufacturer.
- G. Valves shall be manufacturer's standard cataloged product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.
- H. Shop tests as specified.
- I. The Contractor shall obtain the valves, actuators, flow meters and appurtenances from the valve manufacturer, as a complete and integrated package to insure proper coordination and compatibility and operation of the system.
- J. Services of Manufacturer's Representative as stated in Section 01 43 00 and as specified herein.
- K. Provide services of factory-trained Service Technician, specifically trained on type of equipment specified:
1. Service Technician must be present on site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.
 2. Installation: Inspect grouting, location of anchor bolts; setting, leveling, alignment, field erection; coordination of piping, electrical and miscellaneous utility connection:
 - a. 3 person-days.
 3. Functional Testing: Calibrate, check alignment and perform a functional test. Tests to include all items specified.
 - a. 2 person-days.
 4. Field Performance Testing: Field performance test equipment specified.
 - a. 2 person-days.
 5. Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classroom sessions.
 - a. 1 person-days.

6. Credit to the Owner, all unused service person-days specified above, at the manufacturer's published field service rate.
 - L. Any additional time required of the factory trained service technician to assist in placing the equipment in operation, or testing or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.
- 1.06 DELIVERY, STORAGE AND HANDLING:
- A. Comply with the requirements specified in Section 01 66 10 and as specified.

PART 2 - MATERIALS

2.01 SYSTEM DESCRIPTION:

- B. Valves sizes and operating data are specified in the Valve Schedule herein.

2.02 BUTTERFLY VALVES – AERATION SERVICE:

- A. Manufacturers:

1. DeZurik
2. Bray
3. Flowseal
4. ABZ

- B. Provide valves rated for 250 degree F continuous operation and 300 degree F intermittent operation.

- C. Body:

1. Wafer-lug type with full-lug body, drilled and tapped for mounting bolts design.
2. Material:
 - a. Type 316 stainless steel
 - b. ASTM A126 cast or ASTM A536 ductile iron
3. Provide to mate with 125 pound ANSI B16.1 (Class 125) flanges.
4. Wafer type valves are not acceptable.

- D. Seat: Dovetail, EPDM, installed in the body with elastomer formed continuously over the ends to provide seal with mating pipe flanges.

- E. Disk: Air profile design, aluminum bronze ASTM B148 Alloy 952 or Type 316 stainless steel. Provide bubble-tight shut off at 25 psi working air pressure.
- F. Stem: One-piece of Type 316 stainless steel with bronze or Teflon bushings and EPDM or Buna-N O rings or self-adjusting packing.
 - 1. Disc stem connection:
 - a. 12-inch and smaller: Type 316 stainless steel torque plug.
 - b. 14-inch and larger: Type 316 stainless steel disc screws.
- G. Valve Operators:
 - 1. Manually operated valves 12-inch and smaller provide lever-type with 10-position lock plate and valve position indicator.
 - 2. Manually operated valves 14-inch and larger provide geared-type permanently lubricated, totally enclosed operator with stops to prevent over-travel, and with valve position indicator and hand wheel or chain wheel as specified.
 - 3. Provide chainwheel operator where required as specified herein.
 - 4. Electric motor actuators: Provide in accordance with Section 40 23 13.03.

2.03 SHOP TESTING:

- A. Hydrostatically test valve body and head for a minimum of 10 minutes and at a pressure of 1.50 times the working pressure as specified herein.
- B. Once the valves have passed the above testing, test valves through three (3) cycles with the job actuators and all controls so that each valve is tested as a complete unit
- C. Functional test of five (5) complete cycles of operation with the valve actuator settings in place (limit switches, torque switches, pilot pressure settings, etc).
- D. In the event that specified tests indicate that the valves or the controls will not meet specifications, Engineer has the right to require additional complete witnessed tests for all valves and control at no additional cost to the Owner.
- E. Repeat tests until specified results are obtained.
- F. Correct or replace promptly all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.

2.04 PAINTING:

- A. Coat internal and external ferrous surfaces of valve with manufacturers standard epoxy painting system..

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Prior to installation, protect stored valves and appurtenances from damage due to exposure to sunlight, heat, dirt, debris, freezing and thawing, vandalism, etc.
- B. Clean all debris, dirt, gravel, etc, from inside of piping before placing valves in place.
- C. Erect and support valves in respective positions free from distortion and strain on appurtenances during handling and installation. Inspect material for defects in workmanship and material. Clean out debris and foreign material from valve openings and seats, test operating mechanisms to check functioning, and check nuts and bolts for tightness. Repair, valves and other equipment which does not operate easily or are otherwise defective at no additional cost to the Owner.
- D. Set plumb and support valves in conformance with instructions of manufacturer. Shim valves mounted on face of concrete vertically and grout in place. Install valves in piping system for access.

3.02 FIELD TESTING:

- A. Performance test valves with pipeline under normal operating pressure.
- B. Test piping connections to prove the valves are installed with the pipe in a free supported state and without need to apply vertical or horizontal pressure to align piping with valve.
 - 1. After installation of valves, and after inspection, operation, testing and adjustment have been completed by manufacturer's field service technician, conduct tests for each valve in presence of the Engineer to determine its ability to operate within the specified conditions.
 - 2. During tests, observe and record flow rate, pressure drop, valve position and noise.
 - 3. Test valve repeatability in accordance with the following at 90, 75 and 50% open:
 - a. Open valve to each position specified above for 2 minutes and measure flow rate in scfm
 - b. Close valve to 30% for 1 minute, open valve to original position and measure air flow rate in scfm
 - c. Maximum % repeatability: 1%
 - 4. Noise Limit: 90 dba at a distance of 3 feet from the valve.
 - 5. Immediately correct or replace all defects or defective equipment revealed by or noted during tests, at no additional cost to the Owner, and repeat tests until specified results and results acceptable to the Engineer are obtained.

- 6. Contractor to provide all labor, piping, equipment, flowmeters, test gauges and materials for conducting tests.
 - 7. Test Duration: Determined by the Engineer, but not less than three hours of continuous operation at each condition specified and indicated.
 - C. Test functions of each valve.
 - C. Make all adjustments necessary to place valves in specified working order at time of above tests.
 - D. Remove all replace valves and appurtenances at no additional cost to the Owner with equipment that will meet all requirements specified and indicated if unable to demonstrate to the satisfaction of the Engineer that valves will perform the service specified, indicated and as submitted and accepted.
- 3.03 FIELD TOUCH-UP PAINTING:
- A. After installation and accepted testing by the Engineer, apply touch-up paint to all scratched, abraded and damaged shop painted surfaces. Coating type and color shall match shop painting.
- 3.04 CONTRACT CLOSEOUT:
- A. Provide in accordance with Section 01 77 00.

END OF SECTION

SECTION 40 23 19.01

PIPE SUPPORTS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Design, and provide a complete system of pipe supports with inserts, bolts, nuts, restraining and hanger rods, washers, miscellaneous steel, sliding Teflon plates, and accessories as indicated and in compliance with Contract Documents. The term pipe support includes hangers, guides, restraints, anchors and saddles.
- B. Provide all support systems and the design of all support systems for all piping as specified herein. The Contractor shall provide pipe support locations, configurations and details through accepted shop drawing submittals stamped by a Registered Professional Engineer as specified herein.
- C. The Contractor shall be responsible for the proper design, fabrication, location, shop drawings and installation of all pipe supports in accordance with the specified requirements.
- D. Pipe support locations and types for piping 1/2-inch and larger shall be determined by the Contractor using the guidelines for support spacing specified herein and other criteria contained in this pipe support specification. Guidelines for pipe supports may need to be adjusted based upon field coordination, field routing, or other considerations outlined herein such as structural load limits. The Contractor may revise the pipe support locations and details through accepted shop drawing submittals stamped by a Registered Professional Engineer as specified herein. The Contractor is responsible for the proper design, installation and fabrication of all pipe supports in accordance with the specified requirements. For pipe supports 1/2-inch and larger pipe support shop drawings together with a marked up piping drawing showing support number, location and typical type shall be submitted by the Contractor for acceptance.
 - 1. The Contractor shall be responsible for coordinating all pipe support designs for all trades to ensure compliance with all of the requirements of this specification, including but not limited to the total limitations specified herein.
- E. Design and provide all temporary pipe supports required during installation and testing.

1.02 REFERENCES:

- A. The American Society of Mechanical Engineers (AMSE):
 - 1. B31.1: Power Piping.
- B. ASTM International (ASTM):

1. A36: Standard Specification for Carbon Structural Steel
2. A307: Standard Specification for Carbon Steel Externally Threaded Standard Fasteners
3. A312: Seamless and Welded Austenic Stainless Steel Pipe
4. A500: Cold Formed Welded and Seamless Carbon Steel Structural Tubing.
5. A572: Specification for Steel Plate.
6. E165: Practice for Liquid Penetrant Inspection Method.
7. E709: Practice for Magnetic Particle Examination.

C. American Welding Society (AWS):

1. D1.1: Structural Welding

D. Canadian Standards Association (CSA):

1. 40.20: General Requirements for Rolled or Welded Structural Quality Steel
2. 40.21: Structural Quality Steel
3. Welding Procedure Specifications.

E. Fluid Sealing Association: Technical Handbook.

F. Manufacturers' Standardization Society (MSS):

1. SP-58: Pipe Hangers and Supports - Materials and Design.
2. SP-69: Pipe Hangers and Supports - Selection and Application.
3. SP-89: Pipe Hangers and Supports - Fabrication and Installation Practices.
4. SP-90: Guidelines on Terminology for Pipe Hangers and Supports.

G. National Association of Expansion Joint Manufacturers: Standards of the Expansion Joint Manufacturers Association, Inc.

1.03 SUBMITTALS:

A. Submit the following in accordance with Section 01 33 00:

1. Pipe support drawings specified herein and including data for accessory items for acceptance prior to fabrication. The Contractor shall submit pipe support coordination drawings including all piping and pipe supports for all trades.

- a. Detailed drawing of the device with dimensions.
 - b. A table of applied forces and moments.
 - c. A complete bill of materials.
 - d. A unique identification and revision level.
 - e. Stamp of a Registered Professional Engineer, registered in the of Ohio, experienced in pipe support design and pipe stress analysis as specified herein.
 - f. Detailed connections to existing structure.
 - g. Indicate all welds, both shop and field, by Standard Units of Measurement as specified in AWS D1.1.
2. Welding Procedure: Submit description required to illustrate each welding procedure to be performed in the specified work.
3. Welding Equipment: Submit descriptive data for welding equipment, including type, voltage and amperage.
4. Qualification for Welders: Provide certification that welders to be employed in work have satisfactorily passed AWS or ASME qualification tests. If recertification of welders is required, retesting is the Contractor's responsibility at no additional cost to the Owner.
5. Pipe support manufacturers' qualifications as specified herein.
 - a. List of at least five (5) successful pipe support projects and current addresses and telephone numbers of persons in charge of representing the owner or the owner of those construction projects during the time of pipe support design, fabrication and installation.
 - b. Qualification of manufacturers' Registered Professional Engineer, registered in Ohio, who stamps and seals shop drawings and designs.
6. Coordination drawings for pipe supports shall include as a minimum the following information.
 - a. Coordination drawings shall include all pipe supports covered by specifications.
 - b. These coordination drawings will be used by the Contractor to ensure that the pipe supports do not obstruct access, access for equipment operation or removal including all mechanical and electrical equipment, panels, valves, gauges, and instrumentation.

- c. The Contractor shall be responsible for including and coordinating the work of all subcontractors into the coordination drawings.
 - d. Prepare reproducible coordination drawings, indicating equipment, piping, valves, expansion joints, ductwork, conduit, cable trays, junction boxes, lighting fixtures, sleeves, inserts, embedments, supports, hangers and appurtenances at not less than 1/4-inch scale. Drawings shall show beams, columns, ceiling heights, wall, floors, partitions and structural features as indicated on the contract drawings. Individual pipes and conduit 2-inches or less in diameter that will be field routed need not be shown on coordination drawings.
 - e. Coordination drawings shall include large-scale details as well as cross and longitudinal sections required to fully delineate all conditions. Particular attention shall be given to the location, size, and clearance dimensions of equipment items, shafts, operators and necessary maintenance access.
 - f. Make all minor changes in duct, pipe or conduit routings that do not affect the intended function, but items may not be resized or exposed items relocated without the approval of the Owner. No changes shall be made in any wall locations, ceiling heights, door swings or locations, window or other openings or other features affecting the function or aesthetic effect of the building. If conflicts or interferences cannot be resolved, the Owner shall be notified. Any problems of coordination that require architectural or structural changes of design shall be submitted to the Owner for resolution.
 - g. After the reproducible drawings have been coordinated and all changes have been made, the drawings shall be signed by the Contractor and all subcontractors indicating that all work on that drawing has been coordinated with all associated vendors and subcontractors and all conflicts have been resolved.
 - h. Relocation of any duct, pipe, conduit or other material that has been installed without proper coordination among all trades shall be performed at no additional cost to the Owner.
- 7. Written notification of any deviations from the requirements of this specification.
 - 8. Support documentation and justification as specified.
 - 9. Certificates of Design signed by a Registered Professional Engineer for all pipe supports.
 - 10. Manufacturer's product data and specifications for shop painting.

B. Material Certification:

1. Provide certification from the manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.
 2. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.
- C. A copy of the contract mechanical process, and structural drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with “No changes required” or provide a statement that no changes are required.
1. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.
 2. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
 - a. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
 - b. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.04 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01 43 00 and as specified.
- B. Provide manufacturer's certification in writing, that materials meet or exceed minimum requirements as specified.
- C. Welder Qualifications:
 1. Quality and certify welding procedures, welders, and operators in accordance with ANSI B31.1, paragraph 127.5 for shop and project site welding of piping work.

- D. Pipe supports: All supports and parts shall conform to the latest requirements of the Code for Pressure Piping ASME/ANSI B31.1 and Manufacturers Standardization Society (MSS) Standard Practice SP-58, SP-69, SP-89 and SP-90 except as supplemented or modified by the requirements of this specification.
- E. Structural Concrete: Conform to the requirements of Section 03 30 00. Concrete strength: 4,000 PSI (28 MPa) unless noted otherwise.
- F. Conform to the requirements of the latest edition of the AISC Manual of Steel Construction for miscellaneous and supplementary steel. Tube steels are ASTM A500 Grade B, structural shapes A36, plates A-572 or equal. Stainless steel structural members shall conform to ASTM requirement Type 316L.
- G. Pipe Support Manufacturer Qualifications:
 - 1. Must possess a written quality assurance program.
 - 2. Have a minimum of 5 years experience in the design and fabrication of pipe supports.
 - 3. Have completed the design and fabrication of at least 5 successful pipe support projects of equal size, complexity, and systems as this project within the past 10 years.
 - 4. Retains the services of a Registered Professional Engineer, registered in the state where this project is being constructed, with a minimum of ten years experience in the design of piping systems and pipe supports.
 - 5. Manufacturers' Standardization Society (MSS) Member.
 - 6. Have a field service technician on staff with at least 5 years experience in resolving field installation, interference and interface problems associated with the design, installation and manufacture of pipe supporting components.
- H. Hanger inspections shall be performed in accordance with MSS-SP-89 and ASME B31.1.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Comply with the requirements specified in Section 01 66 10.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Provide materials used in pipe supports, which are compatible with the pipes to which they are attached. Provide Type 316L stainless steel supports for all stainless steel piping. Copper plated pipe supports are not acceptable.

- B. Allowable materials: As indicated in ANSI B31.1 Appendix A and MSS-SP-58 Table 2.
- C. Provide Type 316L stainless steel for pipe supports, hangers, guides, restraints, and anchors that are exterior or interior submerged, in potentially wetted areas in wet wells, channels, screening and grit removal areas and in chemically corrosive atmospheres.
- D. Provide only new material. Previously used and/or scrap material is not acceptable.
- E. Provide tube steels that are ASTM A500 Grade B, Structural shapes A-36, plates A-572 or equal.
- F. Provide sliding Teflon plates. The sliding surfaces shall be a nominal 3/8-inches (10 mm) glass filled Teflon bonded to stainless steel backup plate with a 10 gauge minimum thickness. The bearing pad upper and lower units shall be as follows: Conslide Type CSA elements as manufactured by Con-Serv. Inc., Balco TFE Slide Bearing Plates 10N-cs as manufactured by Balco Inc., or Dynalon Slide Bearings as manufactured by JVI, Inc. or acceptable equivalent product.
 - 1. The blended TFE material used for this bearing shall be composed of virgin (unreprocessed) TFE resin tested per ASTM D1457 and reinforcing agents milled glass fibers. This structural material shall have the following representative mechanical and physical properties:
 - 2. Tensile strength -2,000 psi.
 - 3. Elongation -225 percent
 - 4. Specific Gravity -2.17 to 2.22
 - 5. The coefficient of friction shall average 0.06 under compressive load of 2,000 psi.
 - 6. The compressive creep shall be a minimum of 2 percent at 2,000 psi (14 MPa) and 70 degrees F.
 - 7. The elements shall be flat, clean and prepared for installation in the structure. Slots and holes shall be fabricated in the bearing manufacturer's plant.
- G. Concrete anchor bolts - Hilti Kwik-Bolt II Stud Anchors, Rawl Bolt, Phillips Wedge Anchors, or equal.

2.02 DESIGN, LOCATION, AND TYPE OF PIPE SUPPORTS:

- A. Design and provide pipe supports for piping 1/2-inch and larger to include the following loads:
 - 1. Gravity Force: This force includes the weight of pipe, pipe contents (hydro load), valves, in-line equipment, insulation and any other weight imposed on the piping and/or pipe support.

2. Thermal Expansion Force: This force is developed by the restraint of free end displacement of the piping due to thermal growth.
 3. Hydrostatic/Dynamic Forces: These forces are developed due to the internal pressure (positive and negative) during operation of the piping system. These forces include the forces due to water hammer, pressure pulses due to rapid valve closure, fluid discharge resulting from pump startup, operation of positive displacement pumps, etc.
 4. Wind Loadings: Wind loadings.
- B. Provide supports, guides, anchors, flexible couplings and expansion joints in accordance with the coupling and joint manufacturers' specifications and requirements.
- C. For all pump suction and discharge nozzles provide an anchor located between the pump nozzles and the nearest expansion joint or non-rigid coupling.
- D. Where possible, provide pipe supports, which are the manufacturers' standard products.
1. Provide pipe supports with individual means of adjustment for alignment.
 2. Provide pipe supports complete with appurtenances including locking and adjusting nuts.
 3. Hanger rods shall be subjected to tension only.
 4. Where lateral or axial pipe movement occurs, provide hangers for the necessary swing without exceeding 4 degrees. Provide base supports designed using pipe slides. The bearing surfaces: 0.06 coefficient of friction or less.
 5. Provide concrete inserts capable of supporting the design loads.
 6. Metal framing systems will be acceptable to support piping 2 inch and smaller.
 7. Provide insulated piping supported using rigid load bearing insulation (baton board type) with 16 gauge shields to fit between the insulation and the support. Shields to encompass a minimum 1/3 of the pipe circumference and be 12 inch in length.
 8. Provide load-bearing insulation capable of supporting the load, as a minimum on the bottom 60 degrees of the pipe support. Cope insulation and adjust to avoid interference of steel structures.
 9. Provide supplementary steel as needed.
 10. Do not support pipes from other pipe, conduits or metal stairs.
 11. Chain, strap, T-bar, perforated bar and/or wire hangers are not acceptable.

- 12. Contact between piping and dissimilar metals such as hangers, building structural work or equipment subject to galvanic action is not acceptable.
 - 13. All pipe supports located in fluid flow shall be supplied with double nutting.
 - E. Provide thrust anchors to resist thrust where required. Wall pipes may be used as thrust anchors if so designed. Welded attachments shall be of material comparable to that of the piping, and designed in accordance with governing codes.
 - F. Provide expansion joints where indicated and where required based on Contractor's design of the pipe support system. Indicate expansion joints on submittal drawings.
 - G. For piping 2-inch and smaller provide manufacturer's standard supports and standard spacing guidelines
 - H. All outside above ground supports shall be Type 316L stainless steel as specified herein.
 - I. Provide pipe supports that do not overload or over stress the piping, equipment, or structure that they are supporting or to which they are attached. Allowable pipe stress to be within ANSI B31.1 code allowable.
 - J. The Contractor shall provide the services of a field service technician (preferably from the pipe support manufacturer) to field coordinate the locations of supports and resolve interferences and conflicts encountered during installation.
- 2.03 FABRICATION:
- A. Provide pipe supports formed in accordance with paragraph 5.1 of MSS-SP-58.
 - B. Providing welding in accordance with Structural Welding Code.
 - C. Provide dimensional tolerances as specified in MSS-SP-89.
 - D. Provide threading and tapping in accordance with MSS-SP-89.
- 2.04 SHOP PAINTING:
- A. Primer and Finish Paint: Shop apply to all exterior ferrous surfaces, high solids epoxy in accordance with Section 09 91 10.
 - B. Ferrous surfaces which are not to be painted shall be given a shop applied coat of grease or rust resistant coating.
 - C. Provide additional shop paint coating for touch-up to all surfaces after installation and testing is completed and equipment accepted.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install items in accordance with manufacturers' printed instructions and as indicated and specified herein.
- B. Perform welding in accordance with Structural Welding Code:
 - 1. Visually inspect welding while the operators are making the welds and again after the work is completed in accordance with AWS D1.1 Section 6.0. After the welding is completed, hand or power wire brush welds, and clean them before the Qualified Inspector makes the check inspection. The Qualified Inspector shall inspect welds with magnifiers under light for surface cracking, porosity, and slag inclusions; excessive roughness; unfilled craters; gas pockets; undercuts; overlaps; size and insufficient throat and concavity. The Qualified Inspector shall inspect the preparation of groove welds for throat opening and for snug positioning for back-up bars.
 - 2. Nondestructive evaluation of welds connecting structural steel members subjected to critical stresses: Perform in accordance with the weld quality and standards of acceptance in AWS D1.1.
 - 3. Magnetic Particle Inspection: Perform in accordance with ASTM E709.
 - 4. Liquid Penetrant Inspection: Perform in accordance with ASTM E165.
 - 5. For weld areas containing defects exceeding the standards of acceptance in accordance with AWS D1.1, Section 3.7. Provide additional testing of the repaired area at no additional cost to the Owner.
 - 6. Test Locations: As selected by the Owner.
 - 7. Correct any deficiencies detected as directed by the Engineer at no additional cost to the Owner.
- C. Proceed with the installation of the pipe supports only after required building structural work has been completed and concrete support structure has reached its 28-day compressive strength as specified in Section 03 30 00.
- D. Install pipe supports to comply with MSS-SP-89. Group parallel runs of horizontal piping to be supported together on trapeze type hangers.
- E. Install pipe supports to provide indicated pipe slopes. Do not exceed maximum pipe deflection allowed by ANSI B31.1.
- F. For exposed continuous pipe runs, install pipe supports of same type and style as installed for adjacent similar piping.

- G. Install pipe supports to allow controlled movement of piping systems. Permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
 - H. Piping to be free to move when it expands or contracts except where fixed anchors are indicated or required by the Contractor's pipe support systems. Where hanger rod swing length cannot be provided or where pipe movement based on expansion of 1 inch/100 feet, for each 100 degrees F change in temperature exceed 1/2-inch, provide sliding supports.
 - I. Prevent contact between dissimilar metals. Where concrete or metal support is used, place 1/8-inch (3 mm) thick Teflon, neoprene rubber, or plastic strip under piping at point of bearing. Cut to fit entire area of contact between pipe and pipe support.
 - J. Prevent electrolysis in support of copper tubing by use of pipe supports which are plastic coated. Electrician's tape is not an acceptable isolation method.
 - K. Apply an anti-seize compound to nuts and bolts on all pipe supports.
 - L. Locate reinforcing steel in concrete structure with x-ray prior to drilling for embedment plates and anchor bolts. Avoid contact or interference with reinforcing steel.
- 3.02 INSTALLATION OF BUILDING ATTACHMENTS:
- A. Support piping from structural framing, unless otherwise indicated.
 - B. Concrete Inserts:
 - 1. Use existing embedded concrete items whenever possible.
 - 2. Use expansion anchors only when existing embedded attachment points are not available or unsuitable. Attach to hardened concrete or completed masonry.
- 3.03 THRUST ANCHORS AND GUIDES:
- A. Thrust Anchors:
 - 1. Center thrust anchors between expansion joints and between elbows and expansion joints for suspended piping. Anchors must hold pipe rigid to force expansion and contraction movement to take place at expansion joints and/or elbows and to preclude separation of joints.
 - 2. Restraining rod size and number shall be as indicated and adhere to manufacturers recommendations as a minimum.
 - B. Pipe guides: Provide adjacent to sliding expansion joints in accordance with recommendations of the National Association of Expansion Joint Manufacturers and the specific joint manufacturer.

3.04 PIPE SUPPORTS:

- A. Where piping of various sizes is to be supported together, space supports for the largest pipe size and install intermediate supports for smaller diameter pipes.
- B. Provide minimum of two pipe supports for each pipe piece.
- C. Where pipe connects to equipment, support pipe independently from the equipment. Do not use equipment to support piping.
- D. Provide pipe supports so that there is no interference with maintenance or removal of equipment.
- E. Unless otherwise indicated or authorized by the Engineer, place piping running parallel to walls approximately 1-1/2 inch out from face of wall and at least 3 inches below ceiling.
- F. Pedestal pipe supports: adjustable with stanchion, saddle, and anchoring flange. Provide grout between baseplate and floor.
- G. Piping supports for vertical piping passing through floor sleeves: use hot dipped galvanized steel riser clamps.
- H. Support piping to prevent strain on valves, fittings, and equipment. Provide pipe supports at changes in direction or elevation, adjacent to flexible couplings, adjacent to non-rigid joints, and where otherwise indicated. Do not install pipe supports in equipment access areas or bridge crane runs.
- I. Stacked horizontal runs of piping along walls may be supported by metal framing system attached to concrete insert channels.
- J. Do not support piping from other piping.
- K. Designs generally accepted as exemplifying good engineering practice, using stock or production parts, shall be utilized whenever possible.
- L. Whenever possible, pipe attachments for horizontal piping shall be pipe clamps.
- M. All rigid rod hangers shall provide a means of vertical adjustment after erection.
- N. Where the piping system is subjected to shock loads, such as disturbances due to pump discharge or thrust due to actuation of safety valves, hanger design shall include provisions for rigid restraints or shock absorbing devices.
- O. Hanger rods shall be subject to tensile loading only. At hanger locations where lateral or axial movement is anticipated suitable linkage shall be provided to permit rod swing.
- P. Hanger spacing shall not exceed the spacing listed below:

1. In the case of concentrated loads the supports shall be placed as close as possible to the load to reduce the bending stress.
 2. Where changes in direction of the piping system occur between supports, the total length between supports shall be kept to less than three-fourths of the full span. When practical, a support shall be placed immediately adjacent to any change in direction of the piping system.
- Q. Where practical, riser piping shall be supported independently of the connected horizontal piping. Pipe support attachments to the riser piping shall be riser clamp shear lugs. Welded attachments shall be of material comparable to that of the piping, and designed in accordance with governing codes. If friction is relied upon to support riser piping proper justification and documentation shall be submitted to ensure that enough friction force is provided to resist the applied loading.
- R. Hanger components shall not be used for purposes other than for which they were designed. They shall not be used for rigging and erection purposes.
- S. All threads shall be UNC unless otherwise specified.
- T. TFE slide bearing plates with steel backup plates shall be stitch weld attachments to the structure. A 1/8-inch fillet weld, 1/2-inch long every 3 inches on center each side of an element shall be used unless otherwise indicated or specified by the manufacturers' written recommendations. Bearing elements with slots or holes shall be stitch welded in place for location. The TFE surfaces of the bearings shall be maintained clean and free from grit, dirt or grease.
- 3.05 INSULATED PIPING:
- A. Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed allowable pipe stresses.
 - B. Where vapor barriers are indicated on water piping, install coated protective shields.
- 3.06 CONTRACT CLOSEOUT:
- A. Provide in accordance with Section 01 77 00.

END OF SECTION

SECTION 40 23 19.05

PROCESS PIPING AND APPUTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide and test process piping and appurtenances as indicated and in compliance with Contract Documents.

1.02 REFERENCES:

- A. American Society of Mechanical Engineers (ASME):

1. B16.1: AN Standard for Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800
2. B16.3: Malleable Iron Threaded Fittings Classes 150 and 300
3. B16.5: AN Standard for Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys
4. B16.9: Factory-Made Wrought Buttwelding Fittings
5. B16.15: Standard for Cast Bronze Threaded Fittings, 125 and 250 lb
6. B31.1: Power Piping

- B. ASTM International (ASTM):

1. A36: Standard Specification for Carbon Structural Steel
2. A47: Standard Specification for Ferritic Malleable Iron Castings
3. A53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
4. A105: Standard Specification for Carbon Steel Forgings for Piping Applications
5. A139: Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)
6. A181: Standard Specification for Carbon Steel Forgings, for General-Purpose Piping
7. A193: Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

8. A194: Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
9. A197: Standard Specification for Cupola Malleable Iron
10. A216: Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service
11. A240: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
12. A256: Standard Method of Compression Testing of Cast Iron
13. A269: Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
14. A278: Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650°F
15. A307: Standard Specification for Carbon Steel Externally Threaded Standard Fasteners
16. A312: Seamless and Welded Austenitic Stainless Steel Pipe
17. A351: Standard Specification for Castings, Austenitic, for Pressure-Containing Parts
18. A449: Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
19. A536: Ductile Iron Castings
20. C177: Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
21. C1136: Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
22. D1330: Standard Specification for Rubber-Sheet Gaskets
23. D1457: Standard Specification for Polytetrafluoroethylene (PTFE) Molding and Extrusion Materials
24. E84: Standard Test Method for Surface Burning Characteristics of Building Materials
25. F593: Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

26. F1476: Standard Specification for the Performance of Gasketed Mechanical Couplings for Use In Piping Applications.
- C. American Welding Society (AWS):
1. B3.0: Welding Procedure and Performance Qualification
- D. American Water Works Association (AWWA):
1. C213: Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
 2. C219: Bolted, Sleeve-Type Couplings for Plain-End Pipe
 3. C606: Grooved and Shouldered Joints
- F. Expansion Joint Manufacturers Association Standards.
- G. Fluid Sealing Association - Technical Handbook.
- H. Manufacturer's Standardization Society (MSS):
1. SP-67: Butterfly Valves
 2. SP-69: Pipe Hangers and Supports - Selection and Application
- 1.03 SUBMITTALS:
- A. Submit the following in accordance with Section 01 33 00:
1. Submit manufacturer's certificates of conformance.
 2. Submit certified copies of test reports.
 3. Piping layouts in full detail.
 4. Location of pipe hangers and supports.
 5. Large scale details of wall penetrations and fabricated fittings.
 6. Schedules of all pipe, fittings, special castings, flexible connectors, adapters, couplings, expansion joints, and other appurtenances.
 7. Reports as required for welding certifications per ASME B31.1 Paragraph 127.6.
 8. Catalog cuts of joints, couplings, harnesses, expansion joints, gaskets, fasteners and other accessories.

- B. Grooved joint couplings and fittings: Provide product submittals with products specifically identified by the manufacturer's style or series designation.
1. Brochures and technical data on coatings and linings and proposed method for application and repair.
 2. Manufacturer's descriptive literature and technical data on insulation and proposed method of installation.
 3. Shop drawing data for accessory items.
 4. Manufacturer's literature as needed to supplement certified data.
 5. Operating and maintenance instructions and parts lists.
 6. Schematic control and power wiring diagrams.
 7. Shop and Field inspections reports.
 8. List of recommended spare parts other than those specified.
 9. Recommendations for short and long term storage.
 10. Special tools.
 11. Shop and field testing procedures and equipment to be used.
 12. Provide a listing of the materials recommended for each service specified and indicated. Provide documentation showing compatibility with process fluid and service specified and as indicated.
 13. The latest ISO 9001 series certification or quality system plan.
 14. Material Certification:
 - a. Provide certification from the piping and equipment manufacturers that the materials of construction specified are recommended and suitable for the service conditions specified and as indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified. And indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Authority.
 - b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.

- C. A copy of the contract mechanical process, civil, structural, electrical and instrumentation drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with “No changes required”.
 - 1. Failure to include all drawings applicable to the equipment specified in this section will result in submittal return without review.
- D. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations and clarifications from the specified requirements.
 - 1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
 - 2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specification and justification are resubmitted with the entire package.

1.04 QUALITY ASSURANCE:

- A. Welder Qualifications:
 - 1. Qualify and certify welding procedures, welders, and operators in accordance with ANSI B31.1, for shop and project site welding of piping work.
 - 2. Qualification for welders: Welding shall be performed by welders holding current certification for the welding procedures in use.
 - 3. Visually inspect welding while the operators are making the welds and again after the work is completed. After the welding is completed, hand or power wire brush welds and clean them before the inspector makes the check inspection. Inspect welds for defects exceeding tolerances allowed by code under which the weld was made. Repair all defects exceeding tolerance.
- B. Provide all grooved joint couplings, fittings, valves, and specialties to be the products of a single manufacturer. Grooving tools used must be of the same manufacturer as the grooved components.
 - 1. Provide all castings used for coupling housings, fittings, and valve bodies date stamped for quality assurance and traceability.
- C. Job Conditions:

1. Coordinate dimensions and drillings of flanges with flanges for valves, pumps, and other equipment to be installed in piping system.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Provide in accordance with Section 01 66 10.
- B. During loading, transportation and unloading, prevent damage to pipes and coatings. Load and unload each pipe under control at all times. Under no circumstances will a dropped pipe be used unless inspected and accepted by Engineer. Place skids or blocks under each pipe in the shop and securely wedge pipe during transportation to protect pipe, lining, and coating.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE AND FITTINGS:

- A. Ductile Iron Pipe:
 1. Design conforming to AWWA A21.50.
 2. Manufacture conforming to AWWA A21.15 or AWWA A21.51.
 3. Thickness class, unless otherwise indicated or specified:
 - a. Minimum Thickness Class 52.
 - b. Minimum thickness Class 53 for use with threaded flanges.
 - c. Minimum thickness Class 53 for use with flanged pipe.
 - d. Minimum thickness for use with grooved couplings conforming to AWWA C606.
 4. Pressure Class, unless otherwise indicated or specified:
 - a. Minimum Pressure Class, 4-inches through 12-inches: 350
 - b. 14 inches through 64 inches: 250
 - c. Minimum thickness for use with grooved couplings conforming to AWWA C606.
- B. Fittings:
 1. Provide fittings conforming to AWWA A21.10 or AWWA A21.53, at least Class 150 and match piping class.

2. Provide all bell push-on or mechanical-joint fittings unless otherwise indicated or specified.
3. Face and drill flanged fittings conforming to AWWA A21.10 except special drilling or tapping for correct alignment and bolting.
4. If flanged fittings are not available under AWWA A21.10 provide fittings conforming to ASME B16.1 in 125 lb. pressure class.
5. Provide standard base fittings where indicated.
6. Provide grooved-end fittings ductile-iron conforming to AWWA A21.10 for center-to-face dimensions.
 - a. End preparation for grooved-ends conforming to AWWA C606 for flexible or rigid joints as required by type of joint.

C. Wall Castings:

1. Provide size and type indicated and specified.
 - a. Piping 24-inches and Smaller: Mechanical Joint with specified restraint or Restrained Push-On.
 - b. Piping 30-inches and Larger: Restrained Push-On.
2. Wall Castings: Conform to requirements of AWWA A21.10 or fabricate of Class 53 ductile iron pipe with screwed on flanges and welded on waterstop. Screwed on mechanical or push-on joints are not acceptable.
3. Provide water stop centered in wall. Weld water stops on in factory under controlled conditions to ensure adequate strength to permit waterstop to absorb thrust up to the pressure rating of the pipe.

Wall Castings with annealed ductile iron water stops	
Pipe Size	Waterstop thickness, inches
4 inch-12 inch	0.50
14 inch-24 inch	0.75
30 inch-36 inch	1.00
42 inch-48 inch	1.25

Wall Castings with fabricated steel water stops	
Pipe Size	Waterstop thickness, in
4 inch-16 inch	0.25
18 inch-24 inch	0.38
30 inch-36 inch	0.50
42 inch-48 inch	0.75

Wall Castings with fabricated steel water stops	
Pipe Size	Waterstop thickness, in
54 inch-64 inch	1.00

4. On flanged wall castings, provide space between the wall and flange to permit mounting the nuts on the flange bolts.
5. Flanged wall castings located with the flange flush with the wall are not acceptable.
6. Locate push-on joint wall castings with space between the bell and the wall to insert the follower bolts.
7. As an option, fabricated wall pipe of Type 316L stainless steel may be substituted for ductile iron wall castings specified above.
 - a. Provide with waterstops of above dimensions and welded continuously on both sides of waterstop.
 - b. Flanges of Type 316 stainless steel. Bolts for connection to buried pipe Type 316 stainless steel. Provide flange insulation gaskets, sleeves and washers for all flanges.
 - c. Provide pipe ID to match connecting ductile iron pipe ID and provide pipe wall thickness to match pressure rating of connecting ductile iron pipe.
8. Testing: Factory pressure test all wall castings to pipe and joint pressure rating for a minimum of 5 minutes. No visible leakage is acceptable.

D. Joints:

1. Provide push-on joint and mechanical joint pipe with necessary accessories, conforming to AWWA A21.11.
 - a. Provide gasket composition designed for exposure to liquid within pipe.
 - b. Provide mechanical joint gaskets with copper tips to provide electrical continuity.
 - c. Provide serrated brass wedges for push-on joints to provide electrical continuity; two per joint for pipe 12-inch and smaller and four per joint for larger pipe.
2. Provide pipe flanges and accessories conforming to AWWA A21.15.
 - a. Provide flat faced flanges.

- b. Provide 1/8-inch thick, full faced gaskets designed for exposure to liquid within pipe.
 - 3. Provide restrained joint on pipe and fittings where indicated. Provide restrained joint which is:
 - a. Boltless
 - b. Capable of being deflected after assembly
 - c. Designs using set screws or requiring field welding are not acceptable.
- E. Expansion Joints:
 - 1. Provide in accordance with Section 40 23 19.04.
 - 2. Pressure rating at least equal to that of related pipeline.
- F. Pipe Coating:
 - 1. Outside of pipe and fittings within structures: Clean and apply one shop coat with a 3 to 5 mil DFT of moisture cured urethane.
 - 2. Outside surfaces of castings to be encased in concrete: No coating.
 - 3. Machined surfaces cleaned and coated with rust-preventative compound at shop.
 - a. Outside of buried pipe and fittings:
 - b. Provide the exterior of all buried ductile iron pipe coated with a layer of arc-sprayed zinc in accordance with ISO 8179.
 - c. Mass of zinc applied: 200 g/m² of pipe surface area.
 - d. Provide a finishing topcoat applied to the zinc.
 - e. Provide the coating system conforming ISO 8179-1 “Ductile iron pipes - External zinc-based coating - Part 1: Metallic zinc with finishing layer. Second edition 2004- 06-01”.
- G. Cement Lining:
 - 1. Inside of pipe and fittings: Provide double thickness cement lining and bituminous seal coat conforming to AWWA A21.4.
- H. Gaskets, Bolts, and Nuts:

1. Provide ring or full face synthetic rubber gaskets for flanged joints and neoprene faced phenolic for insulating gaskets in accordance with AWWA A21.11 and ASME B16.21.
 - a. 1/8 inch thick.
2. Make flanged joints with:
 - a. Bolts.
 - b. Bolt studs with nut on each end.
 - c. Studs with nuts where flange is tapped.
 - d. Plastic bolt sleeves and washers for insulating joints.
3. Number and size of bolts conform to same ANS as flanges.
4. Provide Type 316 stainless steel bolts, washers and nuts for all services:

2.02 STAINLESS STEEL PIPE AND FITTINGS 2-1/2-INCH AND LARGER:

A. Manufacturers:

1. Douglas Brothers
2. Felker
3. J.F. AhernMaterial:

1. Type 316L sheet and plate per ASTM A240.
 - a. Maximum carbon content of 316L material limited to 0.03 percent.
 - b. Finish: 2D.
2. 205 Duplex stainless steel.
3. AL-6XN stainless steel.

C. Fabrication:

1. Fabricate in accordance with ASTM A778 in NPS sizes shown with dimensional tolerances per ASTM A530.
2. Perform welding by qualified welders conforming to standard procedures. Weld piping with wall thickness up to 11 gauge, 0.125-inch, with the TIG (GTAW) process. Properly bevel heavier walls and use a root pass with the TIG (GTAW)

process followed by subsequent passes with the TIG (GTAW), MIG (GMAW), or Metallic Arc (SMAW) process.

3. Add filler wire of ELC grades to all welds to provide a cross section at the weld equal to or greater than the parent metal. Distribute smooth and evenly weld deposit and provide a crown of no more than 1/16-inch on the I.D. and 3/32-inch on the O.D. of the piping.
4. Concavity, undercut, cracks or crevices are not acceptable.
5. Butt Welds: Full penetration to the interior surface, with inert gas shielding provided to the interior and exterior of the joint.
6. Remove excessive weld deposits, slag, spatter, and projections by grinding.
7. Continuously weld angle face rings on both sides to the pipe or fitting.
8. Grind all welds on gasket surfaces smooth.
9. Contour pipe branches, taps and bosses to the radius of the main pipe run and bevel and weld with full penetration. No projections to the inside of the branch or main run are acceptable. Provide a smooth transition from ID of run to ID of branch.
10. Wire-brush inside and outside weld areas with brushes of stainless steel that are specifically designed to be used only on stainless steel.
11. After manufacture, passivate stainless steel pipe, fittings, and appurtenances by immersion in a pickling solution of 6 percent nitric acid and 3 percent hydrofluoric acid. Temperature and detention time to be sufficient for removal of oxidation and ferrous contamination without more than superficial etch of surface. Perform a complete neutralizing operation by immersion in a trisodium phosphate rinse followed by clean water wash. Perform in accordance with ASTM A380.
12. After fabrication, either passivate by immersion (see above paragraph) or scrub interior and exterior of welds with same solution or pickling paste and stainless steel wire brushes to remove weld discoloration and then neutralize and wash clean. Perform in accordance with ASTM A380.
13. Perform all welding in the shop. Field welding is not acceptable.
 - a. If field welding is allowed for certain circumstances, the Contractor shall submit the welders qualifications and an acceptable method of cleaning the pipe and fittings for review prior to start of any field welding.
14. Fittings: Butt weld type manufactured in accordance with ASTM A774 of the same raw material and in the same thicknesses as the pipe. Socket weld fittings are not acceptable.

- a. Elbows up to 24-inch diameter: Provide smooth flow-die formed, long radius; with centerline to end of elbow equal to 1.5 times the nominal pipe size.
- b. All short radius, special radius, and reducing elbows and long radius elbows greater than 24-inch diameter: Fabricate with pieces in accordance with the following table with dimensions in accordance with AWWA C208:

Bend, degrees	Number of Pieces
0 to 22.5	2
23 to 45	3
46 to 67.5	4
68 to 90	5

15. 90 Degree LR Reducing Pump Suction Elbows: Provide a minimum 7 piece miters bend.
16. Fabricate tees and branch connections true and square with wall thickness same as pipe.
17. Reducers evenly tapered with tangent ends for butt weld connection.
 - a. Reducers may be straight tapered cone construction.
18. Secure flanges to pipe ends and plug openings prior to shipment.

D. Design:

1. Stainless steel pipe: Nominal pipe size diameter pipe fabricated of stainless steel sheets having the following Schedule, U.S.S. gauges and plate thickness:

Nominal Pipe Size inches	Actual O.D. inches	Schedule/Gauge/Plate	Nominal Wall Thickness inches
2.5	2.875	SCH 5S or 10S	0.083
3	3.500	SCH 5S or 10S	0.083
4	4.500	SCH 5S or 10S	0.083
6	6.625	SCH 5S or 10S	0.109
8	8.625	SCH 5S or 10S	0.109
10	10.750	12 Ga. Sheet	0.109
12	12.750	12 Ga. Sheet	0.109
14	14.000	11 Ga. Sheet	0.125
16	16.000	11 Ga. Sheet	0.125
18	18.000	11 Ga. Sheet	0.125
20	20.000	10 Ga. Sheet	0.140
24	24.000	3/16 inch Plate	0.188
28	28.000	3/16 inch Plate	0.188

Nominal Pipe Size inches	Actual O.D. inches	Schedule/Gauge/Plate	Nominal Wall Thickness inches
30	30.000	3/16 inch Plate	0.188
36	36.000	3/16 inch Plate	0.188
42	42.000	1/4 inch Plate	0.250
48	48.000	1/4 inch Plate	0.250
54	54.000	5/16 inch Plate	0.312
60	60.000	5/16 inch Plate	0.312
66	66.000	1/2 inch Plate	0.500
72	72.000	1/2 inch Plate	0.500
84	84.000	1/2 inch Plate	0.500

2. For buried piping use a minimum SCH 10S or as indicated in the Process Piping Schedule.
3. Joints: Flanged or, bolted split sleeve type couplings as indicated and specified. Split couplings requiring cut or roll grooving of the pipe not allowed unless specifically called for.
4. Flanged Joints: Van Stone back-up flange type, ANSI Class 150 lb.
5. Provide stainless steel back-up flanges of the grade of pipe specified with the following thickness. Galvanized steel and ductile iron flanges are not acceptable.

Pipe Size, inches	Flange Thickness, inches
2.5, 3 and 4	0.375
6 and 8	0.500
10 to 18	0.750
20 and 24	0.750
28	0.875
30	0.875
36	1.000
40	1.125
42	1.125
48	1.250
54	1.375
60	1.500
66	1.625
72	1.625

6. Hardware: Minimum Type 316 stainless steel. Provide materials to match pipe material specified.
7. Fabricate flanged joint face rings fabricated of rolled stainless steel angles.

8. Use angle face rings with thickness equal to or greater than the wall of the pipe or fitting to which it is welded. Continuously weld on both sides to the pipe or fitting. Fabricate angle legs so as not to interfere with the flange bolt holes.
9. Isolate stainless steel flanges from all other ferrous metal connections at valves, flanges and equipment with flange insulating kit.
 - a. Pipe Flange Insulating Kit:
 - (1) Flange gasket: Type E, 1/8-inch thick NEMA Grade G-10 reinforced epoxy retainer with two seals of the following material:
 - (a) Potable Water: Teflon or EPDM, NSF61 certified.
 - (b) Wastewater and Residuals: Nitrile.
 - (c) Aeration Systems: EPDM.
 - (2) Insulating sleeves: 1/32-inch thick NEMA Grade G-10, full length, one for each flange bolt.
 - (3) Insulating washers: 1/8-inch thick NEMA Grade G-10, two for each flange bolt.
 - (4) Mechanical washers: 1/8-inch thick Type 316 stainless steel, two for each flange bolt.
 - (5) Manufacturers:
 - (a) Trojan Insulating Gasket Advance Products and Systems.
 - (b) Or equal.

2.03 PRESSURE AND FLOW INSTRUMENTATION:

- A. Provide in accordance with Section 40 90 00.

2.04 EXPANSION JOINTS-ELASTOMERIC FLEXIBLE CONNECTION:

- A. General: Provide flexible connectors as indicated, specified and as required for ductile iron, steel and stainless steel piping
 1. At equipment connection: To eliminate vibration and stress on equipment.
 2. Elsewhere: Designed for expansion/contraction.
 - a. Hot Water Systems: 1.25 inch per 100 feet .
 - b. All other Piping Systems: 0.5 inch per 100 feet.

B. Manufacturers:

1. Mercer Rubber Co.
2. General Rubber Co.
3. Garlock, Inc.
4. Proco.

C. Products:

1. Straight-through or tapered design as required.
2. Filled arch type for wastewater, sludge and scum applications
3. Furnish control rods for test pressures as indicated or required.
4. Materials: Suitable for service specified and indicated.
5. At expansion joints, provide guide supports located per manufacturer's recommendations.
6. Flanges: 125 lb (Class 125) drilling.
7. Provide Type 316 stainless steel retaining rings.

D. Install joints in their neutral position.

2.05 EXPANSION JOINTS-STAINLESS STEEL:

A. Manufacturers:

1. Pathway
2. Flexonic
3. Adsco
4. Victaulic Omni-Flex

B. Design Criteria:

1. Liquid: Service as indicated in the Process Pump Schedule.
2. Liquid Temperature: As indicated in the Process Pump Schedule.
3. Minimum Pressure Rating: 150 psi minimum or as indicated in the Process Piping Schedule.

4. Minimum Lateral Movement: 0.125-inch.
5. Minimum Axial Movement: 0.4-inch.
6. For expansion joints used on pump discharge nozzles the Contractor shall coordinate the rod size and movement allowable with the pump manufacturer and provide a statement from the pump manufacturer that the expansion joint and rod size is acceptable for the pump provided.

C. Products:

1. Provide bellows of two ply construction formed from concentric tubes having only longitudinal seams.
2. For two ply construction, each ply shall be capable of retaining the rated pressure at the specified temperature independently.
3. For two ply construction, seal weld both plies so that no gas or liquid leaks out at the ends.
4. For two-ply construction, provide a pressure monitoring connection with pressure gauge and pressure switch as specified herein for the annular space.
5. Provide control rods for test pressure.
6. Provide minimum two lifting lugs on each joint. Each lug shall be designed to carry the entire weight of the assembly.
7. Provide each joint with a liner and mark a flow arrow on the outside to indicate direction of flow.
8. Provide each expansion joint with a Type 316 stainless steel nameplate indicating size, bellows material, pressure and temperature rating, lateral and axial limits on movement, date of manufacturer, and the manufacturer.

D. Materials:

1. Bellows:
 - a. Inner Ply: Inconel alloy 625, minimum 0.048-inch thick.
 - b. Outer Ply: Inconel alloy 625, minimum 0.048-inch thick.
 - c. Fully annealed stainless steel, Type 316 or 321; to ASTM A240.
2. Liner: Type 316L stainless steel, minimum 0.1875-inch thick.
3. Flanges: Type 316L stainless steel, Class 150.

4. End Preparation: Stainless steel; suitable for installation with Victaulic Depend-O-Lok couplings.
 5. Limit Rods/Nuts and Hardware: Type 316 stainless steel.
- E. Install joints in their neutral position.
- 2.06 WALL AND FLOOR SLEEVES:
- A. Materials:
1. Provide materials as specified and as indicated:
 - a. Schedule 40 Type 316L stainless steel with 2-inch water stop welded both sides to prevent thrust movement and provide positive water sealing.
 - b. Schedule 40 carbon steel with 2-inch water stop welded both sides to prevent thrust movement and provide positive water sealing. Model GPWSW manufactured by Advance Products & Systems, Inc., or equal.
 - c. HDPE, 2-inch thru 24-inch and only where indicated and specified.
- B. Water Stops: Provide water stops welded on both sides. Provide water stops 1/4-inch thick and 2-inch high and centered on the wall thickness.
- C. Provide modular, mechanical type seals, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening.
1. Manufacturer:
 - a. Innerlynx
 - b. Or equal.
- D. Provide the elastomeric elements sized and selected per manufacturer's recommendations and have the following properties as designated by ASTM. Coloration shall be throughout elastomer for positive field inspection. Each link shall have a permanent identification of the size and manufacturer's name molded into it.
- E. Temperature Range: -40 to +250 degrees F.
1. Material: EPDM, ATSM D2000 M3 BA510
 2. Color: Black
- F. Modular seal pressure plates: Molded of glass reinforced Nylon Polymer with the following properties:

1. Izod Impact – Notched: 2.05ft-lb/in. per ASTM D256
2. Flexural Strength @ Yield: 30,750 psi per ASTM D790
3. Flexural Modulus: 1,124,000 psi per ASTM D790
4. Elongation Break: 11.07 percent per ASTM D638
5. Specific Gravity: 1.38 per ASTM D792

G. Hardware: Type 316 stainless steel.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPE:

- A. Install pipelines parallel to building walls wherever possible. Install piping to lines and grades indicated and support. Where temporary supports are used, provide temporary supports as specified in Section 40 23 19.01 to prevent shifting or distortion of pipe. Provide for expansion.
- B. Slope piping toward low points and provide for draining at low points.
- C. Before assembly, remove debris from inside pipes and fittings.
- D. Before flanges pieces are assembled, remove rust resistant coating from machined surfaces, clean gaskets and smooth burrs. Make up flanged joints tight, and prevent strain upon valves or other pieces of equipment.
 1. Bolt threads must fully engage the nuts. At a minimum the bolt must be flush with the nut and no more than 1/2-inch excess thread protruding from the nut.
- E. Install grooved joints in accordance with the manufacturer's written recommendations.
 1. Grooved ends: Clean and free from indentations, projections, or roll marks.
 2. Gaskets: Molded and produced by the coupling manufacturer of an elastomer suitable for the service specified and indicated.
 3. The coupling manufacturer's factory trained representative shall provide on-site training for the contractor's field personnel in the use of grooving tools and installation of product. The representative shall periodically visit the job site to ensure best practices in grooved product installation are being followed.
- F. Install tierods, pipe clamps or bridles when sleeve type couplings or fittings are used in piping system as indicated, and at changes in direction or other places to prevent joints from pulling apart under pressures indicated in the Process Pipe Schedule.

- G. Examine pieces for damage. Do not install pieces that are damaged according to Engineer. If any damaged piece should be discovered after having been installed, remove and replace with a sound piece at no additional cost to the Authority.
 - H. Handle pipe with equipment such as nylon slings and padded skids, designed to prevent damage to the coating. Repair abrasions and injuries to the coating prior to the application of insulation or prior to the application of final field coating.
 - I. Support piping laid in trenches in trench on bed of selected backfill material which maintains desired line and grade.
 - J. Use dielectric bushings or unions when ferrous pipes join nonferrous pipes carrying liquid either underground or elsewhere.
 - K. Welding in accordance with AN Standard B31 and AWS B3.0.
- 3.02 WALL SLEEVE SEALS:
- A. Expand rubber against pipe and sleeve by tightening bolts when assembled around pipe and inserted in wall.
- 3.03 TEMPORARY PLUGS:
- A. Close open ends of pipe with temporary plugs or caps when pipe installation is not in progress. Use watertight plugs for exterior, buried piping and if water or debris is in trench when work is resumed, do not remove until adequate provision has been made to prevent any water or debris entering pipe even if it necessitates dewatering trench.
- 3.04 PHYSICAL CHECKOUT, FIELD AND FUNCTIONAL TESTING:
- A. Clean dirt, dust, oil, grease and other foreign material, before pressure and leakage tests.
 - B. Water for testing provided by the Contractor.
 - C. Pressure and Leakage Tests:
 - 1. Provide temporary testing plugs or caps; pressure pumps, pipe connections, meters, gages, equipment, and labor.
 - 2. Test pipelines in sections of acceptable length.
 - 3. Fill section of pipe with water and expel air.
 - 4. Pressure and leakage test consists of first raising pressure (based on elevation of lowest point of section under test and corrected to gage location) to pressure in psi numerically equal to test pressures indicated in the Process Pipe Schedule.
 - 5. No visible leakage in joint is acceptable.

6. If unable to achieve and maintain specified pressure for one hour with no additional pumping, section has failed to pass test.
7. If section fails pressure and/or leakage test, locate, uncover, and repair or replace defective pipe, fitting, or joint, and conduct additional tests and repairs until section passes test at no additional cost and without any time extensions.

- D. Make piping connections to equipment with pipe in a free supported state and without application of vertical or horizontal forces to align piping with the equipment flanges.
- E. Do not cover joints in underground piping with backfill material until piping has successfully passed pressure test.
- F. Test pressures as indicated in Process Pipe Schedule.
- G. Repair faulty joints even to extent of disassembling and remaking joint, remove defective pipe and fittings and replace in manner satisfactory to the Owner.

3.05 FIELD PAINTING:

- A. Provide in accordance with Section 09 91 13.

3.06 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01 77 00.

END OF SECTION

SECTION 40 90 00

PLANT INSTRUMENTATION AND CONTROL SYSTEM GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, install, calibrate, test, and place in satisfactory operation, instrumentation and control system equipment necessary to perform specified functions in accordance with the requirements of Sections 40 9X XX and the Drawings. The system includes, but is not necessarily limited to, the following equipment:
 - 1. Primary sensor/transducers, field instruments, and associated mounting hardware as specified in Section 40 91 00, Primary Sensors and Field Instruments.
 - 2. Local control panels, monitoring panels, and existing panel modifications as specified and as shown on the Drawings.
 - 3. An expansion of the existing plant-wide control system including processors, communication modules, input/output modules, operator interface stations, as specified and as shown on the Drawings.
 - 4. Interconnecting cables, wiring, and associated components. Ethernet networking components such as switches, transceivers, fiberoptic and twisted-pair patch panels and patch cables, and equipment enclosures as specified and shown in the Contract Documents and in Section 40 95 53, Network Devices.
- B. Configuration and programming of control system end devices such as but not limited to: instruments, device serial networks, actuator master stations, variable frequency drives, motor protection units, actuators, etc., shall be provided by the Contractor. Unit process logic residing in the process area PLC(s), OIT system and/or HMI system depicting the process monitoring and controls shall be provided as specified in Section 40 94 43, Plant Control System.
- C. The Process and Instrumentation Diagrams (P&IDs) and the Specifications of this Section and the other Division 40 Sections illustrate and describe the overall instrumentation and control system functional and operational requirements.
- D. Contractor shall conform to the requirements specified within Division 40 9X XX for the selection of equipment and materials, installation methods, configuration and programming. In addition, it should be noted that Division 40 90 00, Plant Instrumentation and Control System General Requirements, are not limited to work in this Division, but are also imposed for equipment and systems specified in other Divisions of the Contract Documents.

E. Related Sections:

1. Section 40 91 00, Primary Sensors and Field Instruments
2. Section 40 94 43, Plant Control System
3. Section 40 95 13, Control Panels
4. Section 40 95 53, Network Devices

1.02 REFERENCES

A. Reference Standards: The following organizations have generated standards that are to be used as guides in assuring quality and reliability of components and systems; govern nomenclature; define parameters of configuration and construction, in addition to specific details in this Specification and the Drawings.

1. American National Standards Institute (ANSI)
2. ANSI C1, "National Electrical Code" (NEC)
3. Factory Mutual (FM)
4. Institute of Electrical and Electronic Engineers (IEEE)
5. Instrumentation, Systems, and Automation Society (ISA)
6. Society of Automotive Engineers (SAE)
7. National Electrical Manufacturers Association (NEMA)
8. National Fire Protection Association (NFPA)
9. National Institute of Standards and Technology (NIST)
10. Scientific Apparatus Makers Association (SAMA)
11. Underwriters Laboratories (UL)
12. Occupational Safety and Health Administration (OSHA)

1.03 DEFINITIONS

A. Control System: The Control System shall be comprised of all the instrumentation and control system equipment throughout the Contract Documents, including but not limited to:

1. Instrument loop components including, but not limited to: primary elements, sensors, transducers, transmitters, indicators, controllers, and recorders.

2. Final operators or control elements including, but not limited to: control valves, solenoids, motors, adjustable frequency drives, and louver operators.
 3. Indicating and control devices including, but not limited to: operator interface terminals, pushbuttons, selector switches, pilot lights, recorders, and indicators.
 4. Ancillary components including, but not limited to: instrument power supplies, signal repeaters, signal isolators, current trips, adder/subtractor modules, relays, and timers.
 5. Instrumentation power requirements including, but not limited to: dedicated power, power conditioning, uninterruptable power supplies, and grounding systems.
 6. Cabinets, consoles, panels, and enclosures
 7. Alarm systems
 8. Controls for process equipment and systems including, but not limited to: service pumps, chemical systems, filtration, sample pumps, sump pumps, and treatment systems
 9. Motor controls
 10. Programmable controllers (PLCs)
 11. Supervisory control and data acquisition systems (SCADA)
 12. Wiring and conduit
 13. Network Communication system equipment and wiring
- B. Instrumentation and Control System Integrator: The instrumentation and control system integrator shall furnish a complete and integrated instrument and control system including, but not limited to: detailed design, engineering, fabrication, assembly, testing, checkout, commissioning, debugging, and training in accordance with the Contract Documents.

1.04 SYSTEM DESCRIPTION

A. General Design Requirements:

1. Power Supplies:
 - a. All electrically powered equipment and devices shall be suitable for operation on 115 V +/- 10%, 60 Hz +/- 2 Hz power. If a different voltage or better regulation is required, a suitable regulator or transformer shall be provided.

- b. Appropriate 24 VDC power supplies for analog loop power shall be furnished for each two-wire transmitter. Power supplies shall be mounted in control panels or enclosures.
- c. Provide power supplies sized for a minimum of 130% of the maximum simultaneous current draw of all connected load.
- d. A power on off switch or a molded case circuit breaker shall be furnished for each item requiring 120 VAC electrical power.
- e. Provide isolation transformers, transient voltage surge suppressers, line voltage regulators, and output line reactors for power distribution as required to eliminate electrical noise and/or transients entering on power lines.

2. Signal Requirements:

- a. The control system shall be designed to use 4 to 20 mA DC analog signals and/or digital communication networks as specified in Sections 40 9X XX, or as shown on Contract Drawings.
- b. Signal converters and repeaters shall be provided where required for proper interfacing. Power supplies shall be sized adequately for signal converter and repeater loads.
- c. Signals shall be isolated from ground. Shields of 4 to 20 mA and thermocouple 2-wire systems shall be grounded at a single point only. Ground 4 to 20 mA shields only at the control panel that contains the associated 2-wire loop power supply, unless shown otherwise. Ground thermocouple sensors at the thermocouple.
- d. This system will be used in a treatment plant environment where there can be high energy AC fields, DC control pulses, and varying ground potentials between the sensors/transducers and the system components. The system design shall be adequate to provide proper protection against interferences from all such possible situations.

3. Miscellaneous:

- a. All new equipment provided shall be listed by Underwriters Laboratory or other testing agency as defined in these Specifications. Such listing requirements only apply for equipment where such listings exist.
- b. All instrumentation and control system components shall be heavy duty types, suitable for continuous service in a municipal water treatment plant environment.

- c. All similar components shall be products of a single manufacturer and shall consist of equipment which is currently in production and shall remain in production for at least 2 years.
- d. All instrumentation and control system components shall be designed to automatically return to accurate measurement within 60 seconds upon restoration of power after a power failure or when transferred to standby power supply.
- e. Surge and lightning protection shall be provided for all power supplies, field instruments, and all other control system components to protect against damage by electrical surges.
- f. All field mounted instruments and system components shall be designed for installation in high humidity and corrosive service conditions. All field mounted instrument enclosures, junction boxes, and appurtenances shall have a NEMA 4X endorsement, at a minimum. Hazardous areas require a NEMA 7 endorsement.
- g. All components with interconnections to field devices shall be wired through terminal blocks. Integral terminals, such as that of a relay, are not an acceptable alternate.
- h. All components furnished including field and rear of panel instruments shall be tagged with the item number and nomenclature indicated on the Contract Documents and/or approved Shop Drawings.
- i. Ranges and scales specified herein shall be coordinated to suit field conditions and equipment furnished.
- j. Field mounted devices, instruments and control panels/enclosures located outdoors shall be protected from exposure to freezing temperatures and from overheating due to prolonged exposure to high ambient temperatures and shall be provided with sunshields where necessary to protect the enclosure surfaces from the additional heating effects of exposure to direct sunlight.
- k. Field instruments mounted in hazardous areas shall be provided as "factory sealed" units whenever available which can be installed in non-explosion proof enclosures in Division 2 areas and in explosion proof enclosures in Division 1 areas, in both cases without the need for conduit seals.

4. System Designs:

- a. Range, scale, and setpoint values specified are for initial setting and configuration. Modifications to these values may be required based on actual equipment furnished and as necessary to implement proper and stable process actions which are determined as systems are placed in operation.

These modifications shall be done by Contractor at no additional cost to the Owner.

- b. For any items where ranges, scales, and setpoints may not have been specified, Contractor shall submit a recommendation to the Owner for review.

1.05 SUBMITTALS

A. Product Data: Control System Components Submittal Requirements:

1. Sensors/transducers and field instruments: Product data and Manufacturer's literature include the following:
 - a. Instrument Specification Form: SP20 Instrumentation Specification Forms were developed by the ISA Standards Committee for most commonly used instruments. Submit a completed SP20 instrument specification form for each instrument.
 - b. Manufacturer's product name and model number and all required accessories
 - c. Instrument tag number from Contract Documents
 - d. Manufacturer's standard catalog product data with irrelevant sections crossed out.
 - e. Description of construction features
 - f. Performance and operation data
 - g. Installation and mounting details, instructions, and recommendations
 - h. Identification of all wiring interconnections and points of connection
 - i. Service requirements
 - j. Dimensions
2. Programmable Controller (PLC) System Information:
 - a. System Description:
 - 1) Detailed block diagram showing system hardware configuration and identifying manufacturers and model numbers of system components.
 - 2) Format, protocol, and procedures for remote communications and local communications with input/output modules and peripheral devices

- 3) On-line and off-line capabilities for programming, system utilities and diagnostics
- 4) Input/output point listing with I/O module cross reference identification
- 5) List of repair parts and test equipment

b. Equipment Hardware:

- 1) Manufacturer's standard catalog product data for all system components
- 2) Layout drawings showing front, rear, end, and plan views to scale of all processing equipment, I/O components, power supplies, and peripheral devices.
- 3) Construction details, features, and procedures
- 4) Interconnection diagrams including termination details, cable identification lists, and cable lengths
- 5) Plans showing equipment layout in control panels
- 6) Installation requirements, instructions, and/or recommendations

c. Software Description:

- 1) Standard technical documentation covering all aspects of the programmable controller software functions and capabilities, including functional descriptions and programming procedures related to control, monitoring, logging, and alarming functions.
- 2) Documentation describing memory type, size and structure, and listing I/O and Data Table memory and size of memory available for programs.

3. Control Panel and Enclosure Information:

a. Layout Drawings shall include the following:

- 1) Front and plan views to scale
- 2) Dimensional information
- 3) Tag number and functional name of components mounted in and on panel or enclosure
- 4) Product information on all panel components:

- a) Manufacturer's product name and model number
 - b) Instrument tag number from Contract Documents
 - c) Manufacturer's standard catalog product data with irrelevant information crossed out
 - d) Description of construction features
 - e) Performance and operation data
 - f) Installation and mounting details, instructions, and recommendations
 - g) Identification of all wiring interconnections and points of connection
 - h) Service requirements
 - i) Dimensions
- 5) Nameplate location and legend including text, letter size, and colors to be used
 - 6) Location of anchoring connections and holes
 - 7) Location of external wiring and/or piping connections
 - 8) Mounting and installation details
- b. Panel schematic and internal point-to-point wiring and/or piping diagrams shall include the following:
 - 1) Name of panel or enclosure
 - 2) Wiring sizes, types, and numbers
 - 3) Piping sizes, types, and numbers
 - 4) Terminal strip and block numbers for all interconnections.
 - 5) Color coding
 - 6) Functional name and manufacturer's designation for components to which wiring and piping are connected
 - c. Electrical control schematics for all circuits indicated in the specifications or on the Contract Drawings. Generic or typical wiring diagrams, not specific to equipment being provided, will not be accepted. Tables or charts

to describe wire numbers will not be accepted. All wires shall be labeled and shown on the submittal drawings.

- d. Plan showing control panel and enclosure equipment layout in each area.
 - e. Stock lists or Bill of Materials for each panel including tag number, functional name, manufacturer's name, manufacturer's model number, and quantity for all components mounted in or on the panel or enclosure. Bill of Materials shall include the information shown on the sample drawings at the end of this Section.
 - f. Heat calculations for each panel or enclosure to verify that there is sufficient dissipation and/or generation of heat to maintain interior panel temperatures within the maximum and minimum operating temperature of all panel components with ambient temperatures as specified below.
 - g. Samples:
 - 1) One (1) sample nameplate for exterior panel mounting
 - 2) One (1) sample nameplate for interior panel device mounting
 - 3) One (1) sample terminal block
 - 4) Three (3) sample wire labels
4. Field Wiring (Riser) Diagrams:
- a. Shall include the following:
 - 1) Wiring and conduit sizes, types, and numbers
 - 2) Terminal strip numbers for each wire termination
 - 3) Color coding
 - 4) Location, functional name, and manufacturer's designation of items to which wiring and/or piping are connected
 - 5) Point to point wiring diagrams shall include all interconnections between field devices, panels, control stations, lighting panels, and motor starters.
5. PLC I/O Loop Wiring Diagrams:
- a. Prepare drawings on a module-by-module basis and include the following information:

- 1) Rack numbers, module type and slot number, and module terminal point numbers. Also include location and identification of all intermediate panel and/or field terminal block and strip numbers to which I/O wiring and power supply wiring is connected. Identify all power supply circuit numbers and ratings.
- 2) Wiring sizes, type, wire numbers and color coding
- 3) Designation of conduits in which field I/O wiring is routed
- 4) Location, functional name, tag numbers and manufacturer model numbers of panel and field devices and instruments to which I/O wiring is connected. For discrete I/O devices use P&ID electrical symbols tagged with designation shown on drawings.

B. Operation and Maintenance (O&M) Manuals:

1. Operating and Maintenance Instructions, the Instrumentation and Control System O&M Manuals shall include:
 - a. Name, address, and telephone number of each manufacturer's local service representative. Also include internet web site URL and email address when available.
 - b. Complete list of supplied system hardware parts with full model numbers referred to system part designations, including spare parts and test equipment provided.
 - c. Copy of all approved submittal information and system shop drawings as specified herein with corrections made to reflect all shop drawing review comments and the actual system as tested and delivered to the site for installation.
 - d. Manufacturer's Original Copies of Hardware, Installation, Assembly, Programming, and Operations Manuals for all control system components. Manuals shall include the following information:
 - 1) General descriptive information covering the basic features of the equipment
 - 2) Physical description covering layout and installation requirements and all environmental constraints
 - 3) Standard technical documentation covering the procedures for programming, operation, start-up, shutdown, and calibration of the equipment and explaining how the various control functions are performed.

- 4) Principles of operation explaining the logic of operation; provide information covering operation to a component level.
 - 5) Maintenance procedures covering checkout, troubleshooting, and servicing; checkout procedures shall provide the means to verify the satisfactory operation of equipment, trouble-shooting procedures shall serve as a guide in determining faulty components, and servicing procedures shall cover requirements and recommended time schedule for calibration, cleaning, lubrication and other housekeeping and preventive maintenance procedures.
 - 6) Wiring, schematic, and logic diagrams
 - 7) Safety considerations relating to operation and maintenance procedures
 - 8) Manufacturer's recommended spare parts list with model numbers
2. After the initial Operating and Maintenance Instructions have received an acceptable disposition, the manual has been field verified and all final corrections have been made by the Contractor, submit 2 electronic versions of the approved manuals on CD to the Owner.
- a. The electronic color copy shall be an original, computer-generated multi-page Portable Document Format (PDF) file. Scans or pictures of document text will not be accepted.
 - 1) Provide a hyperlinked and bookmarked colored index page hyperlinked and bookmarked to appropriate pages. There shall be a universal return to the index on all pages linking back to the index page.
 - 2) All oversized pages shall be properly sized (to original dimensions) and orientated correctly.
 - 3) Each PDF file shall be no larger than 100 Mb. Any additional files shall be suffixed with an underscore and a number indicating its position.
 - b. Data files, such as those for drawings, source code, ladder logic, etc. shall be submitted in its native electronic format, in addition to PDF form for printing.
 - c. If self-adhesive labels are provided, it must fully cover the CD and be exactly centered on the CD. The front surface of the CD shall contain the following type written information:
 - 1) Contract number

- 2) Specification Section number
- 3) Submittal number
- 4) Brief submittal description
- 5) Submittal date

C. Supplier's Qualifications:

1. Shall submit experience of successful instrumentation and control system equipment installations as specified in Paragraph 1.06 of this Section.

D. Installation/Inspection Data:

1. Prior to commissioning, furnish to Owner an installation inspection report certifying that all equipment has been installed correctly and is operating properly.
2. The report shall describe the inspection and test procedure and include any repairs, modifications, or other work performed during the factory test or on-site.
3. The report shall be signed by the Contractor and the system integrator's authorized representative.

E. Product/Material Certifications

1. Submit to the Owner certified calibration certificates for field instruments and devices specified in Section 40 9X XX, a minimum of 3 weeks prior to commissioning.
 - a. Receipt of any calibration certificate shall in no way imply acceptance of any work or instrument.
 - b. The calibration certificates shall contain the information shown on the sample calibration certificate included at the end of this Section.
 - c. Each calibration certificate shall be signed and dated by the authorized manufacturer's representative and Contractor.

F. Record Drawings and Documentation:

1. All revised shop drawings and documentation shall be submitted to the Owner to replace outdated drawings and documentation contained in the System O&M Manuals. Specific instructions for outdated drawing removal and replacement shall be provided with the record drawing submittal.
2. Record Drawings shall include all data required to identify, locate, and trace circuits.

- a. Required data shall include, but not be limited to, equipment names, conduit numbers, boxes, conductor labels and colors, and terminals.
 - b. Control Panel Layout Drawings shall include, but not be limited to, the following information:
 - 1) Bill of materials identifying all components
 - 2) Enclosure layouts (interior and exterior) including face, sides, back, and subpanels identifying all components
 - 3) Nameplate legend for all components
 - c. Interconnect Wiring Diagrams shall include, but not be limited to, the following information:
 - 1) Identify all wiring components between each end device and PLC terminal(s).
 - 2) Conductor labels shall be consistent throughout loops.
 - d. Control Diagrams shall include, but not be limited to, the following information:
 - 1) Index of equally spaced reference numbers along left side of Control Diagram
 - 2) Include terminal numbers/colors for each control component.
 - e. Provide separate connection drawings for components requiring greater number of interconnects to maintain clarity of information.
 - 1) Information shall include terminal numbers, conductor labels, point, polarity, and function.
 - f. Terminal strip drawings shall include terminal strip name, number, point, and conductor label on each side of terminal.
 - g. PLC rack layout drawings shall include physical module/slot configuration along with point number and description.
3. All Electrical and Instrumentation Record Drawings shall be submitted in hard copy format.

G. Commissioning Procedures and Documentation:

- 1. Provide the following approved and updated documentation for use before the commissioning.

- a. Complete panel schematic and detailed internal point-to-point wiring interconnect drawings
- b. Complete electrical control schematics
- c. Complete panel layout drawings
- d. Complete field wiring diagrams
- e. The drawings corrected and modified by the Contractor during commissioning shall form the basis for the “As-Built” record drawing requirement as specified in this Section.

H. Storage Requirements:

- 1. System Integrator shall submit to Owner the storage requirements and recommendations for the equipment prior to shipment.

1.06 QUALITY ASSURANCE

A. General:

- 1. The instrumentation and control system shall be furnished by a single supplier who shall assume responsibility for providing a complete and integrated system.
- 2. All equipment, components, and materials required shall be furnished by the single supplier who shall assume the responsibility for adequacy and performance of all items.
- 3. The supplier shall identify those system components which are not of his manufacture.
- 4. The supplier shall supply his company’s quality assurance plan, and for components which are not of his manufacture, the component manufacturer’s quality assurance plan. The plans shall include but not necessarily be limited to: method of testing, raw material criteria, methods of documentation, station control, “Burn In”, final tests, serialization coding, and packaging.

B. Instrumentation and Control System Integrator’s Qualifications:

- 1. Shall be a financially sound firm having at least 5 years continuous experience in designing, implementing, supplying and supporting instrumentation and control systems which are comparable to the instrumentation system in terms of hardware, software, cost, and complexity.
- 2. Shall have in existence at the time of bid advertisement, an experienced engineering and technical staff capable of designing, implementing, supplying,

and supporting the instrumentation system and handling the submittal, testing, and training requirements.

3. Shall have an emergency response time ability of less than 4 hours to the project site.
4. Shall have a thorough working knowledge of water/wastewater treatment processes and control philosophy in accordance with standard practices of the water/wastewater treatment industry.
5. System Integrator shall be one of the following:
 - a. Automation Resources, LLC of Ohio
 - b. Pro-Tech Systems Group of Ohio

C. Instrumentation and Control System Integrator's Responsibility:

1. Contractor shall retain the system integrator to assume the responsibilities specified below. However, execution of these specified duties by the system integrator shall not relieve Contractor of the ultimate responsibility for the control equipment.
 - a. Detailed design, engineering, fabrication, assembly, wiring, testing, and debugging of the instrumentation and control system in accordance with the Contract Documents, the reviewed submittal drawings, and all referenced standards and codes.
 - b. Preparation, assembly, submission, and correction of all instrumentation and control system submittals in accordance with the Contract Documents.
 - c. Proper integration and interfacing of the instrumentation and control system hardware, field devices, and panels including required interfacing with package control systems furnished by other equipment suppliers, with existing equipment, and with the plant electrical system.
 - d. Supervision of the installation of the instrumentation and control system, instruments, panels, cabinets, wiring, and other components require.
 - e. Calibration, testing, and startup of the instrumentation and control system.
 - f. Training of Owner personnel in operation and maintenance of the instrumentation and control system.
 - g. Handling of all warranty obligations for the control system components.

D. Coordination and Progress Meetings:

1. Contractor and a representative of the system integrator shall be required to attend the meetings applicable to this Section's scope of work.
2. Representatives at the meetings shall have the competence and authority to make any and all necessary decisions. Decisions and statements made at the meetings shall commit the Contractor and system integrator to agreed procedures and schedules.

E. System Integrator Project Personnel:

1. Contractor shall require the system integrator to provide the following project personnel:
 - a. Project Manager:
 - 1) The system integrator shall appoint a project manager who shall coordinate and schedule all work and assure that the project schedule is met.
 - 2) The project manager shall act as the liaison with Contractor for the installation of the instrumentation and control system equipment and shall assist in all matters required for proper coordination and interfacing of the equipment and processes.
 - b. Field Engineer:
 - 1) The system integrator shall appoint a field engineer with responsibilities as follows:
 - a) Provide advice and technical consultation relative to installation techniques and procedures for equipment furnished.
 - b) Provide guidance and support on-site throughout the control system installation and start-up period.
 - c) Installed system checkout, calibration, adjustment, and start up including tuning of every control loop.
 - d) Involvement in the onsite system training of plant personnel.
 - e) Resolving of control problems encountered during initial startup and testing of all instrumentation and control equipment.
 - 2) The field engineer shall have a minimum of 5 years experience in systems engineering and start up and shall have a thorough working knowledge of the hardware supplied for the instrumentation and control system.

- c. The system integrator shall submit resumes for Field Engineer which detail their relevant experience as specified above.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Instrumentation and control system equipment shall be packaged at the factory prior to shipment to protect each item from damage during shipment and storage.
- B. All equipment shall be handled and stored in accordance with manufacturer's instructions and relevant organization standards. Owner shall have the right to inspect stored equipment.
- C. Packing and Shipping
 - 1. Package equipment as required to protect it from damage.
 - 2. Mount heavy items on pallets or skids to facilitate handling.
- D. Acceptance at Site
 - 1. Inspect all equipment at the time of delivery.
 - a. Ensure that no damage has occurred during shipment.
 - b. Verify make, model, and quantity.
 - 2. Record the following information:
 - a. Description/model of equipment.
 - b. Date and time of delivery.
 - c. Assessment of condition.
 - 3. Handle equipment carefully to prevent damage.
 - 4. Remove any damaged equipment from site and replace with new equipment.
- E. Storage and Protection.
 - 1. Store the equipment provided until it can be installed.
 - 2. Provide a clean, dry, heated, and dust-free location for storage.
 - 3. Such conditions must meet the requirements of the system integrator and manufacturer.

1.08 PROJECT/SITE CONDITIONS

- A. Interior Locations: The following are defined as interior locations:
1. Any location within the boundaries of the foundation of any building.
 2. Any location within the superstructure of other structures not classified as buildings.
- B. Wet Locations: The following are defined as wet locations:
1. All exterior locations.
 2. All interior locations below grade.
 3. All interior locations where wet materials are processed, pumped, transported, or stored.
- C. Corrosive Locations: The following are defined as corrosive locations.
1. All locations with chemical feed/transfer equipment
 2. All locations with chemical storage tanks
 3. All locations where chemical storage drums are located.
- D. Environmental Conditions:
1. The control system shall be designed and constructed for continuous operation without forming condensation under the following temperature and humidity conditions:
 - a. Space Conditioned Areas shown on the Drawings:
 - 1) Ambient Temperature: normal conditions 59 to 90°F; abnormal conditions 40 to 104°F.
 - 2) Relative Humidity: normal conditions 20 to 80%
 - 3) Abnormal conditions up to 95%
 - b. Indoor locations for control panels and instruments:
 - 1) Ambient Temperature: 40 to 120°F
 - 2) Relative Humidity: 0 to 100%
 - c. Outdoor locations for instruments:
 - 1) Ambient Temperature: -30 to 120°F

2) Relative Humidity: 0 to 100%

E. Wet and Corrosive Areas:

1. Instruments and control system components shall be designed and constructed to provide adequate protection against corrosion from gases and chemical which are commonly found in water/wastewater treatment plant environments such as but not limited to zinc orthophosphate, ozone, oxygen, chlorine, hydrogen sulfide, and carbon dioxide.

F. Portions of the instrumentation and control system will be located in areas that may be subjected to excessive vibrations. The control system integrator/manufacturer shall specify any vibration limitations which are required for the equipment and provide vibration proof mountings accordingly.

G. Hazardous (Classified) Areas: Hazardous (classified) areas are defined as in accordance with the NEC, NFPA 820, and as shown on the Drawings. All equipment installed in these areas shall conform to requirements for installation in the designated hazardous area as described in Articles 500, 501, and 502 of the NEC.

PART 2 - PRODUCTS

2.01 GENERAL

A. Mounting Hardware: Provide mounting hardware meeting the requirements of Division 26.

B. Identification: Provide equipment identification meeting the requirements of Division 26.

C. Calibrators and Programmers

1. Provide calibrators/programmers for all I&C equipment that cannot be calibrated from the controls built into the unit.
2. Provide a minimum of one calibrator/programmer for each type of equipment supplied.

D. Adjustable Dead-Band

1. Provide dead-band adjustment for all output contacts from all I&C equipment.
2. Provide a minimum of ± 10 percent adjustment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Conditions

1. Compare the site and existing facilities with the Contract Documents.
2. With respect to the conditions of the premises, locate connections of existing facilities and any obstructions that may be encountered and conduct work to minimize disruption to existing conditions.

B. Field Measurements: Field verify all locations and dimensions to ensure that the equipment will be properly located, readily accessible, and installed in accordance with all pertinent codes and regulations, the contract documents, and the referenced standards.

3.02 INSTALLATION - GENERAL

A. General

1. Equipment locations as shown on the drawings are approximate unless dimensioned.
2. Coordinate equipment locations with existing conditions and adjust locations as required.
3. The Contractor shall furnish, fabricate, and mount all instrument stands and brackets. Mounting of stands and instruments shall be per installation detail drawings. All stands must be level, plumb, rigid, and free from vibration. Additional support shall be added where required for vibration-free mounting.
4. Once instrumentation and control equipment has been set in place, Contractor shall maintain Space Conditioned Areas dust-free and with the following environmental conditions:
 - a. Ambient Temperature: 65 to 80°F
 - b. Relative Humidity: 50 to 70%
 - c. Chlorine: ISA S71.04, Class G2 or better
5. Provide temporary heating, cooling, dehumidification, humidification and air purification as necessary to provide the above conditions.

B. Instrumentation wiring is shown schematically on the plan or described by narrative in the specifications. Contractor to provide type and quantity of wiring necessary to perform the function specified in Sections 40 9X XX and shown on the Drawings. See Division 26 wire and cable sections for "uses permitted." Analog signal conductors and discrete signal conductors shall always be in separate conduits or cable tray compartments. Power wiring shall be in conduits and cable tray compartments separate from all signal wiring.

1. The Contractor shall terminate field wiring for equipment specified under this section. The system integrator shall check instrument installation and field wiring before instrument devices are electrically powered by Contractor. Wires shall be terminated at terminal blocks with crimp type, preinsulated tongue lugs. Lugs shall be of the appropriate size for the terminal block screws and for the number and size of the wires terminated. All signal shields shall have only one ground point that shall be located at the closest control panel. Seal around all conductors inside conduits as they enter equipment. Use watertight seal (closed cell RTU foam type) entering or leaving every building, box, or instrument. Install conduit water relief or "weep" on the system side of all seals to prevent intrusion of water into the equipment.
2. Spare Wiring: Signal and interlock wiring shall contain spare conductors in every raceway. Spare conductors shall be provided in pairs and shall be clearly and distinctly marked at every access point indicated where the pairs start and stop. The minimum number of spare pairs shall be 25 percent of the number of active pairs with a minimum of one spare pair.

C. Valves

1. General Application: Use gate and ball valves for shutoff duty; globe and ball valves for throttling duty.
2. Access: Locate valves for easy access and provide separate support where necessary.
3. Unions: Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown.
4. Stems: Install valves in horizontal piping with stem at or above the center of the pipe.
5. Clearance: Install valves in a position to allow full stem movement.

D. Threaded Connections

1. Procedure
 - a. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.
 - b. Align threads at point of assembly.
 - c. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).

- d. Assemble joint, wrench-tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

E. Tagging

1. All instrumentation equipment shall be provided with identification tags in accordance with the plans and Division 26 Section "Electrical identification". Each field instrument shall have a stainless steel tag.
2. The device tags shall be mounted using stainless steel cabling and crimped lug.

3.03 ADJUSTING

- A. Set Points: Alarm and control set points shall be adjusted to their operational values before the start of the field test.
- B. Calibration: Calibration adjustments shall be performed before the start of the field test. Testing shall commence after calibration verification for each instrument is provided to the Engineer.

3.04 FIELD QUALITY CONTROL

- A. Piping Tests: After piping systems have been put into service, inspect for leaks. Adjust pipes, valves, or fittings to stop leaks; replace equipment if leak persists.
- B. Field Test
 1. A technical representative of the system integrator and the Contractor shall perform a field test on the entire instrumentation and control system. All equipment provided by the system integrator and all interrelated equipment provided by other suppliers, such as pumps, blowers, valve operators, chemical feeders, motor controls, etc., shall be installed and operating properly before the test starts.
 2. All test equipment and materials shall be provided by the system integrator.
 3. As a minimum, the test shall consist of the following:
 - a. All wiring shall be checked at each termination point for correct wire size, type, color, termination, and wire number.
 - b. All instruments and devices shall be checked to verify compliance with the specifications and approved shop drawings. The calibration of analog devices shall be verified including the zero and span.
 - c. Analog wiring shall be checked for correct polarity and ground continuity at each termination point in the loop.

- d. All digital inputs shall be activated at the field element to verify proper response on the OIT.
- e. All analog inputs shall be tested at the field transmitter over a full range to verify proper response at OIT. Analog loops shall be verified at each termination point at 0, 25, 50, 75 and 100% signal levels.
- f. All digital and analog outputs shall be forced, via the OIT, or PLC if necessary, to verify proper response at the final control element.
- g. Communications shall be tested between all components, including existing equipment.
- h. Verify proper calibration of all instruments by independent measurements, such as checking levels with a measuring rod or pole, performing drawdown tests on wells to check flow rates, performing laboratory tests on samples, etc.
- i. Create temporary test conditions to simulate variations in process operation by throttling valves, controlling pump speed, shutting down process equipment, operating safety devices, etc. Where safety concerns or process limitations prohibit physical simulation and when agreed to by the Owner, simulated process signals may be used. Test conditions shall be sufficient to test the operation of every function of the instrumentation and control system including:
 - 1) Alarms and safety shutdowns.
 - 2) Equipment start/stop and speed controls.
 - 3) Pacing of chemical feed equipment.
 - 4) Recorders and indicators.
 - 5) Process controller operation and recovery from upsets.
 - 6) Programmable logic controller (PLC) or Supervisory Control and Data Acquisition (SCADA) system inputs and outputs.
 - 7) PLC or SCADA system programming.
- j. The test shall be performed according to the test procedures submitted. As each phase of the test is completed, test data sheets shall be signed and dated. The test data sheets shall document any modifications to the control and alarm settings, process engineering unit changes, programming changes, wiring changes, problems encountered, and steps taken to solve the problems.

- k. The commissioning effort shall be documented using forms similar to the sample Loop Validation/Inspection Tests form at the end of this Section.

3.05 CLEANING

- A. Instrumentation System: The instrumentation system components shall be kept clean and free of dust during the storage, start-up, demonstration, and warranty period.
- B. Control Panels and Consoles: Clean dust and dirt accumulation inside and outside control panels and consoles, on a monthly basis, during start-up and demonstration period.

3.06 DEMONSTRATION

- A. General: The Contractor shall perform a 30-day operational demonstration of the complete instrumentation and control system. The demonstration shall conform to the following requirements. The 30-day operational demonstration shall not begin until the field test is completed and all problems and defects encountered during the field test have been corrected.
- B. System Acceptance: System acceptance shall not occur until the entire instrumentation and control system has performed as a functioning unit continuously for 30 consecutive days without loss of control and monitoring function, except for periods of scheduled maintenance. Failure of any component, software function, or required function shall require a restart of the 30-day operational demonstration until 30 consecutive days of continuous operation have been completed.
- C. Staffing: Provide for the services of a qualified service technician for the duration of the 30-day demonstration. The service technician shall be on call 24 hours per day, 7 days a week.

3.07 PROTECTION

- A. The Contractor shall protect the instrumentation system components from water, dust, dirt, and corrosion during the start-up, demonstration, and warranty period.

3.08 INSTRUCTION OF PERSONNEL

- A. Field Training: Training shall be conducted on all I&C equipment provided under the 40 9X XX series Sections, and related electrical and interfaces to equipment provided by other division sections. Training sessions shall be conducted as follows:
 - 1. Provide 40 hours of training by factory-authorized representative of equipment to Owner's personnel.
 - 2. Training courses shall include hardware components emphasizing operation, calibration, maintenance, interface with other systems, and associated theory.

3. Minimum Goals: Training shall incorporate operational requirements described in these specifications. Training shall provide the plant operations personnel with the following:
 - a. Control set point and dead band modifications.
 - b. Control system start-up and shutdown.
 - c. Routine diagnostic checks and maintenance.
 - d. Field instrument calibration and maintenance.
 - e. Equipment diagnostic testing and replacement of failed parts.
 4. The process control system integrator shall submit a training program that provides the plant operations personnel a theoretical background and a broad range of related skills to achieve the listed goals. The instructor(s) shall be experienced in system applications similar to the equipment specified herein. The resumes of the training staff for instructing the plant operations personnel shall be available for review by the Owner. The plant operations personnel trainees shall be subjected to program testing, evaluation, and counseling. Study assignments shall be made and later reviewed by the instructors to the satisfaction of class attendees. Trainees shall be encouraged to freely ask questions during the instruction periods.
 5. The Contractor shall provide all classroom training courses and all hands-on training at the project site. Contractor shall provide tables, chairs, and all training documentation for training attendees.
 6. Provide text material for self-study and to supplement classroom lectures. The personnel attending the training courses shall be permitted to retain text materials for future reference.
- B. The Contractor shall develop a training program tailored to the Owner's needs including type and quantity of treatment plant personnel, a curriculum of described courses, duration of courses, and training facilities. The Contractor shall submit for approval a detailed outline of the proposed training schedule, how the training courses are to be conducted, and estimated dates for beginning and end of each training phase. The Contractor shall be responsible for the cost of the training program. The Owner shall be responsible for the trainee salaries and overhead costs.
- C. Calibration Certificate Forms: See following forms.

**SAMPLE
CALIBRATION CERTIFICATE**

Job Name:

Contract No.:

Tag Number/Loop Number:

Loop Description:

Instrument Location:

Manufacturer:

Model Number

Adjustable Range:

Calibrated Range:

Remarks:

Installation Per Manufacturer's Requirements?

Yes

No

Installation Per Contract Documents?

Yes

No

If "No", explain:

Calibration Test:

	Input (Units)	Output (Units)	Accuracy
0%			
10%			
25%			
50%			
75%			
90%			
100%			

Switch Test:

	Setting	Deadband	Switch Point Upscale	Switch Point Downscale
Setpoint 1				
Setpoint 2				
Setpoint 3				
Setpoint 4				

CALIBRATION CERTIFICATE (cont.)

I hereby certify that the above information is correct and accurate, to the best of my knowledge, and that the instrument indicated above has been supplied, installed, calibrated, and tested in accordance with the manufacturer's recommendations and the Contract Documents, unless otherwise noted.

Receipt of this Calibration Certification shall in no way imply acceptance of any work or instrument supplied as a part of this Contract.

CONTRACTOR'S Signature: _____ Date: _____
CONTRACTOR'S Printed
Name: _____

System Integrator's
Authorized Manufacturers
Representative Signature: _____ Date: _____

Representative Printed Name: _____
Phone Number: _____

Tester's Signature: _____ Date: _____
Tester's Printed Name: _____
Phone Number: _____

END OF SECTION 40 90 00

[illegible]

SECTION 40 91 00

PRIMARY SENSORS AND FIELD INSTRUMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall furnish, install, calibrate, test, adjust, and place into operation the primary sensors and field instruments as shown on the Drawings and specified herein to the satisfaction of OWNER.
2. The Drawings and Specifications illustrate and specify functional and general construction requirements of the sensors and field instruments and do not necessarily show or specify all components, wiring, piping, and accessories required to make a completely integrated system. CONTRACTOR shall provide all components, piping, wiring, accessories, and labor required for a complete, workable, and integrated system.
3. CONTRACTOR shall be responsible for installing in-line pressure and flow elements and for providing taps in the process piping systems for installation of other flow and pressure sensing instrumentation.

B. Coordination: Coordinate with other suppliers for installation of all items specified herein and required to ensure the complete and proper interfacing of all the components and systems.

C. Related Sections:

1. Section 40 95 13, Control Panels

1.02 REFERENCES

- A. AMSE B40.100, Pressure Gauges and Gauge Attachments
- B. ASTM A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
- C. ASTM A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
- D. ASTM A403/A403M, Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
- E. ASTM B88, Standard Specification for Seamless Copper Water Tube

- F. National Accreditation of Measurement and Sampling (NAMAS)
- G. NEMA 250, Enclosures for Electrical Equipment
- H. National Institute of Standards and Technology (NIST)

1.03 SUBMITTALS

- A. Comply with Section 40 90 00, Instrumentation and Control System General Requirements

PART 2 - PRODUCTS

2.01 IDENTIFICATION TAGS

- A. Type: White engraved phenolic
- B. Function: Identify specific characteristics of all sensors and field instruments. All instruments, whether field or panel mounted, shall have an identification tag.
- C. Performance Requirements:
 - 1. Tag numbers of sensors and field instruments shall be as shown on the drawings and as specified. For items not shown or specifically tagged, the item tag number shall be established by the system supplier.
 - 2. Information to be permanently engraved onto the tag shall include the identifying tag number, manufacturer, model number, service, and range.
 - 3. The tags shall be fastened to the device with self-tapping stainless steel screws. Where fastening with screws cannot be accomplished secure with 1/8 inch stranded stainless steel wire rope and secured with a crimp sleeve. Provide hole in end of tag for attachment of wire.
 - 4. All sensors and field instruments mounted on or within control panels and enclosures shall have the identification tag installed so that the engravings are easily visible to service personnel. Panel mounted devices shall have the tag attached to the rear of the device.
- D. Construction Features:
 - 1. Tags shall be engraved with 3/16-inch letters and constructed as follows:
 - a. 1/8- inch thick laminated phenolic for engraving composed of core laminated on both sides with a matte (non-glare) finish cover sheet
 - b. Core to be black; cover sheet to be white

- c. Mounting holes to be centered on width and 1/4 inch from each end

2.02 AC POWER ON-OFF SWITCH

- A. Function: Local power on-off selector switch for instruments. All 4-wire transmitters, as identified in the individual instrument sub-sections below or as shown on the Drawing, shall be provided with a 120 VAC power on-off selector switch located at the instrument.
- B. Selector Switch: Comply with the requirements of Specification Section 40 97 00, Control Panel Instruments and Devices.
- C. Enclosure: NEMA 4X stainless steel push button enclosure as manufactured by Hoffman, or approved equal.

2.03 ANALYTICAL INSTRUMENTATION

A. pH/OXIDATION REDUCTION POTENTIAL (ORP) ANALYZER

- 1. Type: Continuous monitoring system consisting of a digital pH/ORP sensor and a microprocessor-based analyzer/transmitter designed to measure pH/ORP of the sample and produce a proportional output signal linear to the pH/ORP
- 2. Performance:
 - a. Sensor:
 - 1) Range: -2 to 14 pH; -1500 to +1500 mV ORP
 - 2) Sensitivity: +/- 0.01 pH; +/- 0.5 mV ORP
 - 3) Stability: 0.03 pH; 2mV ORP per 24 hours, non-cumulative
 - 4) Operating Temperature: 23 to 158°F
 - 5) Maximum Pressure: 100 psi
 - 6) Maximum Flow Rate: 10 fps
 - 7) Built in temperature element
 - 8) Integral preamplifier
 - b. Analyzer/Transmitter:
 - 1) Range: Same as sensor
 - 2) Repeatability: 0.05% of span

- 3) Stability: 0.05% of span for 24 hours, non-cumulative
- 4) Outputs: 4 to 20 mA direct acting and isolated into 0 to 1000 ohms at 24 VDC power supply
- 5) Ambient Temperature Range (Transmitter): 22 to 122°F
- 6) Ambient Relative Humidity: 0 to 90% RH non-condensing

3. Construction Features:

a. Sensor:

- 1) Body: PEEK or Ryton®
- 2) Electrodes: 2 measuring electrodes to compare the process value to a stable internal reference. Reference Electrode shall be self-contained and shall not require an external Electrolyte Reservoir.
- 3) Sensor to contain thermistor or RTD for pH temperature correction
- 4) Sensor to be constructed to allow replenishing of pH 7 buffer in the standard electrode chamber
- 5) Provide submersible, flow-through, or convertible mounting type sensor as required.
- 6) Cable: PVC jacketed submersible type cable terminated in numbered spade lugs. Provide length as required to connect to remotely mounted transmitter (25 feet minimum length)
- 7) Connection: 1-inch NPT female

b. Analyzer/Transmitter:

- 1) Microprocessor-based solid-state circuitry designed for measurement of pH/ORP and transmission of proportional output signal linear to pH/ORP
- 2) The controller shall have the option for RS-232/MODBUS® or RS-485/MODBUS® expansion card for 2-way communication to a computer and have wireless downloading capability through an IR Port located on the interface unit to download and print realtime data, calibration history, and current set points in a CSV format.
- 3) The Interface unit shall allow operators to control sensor and interface functions with menu-driven software.

- 4) The interface unit shall have a built-in data logger with the capacity to store data on 15-minute intervals for up to 6 months with (2) sensors per controller.
 - 5) The interface unit shall have the ability to connect to (4) sensors.
 - 6) The interface unit shall include an isolated analog 4 to 20 mA output for each sensor. Unit shall include (3) Form C alarm contacts.
 - 7) The interface unit shall be housed in a NEMA 4X metal enclosure with corrosion-resistant finish.
 - 8) Power Requirement: 120 VAC, 60 Hz, 15 W
4. Accessories:
 - a. Provide a NEMA 4X rated 120 VAC power on-off switch.
 5. Manufacturer and Model:
 - a. Sensor/Probe:
 - 1) Differential ORP sensor for ORP measurement, as manufactured by Hach Company
 - 2) Or approved equal
 - b. Analyzer/Transmitter:
 - 1) Model SC1000, as manufactured by Hach Company
 - 2) Or approved equal

B. DISSOLVED OXYGEN (DO) ANALYZER

1. General:
 - a. Measurement principle shall be optical by means of the technology frequency domain lifetime-based luminescence quenching and signal processing.
 - b. Each DO analyzer shall be comprised of a sensor and an analyzer/controller tagged as listed in the Instrument Schedule and as shown on the Drawings.
2. Performance:
 - a. Operating range:
 - 1) Temperature: 32°F to 140°F (0°C to 60°C)

- 2) Pressure: less than or equal to 10 bar
 - 3) pH: 4 S.U. to 12 S.U.
 - b. Measuring range: 0.00 to 20.00 mg O₂/l; 0 to 200% of DO saturation
 - c. Accuracy:
 - 1) ± 0.05 mg O₂/L in the range less than 1 mg O₂/L
 - 2) ± 0.10 mg O₂/L in the range greater than 1 mg O₂/L
 - d. Repeatability: ± 0.05 mg O₂/L
 - e. Resolution: 0.01 mg O₂ / L (0.1%)
 - f. Response time: 90 percent of the final (true) reading (t₉₀) in less than 150 seconds [60 seconds for FDO® 701] and 95 percent of the final (true) reading in less than 200 seconds.
 - g. Signal averaging: User selectable, to provide a t₉₀ from 150 seconds to 300 seconds [from 60 seconds to 300 seconds for FDO® 701].
 - h. Temperature measurement (compensation) range: 23°F to 140°F (-5°C to 60°C)
3. Construction Features:
- a. Sensor:
 - 1) DO sensors shall be submersible in-situ probe type with optical Fluorescence Quenching DO measurement.
 - 2) Sensor shaft shall be Stainless Steel
 - 3) The sensor mounting shall use an extension pipe or cable suspension mounting suitable for mounting as shown on the drawings.
 - 4) Probes shall be supplied with 35-foot extension cable fitted with a pre-terminated IP68 inductive quick connect coupling at the probe end.
 - b. Analyzer/Transmitter:
 - 1) The DO analyzer system electronics enclosure, air blast system, and related external components shall have environmental ratings suitable for their respective process areas. In no case shall the product environmental rating be less than NEMA 4X.

- 2) The DO measuring system shall be supplied with an air-blast cleaning system suitable for operation on 120 VAC power source including a wall/railing mounted air blast compressor in a weatherproof enclosure, and solenoid valves to control air blast to each probe. Each sensor probe shall be supplied with an air blast cleaning head and 35 feet of flexible wastewater rated tubing.
- 3) The controller shall operate on 120 VAC power source and have 4-20 maDC loop powered outputs for each DO measurement channel with an accuracy of plus or minus 0.5 percent of calibrated span or better. The analyzer/controller shall also include programmable relay outputs for controller fault and to control the air blast cleaning solenoids.
- 4) The controller output spans shall be calibrated to match the range of each process variable specific to the respective application to maximize measurement resolution.

4. Accessories:

- a. Probes shall be supplied with 35 foot extension cable fitted with a pre-terminated IP68 inductive quick connect coupling at the probe end.
- b. Air blast cleaning assembly
- c. Handrail sensor mounting assembly.

5. Manufacturer and Model:

- a. Sensor/Probe:
 - 1) LDO sc Model 2 by Hach Company
- b. Analyzer/Transmitter:
 - 1) Model SC1000 by Hach Company

C. AMMONIA (NH₃) ANALYZER

1. General:

- a. Analyzer for monitoring of ammonium in water.
- b. The method of measuring ammonium shall be by gas selective electrode (GSE) that uses liquid to gas- phase conversion.
 - 1) Sample shall be mixed with sodium hydroxide to convert ammonium to ammonia which is then expelled from the sample.
 - 2) The ammonia gas can pass the gas selective membrane.

- 3) Ammonia changes the pH of the electrolyte and the electrode then measures the pH value and calculates the ammonium concentration.
 - c. Each NH₃ analyzer shall be comprised of a sensor and an analyzer/controller tagged as listed in the Instrument Schedule and as shown on the Drawings.
2. Performance:
- a. Operating criteria:
 - 1) Ambient Temperature: -20 to 45 °C (-4 to 114 °F)
 - 2) Sample Temperature: 4 to 40 °C (39 to 104 °F)
 - 3) Sample pH: 5 to 9 pH
 - b. Measuring range: As shown on the Instrument Schedule
 - c. Accuracy: 3% + 0.02 mg/L
 - d. Repeatability: 3% + 0.02 mg/L
 - e. Response time: 5 minutes (T₉₀) , including sample preparation
 - f. Measurement interval: 5, 10, 15, 20, or 30 minutes (user adjustable)
3. Construction Features:
- a. The analyzer shall automatically self-calibrate and initiate self-cleaning procedures.
 - b. The system electronics enclosure, air blast system, and related external components shall have environmental ratings suitable for their respective process areas. In no case shall the product environmental rating be less than NEMA 4X.
 - c. The system shall be supplied with an air-blast cleaning system suitable for operation on 120 VAC power source including a wall/railing mounted air blast compressor in a weatherproof enclosure, and solenoid valves to control air blast.
 - d. The controller shall operate on 120 VAC power source and have a 4-20 mA outputs proportional to the measured output with an accuracy of +/-0.5 percent of calibrated span or better. The analyzer/controller shall also include programmable relay outputs for controller fault and to control the air blast cleaning solenoids.

- e. The controller output spans shall be calibrated to match the range of each process variable specific to the respective application to maximize measurement resolution.
- 4. Accessories:
 - a. Sample filtration unit
 - b. Air cleaning system
 - c. Reagent set
 - d. Handrail mounting assembly for all system components and accessories.
- 5. Provide spare parts and reagents required for 1 year worth of maintenance procedures.
- 6. Manufacturer and Model:
 - a. NH6000sc Ammonia Analyzer by Hach Company

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Items shall be inspected for damage upon delivery to the site.
- B. Damaged components shall not be installed.

3.02 INSTALLATION

- A. Contractor shall require the system supplier to furnish the services of qualified factory-trained servicemen to assist in the installation of the instrumentation and control system equipment.
- B. Install each item in accordance with manufacturer's recommendations in accordance with the Contract Documents. Transmitters and instruments which require access for periodic calibration or maintenance shall be mounted so they are accessible while standing on the floor. Care shall be taken in the installation to ensure sufficient space is provided between instruments and other equipment or piping to allow for easy removal and servicing.
- C. All items shall be mounted and anchored using stainless steel hardware unless otherwise noted.
- D. All field instruments shall be rigidly secured to walls, stands, or brackets as required by the manufacturer and as shown on the Contract Drawings.

- E. Conform to all applicable provisions of the NEMA standards, NEC, and local, State, and Federal codes when installing the equipment and interconnecting wiring.

3.03 SCHEDULES

INSTRUMENTATION SCHEDULE							
TYPE	TAG	LOOP #	PROCESS DESCRIPTION	RANGE	SETPOINT	LINE SIZE	SPEC
ANALYZER	AIT	301	ANAEROBIC TANK ORP	(-1500) - 1500 mV	N/A	N/A	2.3 A
ANALYZER	AIT	351A	AERATION TANK 5 ANOXIC ZONE ORP	(-1500) - 1500 mV	N/A	N/A	2.3 A
ANALYZER	AIT	351B	AERATION TANK 5 PASS 2 DO 1	0 - 20 mg/L	N/A	N/A	2.3 B
ANALYZER	AIT	351C	AERATION TANK 5 PASS 2 DO 2	0 - 20 mg/L	N/A	N/A	2.3 B
ANALYZER	AIT	351D	AERATION TANK 5 PASS 3 DO 1	0 - 20 mg/L	N/A	N/A	2.3 B
ANALYZER	AIT	351E	AERATION TANK 5 PASS 3 DO 2	0 - 20 mg/L	N/A	N/A	2.3 B
ANALYZER	AIT	351F	AERATION TANK 5 EFFLUENT NH3	0.02 - 5 mg/L	N/A	N/A	2.3 C
ANALYZER	AIT	361A	AERATION TANK 6 ANOXIC ZONE ORP	(-1500) - 1500 mV	N/A	N/A	2.3 A
ANALYZER	AIT	361B	AERATION TANK 6 PASS 2 DO 1	0 - 20 mg/L	N/A	N/A	2.3 B
ANALYZER	AIT	361C	AERATION TANK 6 PASS 2 DO 2	0 - 20 mg/L	N/A	N/A	2.3 B
ANALYZER	AIT	361D	AERATION TANK 6 PASS 3 DO 1	0 - 20 mg/L	N/A	N/A	2.3 B
ANALYZER	AIT	361E	AERATION TANK 6 PASS 3 DO 2	0 - 20 mg/L	N/A	N/A	2.3 B
ANALYZER	AIT	361F	AERATION TANK 6 EFFLUENT NH3	0.02 - 5 mg/L	N/A	N/A	2.3 C
ANALYZER	AIT	371A	AERATION TANK 7 ANOXIC ZONE ORP	(-1500) - 1500 mV	N/A	N/A	2.3 A
ANALYZER	AIT	371B	AERATION TANK 7 PASS 2 DO 1	0 - 20 mg/L	N/A	N/A	2.3 B
ANALYZER	AIT	371C	AERATION TANK 7 PASS 2 DO 2	0 - 20 mg/L	N/A	N/A	2.3 B
ANALYZER	AIT	371D	AERATION TANK 7 PASS 3 DO 1	0 - 20 mg/L	N/A	N/A	2.3 B
ANALYZER	AIT	371E	AERATION TANK 7 PASS 3 DO 2	0 - 20 mg/L	N/A	N/A	2.3 B
ANALYZER	AIT	371F	AERATION TANK 7 EFFLUENT NH3	0.02 - 5 mg/L	N/A	N/A	2.3 C

END OF SECTION 40 91 00

SECTION 40 94 43
PLANT CONTROL SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. Related Sections: The following sections contain requirements that relate to this section.
 - 1. Division 26 – All Sections
 - 2. Division 40 – Sections 40 9X XX

1.02 DESCRIPTION OF WORK

- A. General: Provide all labor, tools, equipment, and materials necessary for a complete and operational Plant Control System in accordance with the plans and as specified herein.
- B. Contractor shall furnish all labor, materials, and components, and shall provide all design, assembly, testing, and start-up services required to provide a complete and operational programmable controller system (referred to herein as PLC) as specified and shown on the Drawings. The system includes, but is not necessarily limited to the following:
 - 1. Processor modules.
 - 2. Communication equipment.
 - 3. Input/output (I/O) modules.
 - 4. Operator interface equipment.
 - 5. Mounting racks.
 - 6. Power supplies.
 - 7. Programming equipment.
 - 8. Software.

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements of the National Electrical Code

(NEC) and all other applicable federal, state, and local codes and regulatory requirements.

B. Standards: Materials and workmanship shall conform to the following standards:

1. National Electrical Manufacturers Association (NEMA).
2. Institute of Electrical and Electronic Engineers (IEEE).
3. American National Standards Institute (ANSI).
4. National Fire Protection Association (NFPA).
5. Underwriters' Laboratories (UL).
6. International Society for Measurement and Control (ISA).

C. Qualifications

1. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of programmable logic controllers (PLCs) whose products have been in satisfactory use in similar service for not less than 5 years.
2. Installer's Qualifications: Firm with at least 5 years of successful installation experience on projects with materials and equipment similar to items specified herein.

1.04 SUBMITTALS

- A. General: Furnish manufacturer's product data for all components.
- B. Materials List: Submit a bill of materials listing quantities, manufacturer's name, and catalog numbers.
- C. Wiring Diagrams: Submit wiring diagrams showing all connections for all equipment furnished under this section. Wire, terminal, and component labeling shall follow established facility conventions where applicable.
- D. System Hardware and Software Documents: Furnish a system block diagram, I/O drawings, and control strategy descriptions. Turn over all factory software documentation and manuals to the Engineer after completion of field testing.
- E. Dimensional Drawings: Furnish dimensional drawings for each piece of equipment to be provided.
- F. Program Documentation: Submit annotated printouts of all PLC and Human Machine Interface (HMI) programs. Provide copies of all PLC and HMI programs on a flash drive.

- G. Manufacturer's Data Sheet: Provide manufacturer's data sheet on all equipment including model numbers, serial numbers, ranges, scales, and a detail of each component.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection: Store the items furnished under this section in a manner that meets the requirements of the manufacturer until they can be installed. Use all means necessary to protect the material of this section before, during, and after installation, and to protect the installed work and materials of all other trades.

1.06 DEFINITIONS

- A. Training Day: A training day is defined as 8 hours of classroom and hands-on instruction, including two 15-minute breaks and excluding lunchtime, Monday through Friday.

PART 2 - PRODUCTS

2.01 SCADA SYSTEM

- A. Programmable Logic Controller (PLC) Components:
 - 1. DIN Rail Mounted:
 - a. Processor Module: 5069-L320ER
 - b. Digital Input Module: 5069-IA16
 - c. Digital Output Module: 5069-OA16, provide interposing relay for each output. Allen-Bradley 700HLT1L1 or approved equal.
 - d. Analog Input Module: 5069-IF8
 - e. Analog Output Module: 5069-OF8
 - 2. Protocol Gateway:
 - a. Model as required for native protocol to Ethernet/IP conversion for quantity of connected devices.
 - b. DIN Rail mounted
 - 3. Manufacturers:
 - a. All components shall be manufactured by Allen-Bradley or an Encompass Partner.

B. Operator Interface Terminal (OIT):

1. Features:

- a. Touch screen flat display
- b. Color TFT LCD
- c. 18-bit color graphics
- d. Size: 15" diagonal nominal, unless otherwise noted
- e. Resolution: 1024x768, minimum
- f. Communications: Ethernet/IP, USB
- g. SD card slot
- h. NEMA 4X
- i. Real-time battery backed clock
- j. Memory: 512 MB RAM and 512 MB user storage
- k. Input Power: 24Vdc

2. Manufacturers:

- a. Allen-Bradley, PanelView Plus 7 Performance

PART 3 - EXECUTION

3.01 CUSTOM PROGRAMMING

A. Custom Programming of all vendor provided control panels, including their PLCs and OITs, shall be provided by that vendor under the applicable specification section of the associated equipment.

- 1. Provide database spreadsheets for peer-to-peer communication coordination between other onsite PLCs that need to share data.
- 2. Provide database spreadsheets for Plant HMI/SCADA communication coordination.
- 3. Provide annotated copies of all PLC programs.
- 4. Provide an electronic copy of all PLC and OIT programming files for the Owner on a flash drive. Format shall be as required to reload into device memory. Logic

version shall be the final program after all equipment has been installed and commissioned and Operational Demonstration is complete and successful to the Owner's approval.

B. Custom Programming of non-vendor provided control panels, including their PLCs and OITs, shall be provided by the Contractor.

1. Contractor shall write logic using Owner standardized firmware versions.
 - a. PLC standard firmware is Studio 5000 Logix Designer v30.
 - 1) Logic shall be developed using ladder logic only. Function block and structured text shall not be acceptable.
 - b. OIT/HMI standard firmware is FactoryTalk View ME/SE v12.
2. All application files, along with any usernames and passwords, created shall be provided to Owner.
3. All PLC developed logic shall be delivered to the Owner for review and subsequent incorporation into the existing control system. Contractor shall not connect to the live control network or any network devices without prior Owner approval.

C. Custom Programming of existing HMI/SCADA will be provided by the Owner.

D. Variable Frequency Drives

1. Provide programming for all VFDs connected to the network.
2. Read and display the contents of a minimum of eight registers in each VFD.
3. Coordinate with the Owner prior to the start of programming to select the register to be displayed.

E. Graphic Screens

1. Submit all graphic screens for Owner review and comment when sixty percent complete.
2. Provide navigation controls on all screens to allow movement between screens.
3. Conform to Owner standards for colors of process equipment and piping.
4. Utilize industry standard symbols or graphically realistic drawings for process equipment.
5. Provide a separate screen for each group of process equipment.

6. Group related screens in a logical manner such as by building, plant flow, liquid stream/solids stream, etc.
7. At a minimum, provide the following screens:
 - a. East Primary Flow Splitter Overview
 - 1) Control Popup for each associated controllable equipment
 - b. Anaerobic Tank / Splitter Box 3 Overview
 - 1) Control Popup for each associated controllable equipment
 - c. Aeration Tank 5 Overview
 - 1) Control Popup for each associated controllable equipment
 - d. Aeration Tank 6 Overview
 - 1) Control Popup for each associated controllable equipment
 - e. Aeration Tank 7 Overview
 - 1) Control Popup for each associated controllable equipment
 - f. Alarm Summary Screens
 - g. Equipment Runtimes (with resets) Screen
 - h. Totalizers Screen
 - i. (3) Analog Signal Trending Screens – Owner Directed
 - j. (3) Overview/Control Screens – Owner Directed

F. Global Programmed Control Strategies

1. Meet with Plant Personnel before start of programming to determine:
 - a. PLC and SCADA tag naming conventions
 - b. Time of day for resetting of daily totalizers
 - c. Security Levels for all screens
 - d. The master PCS clock and approach to sync network devices
2. Display all alarms at the HMI.
3. Provide means to acknowledge all alarms at the HMI.

4. Provide alarms for PLC failure and network failure.
5. Totalize the number of starts for all process equipment and display on the plant HMI.
6. All process setpoints displayed on HMI screens and read back for confirmation.
7. All process setpoints adjustable from the HMI screens with correct security level.
8. Perform a runtime calculation for all process equipment at PLC and display at the HMI.
9. Display rate, total, and daily total for all process flows at the HMI.
10. Display all process levels at the HMI.
11. All inline instrumentation shall be shown with instantaneous values on the HMI. One year of data shall be stored for trending.
12. All data shall be automatically graphed when chosen by the operator.
13. All bits/elements in PLC logic shall be commented. If not used, then comment as SPARE.

G. SCADA Programming Functional Requirements

1. The Functional Descriptions below are intended to aid in defining the scope of work for PLC/OIT/HMI programming. These functional descriptions are intended to be supplemental to the requirements as shown on the Drawings. Hardwired interlocks for equipment control may not be described below. Hardwired interlocks shall be mimicked in PLC logic.
2. Where the referenced detail applies to multiple, similar equipment controls, only one is described. Control for associated equipment is similar.
3. Reference the PLC I/O schedules. The PLC I/O shall be utilized by PLC/HMI programming, as required, to allow the respective equipment to function as described by the Contract Documents.
 - a. All alarm and equipment status monitoring PLC I/O inputted into the Plant Control System (PCS) shall be annunciated via the HMI.
4. All references to set points as “adjustable” below shall include the capability to adjust the set point via the HMI.
5. FUNCTIONAL DESCRIPTION INDEX:
 - a. “6. EAST FLOW”

- b. “7. ANAEROBIC TANK”
 - c. “8. SPLITTER BOX 3”
 - d. “9. AERATION TANKS”
6. EAST FLOW
- a. WWHT Influent Flow Control Gate (GATE H)
 - 1) General: Used to control flow into the Wet Weather Holding Tank during wet weather events.
 - 2) Control:
 - a) Local: With the LOCAL-STOP-REMOTE selector switch at the actuator in the LOCAL position, the operator can open or close the gate by using the OPEN-CLOSE selector switch at the actuator. With the LOCAL-STOP-REMOTE selector switch at the actuator in the STOP position, the actuator shall stop and maintain the current position.
 - b) PCS: With the LOCAL-STOP-REMOTE selector switch at the actuator in the REMOTE position, the operator shall have the ability to select MANUAL or AUTO control of the gate via the HMI.
 - (1) MANUAL: The operator shall have the ability to adjust the gate position between 0-100%.
 - (2) AUTO: The position of the gate is controlled based on East Train Flows.
 - (a) When the East Influent Flow is above 15.6 MGD, the gate will modulate to maintain the East Influent Flow at 15.6 MGD as the control setpoint. These setpoints are hardcoded into the logic and not available for operator entry.
 - (b) As East Influent Flow decreases after this gate’s auto control is activated, flow below 10 MGD for 5 minutes shall deactivate the auto control and fully close this gate.
 - 3) Logic Interlocks/Permissives: The gate shall not be permitted to open when the WWHT high level alarm is active.
 - 4) Monitoring:

- a) Local: Opened, Closed, Position
 - b) PCS: Opened, Closed, Position, Remote
 - 5) Alarms:
 - a) Local: Fault
 - b) PCS: Fault, Loss of Signal
 - b. East Diversion Structure Flow Control Gate (GATE 10)
 - 1) General: Used to control flow into the East process train.
 - 2) Control:
 - a) Local: Existing to remain.
 - b) PCS: Existing to remain. Modify auto logic setpoint to include once Gate H auto control has been activated and the WWHT High Level Alarm is active, then this gate's auto flow setpoint becomes 15.6 MGD.
 - c) As plant influent flow decreases after this gate's auto control is activated, when plant total influent flow (East Raw Flow + West Raw Flow) is below 30 MGD for 5 minutes shall deactivate the auto control and fully close this gate.
 - 3) Logic Interlocks/Permissives: Existing to remain.
 - 4) Monitoring: Existing to remain.
 - 5) Alarms: Existing to remain.
7. ANAEROBIC TANK
- a. Anaerobic Tank Mixer
 - 1) General: Used to agitate tank flow to maintain solids in suspension.
 - 2) Control:
 - a) Local: With the LOCAL-OFF-REMOTE selector switch at the local control panel in the LOCAL position, the operator shall have the ability to START and STOP the mixer via the START/STOP pushbuttons. The operator shall have the ability to adjust mixer speed from 0-100% at the local control panel.
 - b) PCS: With the LOCAL-OFF-REMOTE selector switch at the

local control panel in the REMOTE position, the operator shall have the ability to manually start/stop the mixer via the HMI.

- 3) Logic Interlocks/Permissives: None
- 4) Monitoring:
 - a) Local: Running, Stopped, Speed
 - b) PCS: Running, Stopped, Remote
- 5) Alarms:
 - a) Local: Warning Fault, Shutdown Fault
 - b) PCS: Warning Fault, Shutdown Fault

b. Anaerobic Tank ORP

- 1) General: Used to continuously monitor the ORP level of the process liquid.
- 2) Control:
 - a) Local: None
 - b) PCS: None
- 3) Logic Interlocks/Permissives: None
- 4) Monitoring:
 - a) Local: Instantaneous ORP indication
 - b) PCS: Anaerobic Tank ORP
- 5) Alarms:
 - a) Local: None
 - b) PCS: High-High, High, Low, Low-Low Anaerobic Tank ORP, Loss of Signal

8. SPLITTER BOX 3

a. Aeration Tank Flow Control Gate

- 1) General: Used to control the flow rate to the aeration tank from the splitter box.

- 2) Control:
- a) Local: With the LOCAL-STOP-REMOTE selector switch at the actuator in the LOCAL position, the operator can open or close the gate by using the OPEN-CLOSE selector switch at the actuator. With the LOCAL-STOP-REMOTE selector switch at the actuator in the STOP position, the actuator shall stop and maintain the current position.
 - b) PCS: With the LOCAL-STOP-REMOTE selector switch at the actuator in the REMOTE position, the operator shall have the ability to select MANUAL or AUTO control of the gate via the HMI.
 - (1) MANUAL: The operator shall have the ability to adjust the gate position between 0-100%.
 - (2) AUTO: The position of the gate is controlled based on the combination of plant flow and availability of the associated aeration tank.
 - (a) AT5, AT6 FCG: When the associated aeration tank's influent gate is not in the fully closed position, the FCG shall move to the 80% open position.
 - (b) AT7 FCG: When the gate is placed into REMOTE-AUTO control mode, the gate shall move to the 88% open position. If Aeration Tank Flow (East Primary Flow + West Primary Flow + Return Aerated Sludge Flow) is greater than or equal to 36 MGD, then the gate shall move to the 72% open position. The gate shall stay at that position until the Aeration Tank Flow falls below 30 MGD for a continuous 5 minutes. Once that timer has expired, the gate shall move back to the 88% open position.
- 3) Logic Interlocks/Permissives: When the associated aeration tank's influent gate is fully closed, this flow control gate shall move to the fully closed position.
- 4) Monitoring:
- a) Local: Opened, Closed, Position
 - b) PCS: Opened, Closed, Position, Remote
- 5) Alarms:

- a) Local: Fault
- b) PCS: Fault, Loss of Signal

9. AERATION TANKS

a. Aeration Tank Influent Gate

- 1) General: Used to isolate the aeration tank from splitter box discharge flow.
- 2) Control:
 - a) Local: With the LOCAL-STOP-REMOTE selector switch at the actuator in the LOCAL position, the operator can open or close the gate by using the OPEN-CLOSE selector switch at the actuator. With the LOCAL-STOP-REMOTE selector switch at the actuator in the STOP position, the actuator shall stop and maintain the current position.
 - b) PCS: With the LOCAL-STOP-REMOTE selector switch at the actuator in the REMOTE position, the operator shall have the ability to open and close the gate via the HMI.
- 3) Logic Interlocks/Permissives: None
- 4) Monitoring:
 - a) Local: Opened, Closed
 - b) PCS: Opened, Closed, Remote
- 5) Alarms:
 - a) Local: Fault
 - b) PCS: Fault

b. Aeration Tank Mixer

- 1) General: Used to agitate tank flow to maintain solids in suspension.
- 2) Control:
 - a) Local: With the LOCAL-OFF-REMOTE selector switch at the local control panel in the LOCAL position, the operator shall have the ability to START and STOP the mixer via the START/STOP pushbuttons. The operator shall have the ability to adjust mixer speed from 0-100% at the local control panel.

- b) PCS: With the LOCAL-OFF-REMOTE selector switch at the local control panel in the REMOTE position, the operator shall have the ability to manually start/stop the mixer via the HMI.
 - 3) Logic Interlocks/Permissives: None
 - 4) Monitoring:
 - a) Local: Running, Stopped, Speed
 - b) PCS: Running, Stopped, Remote
 - 5) Alarms:
 - a) Local: Warning Fault, Shutdown Fault
 - b) PCS: Warning Fault, Shutdown Fault
- c. Aeration Tank Anoxic Pass ORP
 - 1) General: Used to continuously monitor the ORP level of the process liquid.
 - 2) Control:
 - a) Local: None
 - b) PCS: None
 - 3) Logic Interlocks/Permissives: None
 - 4) Monitoring:
 - a) Local: Instantaneous ORP indication
 - b) PCS: Aeration Tank Anoxic Pass ORP
 - 5) Alarms:
 - a) Local: None
 - b) PCS: High-High, High, Low, Low-Low Aeration Tank Anoxic Pass ORP, Loss of Signal
- d. Aeration Tank Air Flow Control Valve
 - 1) General: Used to control the air flow rate to the aeration tank diffusers.

2) Control:

- a) Local: With the LOCAL-STOP-REMOTE selector switch at the actuator in the LOCAL position, the operator can open or close the valve by using the OPEN-CLOSE selector switch at the actuator. With the LOCAL-STOP-REMOTE selector switch at the actuator in the STOP position, the actuator shall stop and maintain the current position.
- b) PCS: With the LOCAL-STOP-REMOTE selector switch at the actuator in the REMOTE position, the operator shall have the ability to select MANUAL or AUTO control of the valve via the HMI.
 - (1) MANUAL: The operator shall have the ability to adjust the valve position between 0-100%.
 - (2) AUTO: The position of the valve is controlled based on the dissolved oxygen (DO) level of the associated zone. Valve shall modulate to maintain the operator entered DO setpoint.

3) Logic Interlocks/Permissives: None

4) Monitoring:

- a) Local: Opened, Closed, Position
- b) PCS: Opened, Closed, Position, Remote

5) Alarms:

- a) Local: Fault
- b) PCS: Fault, Loss of Signal

e. Aeration Tank Pass DO

- 1) General: Used to continuously monitor the dissolved oxygen level of the process liquid.
- 2) Control:
 - a) Local: None
 - b) PCS: None
- 3) Logic Interlocks/Permissives: None

- 4) Monitoring:
 - a) Local: Instantaneous DO indication
 - b) PCS: Aeration Tank Pass DO
- 5) Alarms:
 - a) Local: None
 - b) PCS: High-High, High, Low, Low-Low Aeration Tank Pass DO, Loss of Signal

f. Aeration Tank Effluent Ammonia

- 1) General: Used to continuously monitor the ammonia level of the tank effluent.
- 2) Control:
 - a) Local: None
 - b) PCS: None
- 3) Logic Interlocks/Permissives: None
- 4) Monitoring:
 - a) Local: Instantaneous Ammonia indication
 - b) PCS: Aeration Tank Effluent Ammonia
- 5) Alarms:
 - a) Local: None
 - b) PCS: High-High, High, Low, Low-Low Aeration Tank Effluent Ammonia, Loss of Signal

g. Aeration Tank Internal Mixed Liquor Return Pump

- 1) General: Used to return mixed liquor to the inlet of the associated aeration tank.
- 2) Control:
 - a) Local: With the LOCAL-OFF-REMOTE selector switch at the local control panel in the LOCAL position, the operator shall have the ability to START and STOP the pump via the

START/STOP pushbuttons.

- b) PCS: With the LOCAL-OFF-REMOTE selector switch at the local control panel in the REMOTE position, the operator shall have the ability to manually start/stop the pump via the HMI.
- 3) Logic Interlocks/Permissives: None
- 4) Monitoring:
 - a) Local: Running, Stopped
 - b) PCS: Running, Stopped, Remote
- 5) Alarms:
 - a) Local: General Alarm
 - b) PCS: Motor Overload, Motor High Temperature, Moisture in Motor

3.02 EXAMINATION

- A. Verification of Conditions: Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- B. Discrepancies: In the event any discrepancies are discovered, immediately notify the Owner's Representative in writing. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.03 PREPARATION

- A. Protection
 - 1. All equipment and materials shall be packed at the factory to protect each item from damage during shipment and storage.
 - 2. Provide blocking and cushioning materials to prevent damage during shipment.
 - 3. Panel mounted instruments and equipment to be installed inside enclosures, panels, or consoles shall be mounted and assembled at the panel manufacturer's facility.

3.04 INSTALLATION

- A. General: Install equipment, as indicated, with manufacturer's written instructions and with recognized industry practices.

3.05 FIELD QUALITY CONTROL

- A. Inspection: Provide for services of a qualified representative of the manufacturer to inspect and approve installation.
- B. Tests: Upon completion of all inspections, and prior to acceptance, perform field tests outlined in Division 40 Section “Plant Instrumentation and Control System General Requirements”.
- C. Operational Demonstration: After completion of the field test, perform a 30-day operational demonstration as specified in Division 40 Section “Plant Instrumentation and Control System General Requirements”.

3.06 DEMONSTRATION

- A. General: When all required tests have been performed and prior to final acceptance, the Contractor shall perform a 30-day operational demonstration in accordance with the requirements of Division 40 Section “Plant Instrumentation and Control System General Requirements”.

3.07 EXTRA MATERIALS

- A. Spare Parts: The Contractor shall provide uninstalled spare parts to the Owner to facilitate proper maintenance and minimize downtime of the PLC system.
- B. Quantity: Provide spares for each type of module listed below equal to 10 percent of the total of each type used in the system rounded up to the next whole number.
 - 1. Processor Modules
 - 2. Digital Input Modules
 - 3. Digital Output Modules
 - 4. Analog Input Modules
 - 5. Analog Output Modules
- C. Provide (6) OIT protective screen overlays.
- D. Replacements: Any spare part used during the start-up, demonstration, and warranty period shall be replaced by the Contractor at no cost.

3.08 PLC SYSTEM TRAINING

- A. General.
 - 1. Provide a training course customized for the control system hardware.

2. Provide training on the operation and maintenance of the control system hardware.
3. Provide training manuals for each attendee plus two additional manuals in archival preservation at the project site.
4. Include the following in each manual.
 - a. An agenda
 - b. Defined objectives for each lesson.
5. Provide all equipment, materials, and supplies used in the training.
6. For guidance in planning the required instruction, assume that attendees will have a high school education or equivalent and basic electrical maintenance knowledge.

B. Location, duration, and schedule.

1. Teach the course at the project site.
2. Provide one day of training for five personnel designated by the Owner.
3. Conduct training after completion of the Contractor's field testing.

3.09 INPUT/OUTPUT SCHEDULE

A. Abbreviations

1. AI – Analog Input
2. AO – Analog Output
3. CPU – Processor
4. DI – Digital Input
5. DO – Digital Output
6. RIO – Remote I/O Communications

B. Installed spare inputs and outputs (I/O): In addition to the I/O listed below, provide a minimum of 10 percent installed.

1. All SPARE I/O shall be wired to terminal blocks within the PLC enclosure.

END OF SECTION 40 94 43

I/O LIST					
PLC	MODULE				MODULE / POINT DESCRIPTION
	TYPE	RACK	SLOT	POINT	
CBB	DI	0	1	0	AERATION TANK 5 FLOW CONTROL GATE IN REMOTE
CBB	DI	0	1	1	AERATION TANK 5 FLOW CONTROL GATE OPENED
CBB	DI	0	1	2	AERATION TANK 5 FLOW CONTROL GATE CLOSED
CBB	DI	0	1	3	AERATION TANK 5 FLOW CONTROL GATE FAULT
CBB	DI	0	1	4	AERATION TANK 6 FLOW CONTROL GATE IN REMOTE
CBB	DI	0	1	5	AERATION TANK 6 FLOW CONTROL GATE OPENED
CBB	DI	0	1	6	AERATION TANK 6 FLOW CONTROL GATE CLOSED
CBB	DI	0	1	7	AERATION TANK 6 FLOW CONTROL GATE FAULT
CBB	DI	0	1	8	AERATION TANK 7 FLOW CONTROL GATE IN REMOTE
CBB	DI	0	1	9	AERATION TANK 7 FLOW CONTROL GATE OPENED
CBB	DI	0	1	10	AERATION TANK 7 FLOW CONTROL GATE CLOSED
CBB	DI	0	1	11	AERATION TANK 7 FLOW CONTROL GATE FAULT
CBB	DI	0	2	0	ANAEROBIC TANK MIXER 1 IN REMOTE
CBB	DI	0	2	1	ANAEROBIC TANK MIXER 1 RUNNING
CBB	DI	0	2	2	ANAEROBIC TANK MIXER 1 SHUTDOWN FAULT
CBB	DI	0	2	3	ANAEROBIC TANK MIXER 1 WARNING FAULT
CBB	DI	0	2	4	ANAEROBIC TANK MIXER 2 IN REMOTE
CBB	DI	0	2	5	ANAEROBIC TANK MIXER 2 RUNNING
CBB	DI	0	2	6	ANAEROBIC TANK MIXER 2 SHUTDOWN FAULT
CBB	DI	0	2	7	ANAEROBIC TANK MIXER 2 WARNING FAULT
CBB	DI	0	2	8	AERATION TANK 5 INFLUENT GATE IN REMOTE
CBB	DI	0	2	9	AERATION TANK 5 INFLUENT GATE OPENED
CBB	DI	0	2	10	AERATION TANK 5 INFLUENT GATE CLOSED
CBB	DI	0	2	11	AERATION TANK 5 INFLUENT GATE FAULT
CBB	DI	0	3	0	AERATION TANK 5 MIXER 1 IN REMOTE
CBB	DI	0	3	1	AERATION TANK 5 MIXER 1 RUNNING
CBB	DI	0	3	2	AERATION TANK 5 MIXER 1 SHUTDOWN FAULT
CBB	DI	0	3	3	AERATION TANK 5 MIXER 1 WARNING FAULT
CBB	DI	0	3	4	AERATION TANK 5 MIXER 2 IN REMOTE
CBB	DI	0	3	5	AERATION TANK 5 MIXER 2 RUNNING
CBB	DI	0	3	6	AERATION TANK 5 MIXER 2 SHUTDOWN FAULT
CBB	DI	0	3	7	AERATION TANK 5 MIXER 2 WARNING FAULT
CBB	DI	0	3	8	AERATION TANK 5 PASS 2 AIR FCV 1 IN REMOTE
CBB	DI	0	3	9	AERATION TANK 5 PASS 2 AIR FCV 1 OPENED
CBB	DI	0	3	10	AERATION TANK 5 PASS 2 AIR FCV 1 CLOSED
CBB	DI	0	3	11	AERATION TANK 5 PASS 2 AIR FCV 1 FAULT
CBB	DI	0	3	12	AERATION TANK 5 PASS 2 AIR FCV 2 IN REMOTE
CBB	DI	0	3	13	AERATION TANK 5 PASS 2 AIR FCV 2 OPENED
CBB	DI	0	3	14	AERATION TANK 5 PASS 2 AIR FCV 2 CLOSED

I/O LIST					
PLC	MODULE				MODULE / POINT DESCRIPTION
	TYPE	RACK	SLOT	POINT	
CBB	DI	0	3	15	AERATION TANK 5 PASS 2 AIR FCV 2 FAULT
CBB	DI	0	4	0	AERATION TANK 5 PASS 3 AIR FCV 1 IN REMOTE
CBB	DI	0	4	1	AERATION TANK 5 PASS 3 AIR FCV 1 OPENED
CBB	DI	0	4	2	AERATION TANK 5 PASS 3 AIR FCV 1 CLOSED
CBB	DI	0	4	3	AERATION TANK 5 PASS 3 AIR FCV 1 FAULT
CBB	DI	0	4	4	AERATION TANK 5 PASS 3 AIR FCV 2 IN REMOTE
CBB	DI	0	4	5	AERATION TANK 5 PASS 3 AIR FCV 2 OPENED
CBB	DI	0	4	6	AERATION TANK 5 PASS 3 AIR FCV 2 CLOSED
CBB	DI	0	4	7	AERATION TANK 5 PASS 3 AIR FCV 2 FAULT
CBB	DI	0	4	8	AERATION TANK 5 IMLRP IN REMOTE
CBB	DI	0	4	9	AERATION TANK 5 IMLRP RUNNING
CBB	DI	0	4	10	AERATION TANK 5 IMLRP MOTOR OVERLOAD
CBB	DI	0	4	11	AERATION TANK 5 IMLRP MOTOR HIGH TEMPERATURE
CBB	DI	0	4	12	AERATION TANK 5 IMLRP MOISTURE IN MOTOR
CBB	DI	0	4	13	AERATION TANK 6 INFLUENT GATE IN REMOTE
CBB	DI	0	4	14	AERATION TANK 6 INFLUENT GATE OPENED
CBB	DI	0	4	15	AERATION TANK 6 INFLUENT GATE CLOSED
CBB	DI	0	5	0	AERATION TANK 6 INFLUENT GATE FAULT
CBB	DI	0	5	1	AERATION TANK 6 MIXER 1 IN REMOTE
CBB	DI	0	5	2	AERATION TANK 6 MIXER 1 RUNNING
CBB	DI	0	5	3	AERATION TANK 6 MIXER 1 SHUTDOWN FAULT
CBB	DI	0	5	4	AERATION TANK 6 MIXER 1 WARNING FAULT
CBB	DI	0	5	5	AERATION TANK 6 MIXER 2 IN REMOTE
CBB	DI	0	5	6	AERATION TANK 6 MIXER 2 RUNNING
CBB	DI	0	5	7	AERATION TANK 6 MIXER 2 SHUTDOWN FAULT
CBB	DI	0	5	8	AERATION TANK 6 MIXER 2 WARNING FAULT
CBB	DI	0	5	9	AERATION TANK 6 PASS 2 AIR FCV 1 IN REMOTE
CBB	DI	0	5	10	AERATION TANK 6 PASS 2 AIR FCV 1 OPENED
CBB	DI	0	5	11	AERATION TANK 6 PASS 2 AIR FCV 1 CLOSED
CBB	DI	0	5	12	AERATION TANK 6 PASS 2 AIR FCV 1 FAULT
CBB	DI	0	5	13	AERATION TANK 6 PASS 2 AIR FCV 2 IN REMOTE
CBB	DI	0	5	14	AERATION TANK 6 PASS 2 AIR FCV 2 OPENED
CBB	DI	0	5	15	AERATION TANK 6 PASS 2 AIR FCV 2 CLOSED
CBB	DI	0	6	0	AERATION TANK 6 PASS 2 AIR FCV 2 FAULT
CBB	DI	0	6	1	AERATION TANK 6 PASS 3 AIR FCV 1 IN REMOTE
CBB	DI	0	6	2	AERATION TANK 6 PASS 3 AIR FCV 1 OPENED
CBB	DI	0	6	3	AERATION TANK 6 PASS 3 AIR FCV 1 CLOSED
CBB	DI	0	6	4	AERATION TANK 6 PASS 3 AIR FCV 1 FAULT
CBB	DI	0	6	5	AERATION TANK 6 PASS 3 AIR FCV 2 IN REMOTE
CBB	DI	0	6	6	AERATION TANK 6 PASS 3 AIR FCV 2 OPENED

I/O LIST					
PLC	MODULE				MODULE / POINT DESCRIPTION
	TYPE	RACK	SLOT	POINT	
CBB	DI	0	6	7	AERATION TANK 6 PASS 3 AIR FCV 2 CLOSED
CBB	DI	0	6	8	AERATION TANK 6 PASS 3 AIR FCV 2 FAULT
CBB	DI	0	6	9	AERATION TANK 6 IMLRP IN REMOTE
CBB	DI	0	6	10	AERATION TANK 6 IMLRP RUNNING
CBB	DI	0	6	11	AERATION TANK 6 IMLRP MOTOR OVERLOAD
CBB	DI	0	6	12	AERATION TANK 6 IMLRP MOTOR HIGH TEMPERATURE
CBB	DI	0	6	13	AERATION TANK 6 IMLRP MOISTURE IN MOTOR
CBB	DI	0	7	0	AERATION TANK 7 MIXER 1 IN REMOTE
CBB	DI	0	7	1	AERATION TANK 7 MIXER 1 RUNNING
CBB	DI	0	7	2	AERATION TANK 7 MIXER 1 SHUTDOWN FAULT
CBB	DI	0	7	3	AERATION TANK 7 MIXER 1 WARNING FAULT
CBB	DI	0	7	4	AERATION TANK 7 MIXER 2 IN REMOTE
CBB	DI	0	7	5	AERATION TANK 7 MIXER 2 RUNNING
CBB	DI	0	7	6	AERATION TANK 7 MIXER 2 SHUTDOWN FAULT
CBB	DI	0	7	7	AERATION TANK 7 MIXER 2 WARNING FAULT
CBB	DI	0	7	8	AERATION TANK 7 PASS 2 AIR FCV 1 IN REMOTE
CBB	DI	0	7	9	AERATION TANK 7 PASS 2 AIR FCV 1 OPENED
CBB	DI	0	7	10	AERATION TANK 7 PASS 2 AIR FCV 1 CLOSED
CBB	DI	0	7	11	AERATION TANK 7 PASS 2 AIR FCV 1 FAULT
CBB	DI	0	7	12	AERATION TANK 7 PASS 2 AIR FCV 2 IN REMOTE
CBB	DI	0	7	13	AERATION TANK 7 PASS 2 AIR FCV 2 OPENED
CBB	DI	0	7	14	AERATION TANK 7 PASS 2 AIR FCV 2 CLOSED
CBB	DI	0	7	15	AERATION TANK 7 PASS 2 AIR FCV 2 FAULT
CBB	DI	0	8	0	AERATION TANK 7 PASS 3 AIR FCV 1 IN REMOTE
CBB	DI	0	8	1	AERATION TANK 7 PASS 3 AIR FCV 1 OPENED
CBB	DI	0	8	2	AERATION TANK 7 PASS 3 AIR FCV 1 CLOSED
CBB	DI	0	8	3	AERATION TANK 7 PASS 3 AIR FCV 1 FAULT
CBB	DI	0	8	4	AERATION TANK 7 PASS 3 AIR FCV 2 IN REMOTE
CBB	DI	0	8	5	AERATION TANK 7 PASS 3 AIR FCV 2 OPENED
CBB	DI	0	8	6	AERATION TANK 7 PASS 3 AIR FCV 2 CLOSED
CBB	DI	0	8	7	AERATION TANK 7 PASS 3 AIR FCV 2 FAULT
CBB	DI	0	8	8	AERATION TANK 7 IMLRP IN REMOTE
CBB	DI	0	8	9	AERATION TANK 7 IMLRP RUNNING
CBB	DI	0	8	10	AERATION TANK 7 IMLRP MOTOR OVERLOAD
CBB	DI	0	8	11	AERATION TANK 7 IMLRP MOTOR HIGH TEMPERATURE
CBB	DI	0	8	12	AERATION TANK 7 IMLRP MOISTURE IN MOTOR
CBB	DO	0	9	0	ANAEROBIC TANK MIXER 1 START/STOP COMMAND
CBB	DO	0	9	1	ANAEROBIC TANK MIXER 2 START/STOP COMMAND
CBB	DO	0	9	2	AERATION TANK 5 INFLUENT GATE OPEN COMMAND

I/O LIST					
PLC	MODULE				MODULE / POINT DESCRIPTION
	TYPE	RACK	SLOT	POINT	
CBB	DO	0	9	3	AERATION TANK 5 INFLUENT GATE CLOSE COMMAND
CBB	DO	0	9	4	AERATION TANK 5 MIXER 1 START/STOP COMMAND
CBB	DO	0	9	5	AERATION TANK 5 MIXER 2 START/STOP COMMAND
CBB	DO	0	9	6	AERATION TANK 5 IMLRP START/STOP COMMAND
CBB	DO	0	9	7	AERATION TANK 6 INFLUENT GATE OPEN COMMAND
CBB	DO	0	9	8	AERATION TANK 6 INFLUENT GATE CLOSE COMMAND
CBB	DO	0	9	9	AERATION TANK 6 MIXER 1 START/STOP COMMAND
CBB	DO	0	9	10	AERATION TANK 6 MIXER 2 START/STOP COMMAND
CBB	DO	0	9	11	AERATION TANK 6 IMLRP START/STOP COMMAND
CBB	DO	0	9	12	AERATION TANK 7 MIXER 1 START/STOP COMMAND
CBB	DO	0	9	13	AERATION TANK 7 MIXER 2 START/STOP COMMAND
CBB	DO	0	9	14	AERATION TANK 7 IMLRP START/STOP COMMAND
CBB	AI	0	11	0	ANAEROBIC TANK ORP
CBB	AI	0	11	1	AERATION TANK 5 FLOW CONTROL GATE POSITION FEEDBACK
CBB	AI	0	11	2	AERATION TANK 6 FLOW CONTROL GATE POSITION FEEDBACK
CBB	AI	0	11	3	AERATION TANK 7 FLOW CONTROL GATE POSITION FEEDBACK
CBB	AI	0	11	4	AERATION TANK 5 ANOXIC ZONE ORP
CBB	AI	0	11	5	AERATION TANK 5 PASS 2 AIR FCV 1 POSITION FEEDBACK
CBB	AI	0	11	6	AERATION TANK 5 PASS 2 AIR FCV 2 POSITION FEEDBACK
CBB	AI	0	11	7	AERATION TANK 5 PASS 2 DO 1
CBB	AI	0	12	0	AERATION TANK 5 PASS 2 DO 2
CBB	AI	0	12	1	AERATION TANK 5 PASS 3 AIR FCV 1 POSITION FEEDBACK
CBB	AI	0	12	2	AERATION TANK 5 PASS 3 AIR FCV 2 POSITION FEEDBACK
CBB	AI	0	12	3	AERATION TANK 5 PASS 3 DO 1
CBB	AI	0	12	4	AERATION TANK 5 PASS 3 DO 2
CBB	AI	0	12	5	AERATION TANK 5 EFFLUENT NH3
CBB	AI	0	12	6	AERATION TANK 6 ANOXIC ZONE ORP
CBB	AI	0	13	0	AERATION TANK 6 PASS 2 AIR FCV 1 POSITION FEEDBACK
CBB	AI	0	13	1	AERATION TANK 6 PASS 2 AIR FCV 2 POSITION FEEDBACK
CBB	AI	0	13	2	AERATION TANK 6 PASS 2 DO 1
CBB	AI	0	13	3	AERATION TANK 6 PASS 2 DO 2
CBB	AI	0	13	4	AERATION TANK 6 PASS 3 AIR FCV 1 POSITION FEEDBACK
CBB	AI	0	13	5	AERATION TANK 6 PASS 3 AIR FCV 2 POSITION FEEDBACK
CBB	AI	0	13	6	AERATION TANK 6 PASS 3 DO 1
CBB	AI	0	14	0	AERATION TANK 6 PASS 3 DO 2
CBB	AI	0	14	1	AERATION TANK 6 EFFLUENT NH3
CBB	AI	0	14	2	AERATION TANK 7 ANOXIC ZONE ORP

I/O LIST					
PLC	MODULE				MODULE / POINT DESCRIPTION
	TYPE	RACK	SLOT	POINT	
CBB	AI	0	14	3	AERATION TANK 7 PASS 2 AIR FCV 1 POSITION FEEDBACK
CBB	AI	0	14	4	AERATION TANK 7 PASS 2 AIR FCV 2 POSITION FEEDBACK
CBB	AI	0	14	5	AERATION TANK 7 PASS 2 DO 1
CBB	AI	0	14	6	AERATION TANK 7 PASS 2 DO 2
CBB	AI	0	15	0	AERATION TANK 7 PASS 3 AIR FCV 1 POSITION FEEDBACK
CBB	AI	0	15	1	AERATION TANK 7 PASS 3 AIR FCV 2 POSITION FEEDBACK
CBB	AI	0	15	2	AERATION TANK 7 PASS 3 DO 1
CBB	AI	0	15	3	AERATION TANK 7 PASS 3 DO 2
CBB	AI	0	15	4	AERATION TANK 7 EFFLUENT NH3
CBB	AO	0	16	0	AERATION TANK 5 FLOW CONTROL GATE POSITION CMD
CBB	AO	0	16	1	AERATION TANK 6 FLOW CONTROL GATE POSITION CMD
CBB	AO	0	16	2	AERATION TANK 7 FLOW CONTROL GATE POSITION CMD
CBB	AO	0	16	3	AERATION TANK 5 PASS 2 AIR FCV 1 POSITION CMD
CBB	AO	0	16	4	AERATION TANK 5 PASS 2 AIR FCV 2 POSITION CMD
CBB	AO	0	16	5	AERATION TANK 5 PASS 3 AIR FCV 1 POSITION CMD
CBB	AO	0	16	6	AERATION TANK 5 PASS 3 AIR FCV 2 POSITION CMD
CBB	AO	0	16	7	AERATION TANK 6 PASS 2 AIR FCV 1 POSITION CMD
CBB	AO	0	17	0	AERATION TANK 6 PASS 2 AIR FCV 2 POSITION CMD
CBB	AO	0	17	1	AERATION TANK 6 PASS 3 AIR FCV 1 POSITION CMD
CBB	AO	0	17	2	AERATION TANK 6 PASS 3 AIR FCV 2 POSITION CMD
CBB	AO	0	17	3	AERATION TANK 7 PASS 2 AIR FCV 1 POSITION CMD
CBB	AO	0	17	4	AERATION TANK 7 PASS 2 AIR FCV 2 POSITION CMD
CBB	AO	0	17	5	AERATION TANK 7 PASS 3 AIR FCV 1 POSITION CMD
CBB	AO	0	17	6	AERATION TANK 7 PASS 3 AIR FCV 2 POSITION CMD
PRIMARY	DI	3			WWHT INFLUENT FLOW CONTROL GATE IN REMOTE
PRIMARY	DI	3			WWHT INFLUENT FLOW CONTROL GATE OPENED
PRIMARY	DI	3			WWHT INFLUENT FLOW CONTROL GATE CLOSED
PRIMARY	DI	3			WWHT INFLUENT FLOW CONTROL GATE FAULT
PRIMARY	DO	3			WWHT INFLUENT FLOW CONTROL GATE OPEN CMD
PRIMARY	DO	3			WWHT INFLUENT FLOW CONTROL GATE CLOSE CMD

SECTION 40 95 13

CONTROL PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. General:

1. Drawings and general provisions of Contract.
2. General and Supplementary Conditions and all Division 1 specification sections.

B. Related Sections of Division 26.

1.02 DESCRIPTION OF WORK

- ###### A. General:
- The Contractor shall provide the labor, tools, equipment, and materials necessary to install control panels and consoles in accordance with the Plans and as specified herein.

1.03 QUALITY ASSURANCE

- ###### A. Regulatory Requirements:
- Comply with requirements of the National Electrical Code (NEC) and all other applicable federal, state, and local codes and regulatory requirements.

B. Standards:

Materials and workmanship shall conform to the following standards:

1. National Electrical Manufacturers Association (NEMA).
2. Institute of Electrical and Electronic Engineers (IEEE).
3. American National Standards Institute (ANSI).
4. National Fire Protection Association (NFPA).
5. Underwriters' Laboratories (UL).
6. Joint Industrial Council (JIC).
7. International Society for Measurement and Control (ISA).

C. Qualifications

1. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of control panels whose products have been in satisfactory use in similar service for not less than 5 years.
2. Installer's Qualifications: Firm with at least 5 years of successful installation experience on projects with materials and equipment similar to items specified herein.

1.04 SUBMITTALS

- A. General: Furnish manufacturer's product data for enclosures and all components.
- B. Materials List: Submit a bill of materials listing quantities, manufacturer's name, and catalog numbers.
- C. Wiring Diagrams: Submit wiring diagrams showing all connections for all equipment furnished or installed under this section.
 1. Elementary diagrams shall follow JIC standards.
 2. Instrument loop diagrams shall follow the ISA Standard S5.4.
 3. Wire, terminal, and component labeling shall follow established facility conventions where applicable.
- D. Shop Drawings: Provide control panel layout drawings which follow JIC standards. Provide shop drawings for each control panel and console as follows:
 1. Dimensional drawings of each enclosure and mounting panel.
 2. Scaled layout drawings identifying name and location of all components and nameplates.
 3. Mounting details including location of anchoring flanges, holes, and data on anchor bolt sizing and load-carrying capacity.
 4. Entry and exit locations of external wiring and conduit and equipment connections.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection: The Contractor shall store the items furnished under this section until they can be installed. Such storage shall meet the requirements of the manufacturer and be approved by the Owner. Use all means necessary to protect the material of this section before, during, and after installation, and to protect the installed work and materials of all other trades.

PART 2 - PRODUCTS

2.01 ENCLOSURES

- A. Enclosure shall be NEMA 4X, unless otherwise specified or shown on the Drawings.
 - 1. Hinged Door Enclosures: Material of construction shall be fiberglass, 304 stainless steel or as shown on the Drawings.
 - a. Manufacturer: Hoffman Enclosures, Inc.; Saginaw Control and Engineering; Stahlin Enclosures; or approved equal.
 - 2. Fabricated control panel shall be UL508A labeled.

2.02 COMPONENTS

- A. As specified in related sections.
- B. Miscellaneous Equipment
 - 1. Slotted plastic wiring ducts with snap-on covers.
 - 2. Nylon spiral wrap wiring sheaths.
 - 3. Nylon cable ties with screw anchors.
 - 4. Nameplates as specified in Division 26. Nomenclature as shown on the Drawings.
 - 5. Stainless steel screws, fasteners, and miscellaneous hardware, unless otherwise noted.
- C. Corrosion Inhibitor Device: Shall be provided for all control enclosures. Provide one (1) unit per 5 cubic feet of volume. Provide one (1) replacement unit for each inhibitor device installed. Devices shall be Hoffman A-HCI 10E or approved equal. Install and date mark while enclosure is in fabricator's shop.
- D. Provide thermostatically controlled electric heater in each enclosure for condensation prevention. Heater shall be sized for 40°F temperature rise above ambient, based on enclosure dimensions. Locate heater in compliance with manufacturer recommendations.
- E. Surge Protection
 - 1. Provide surge protection for all communication, analog and digital signals which the cable/conductor(s) enter from outside or underground. These signals include, but are not limited to, all 120VAC digital inputs and 24VDC analog inputs.

- a. Surge protection devices shall be type Category C as defined by IEEE C62.41, and consist of a base and a replaceable plug-in surge element.
2. Provide surge protection on all other PLC inputs, PLC outputs, relays and all other instrumentation and control system components as recommended by the manufacturer of each device.
3. Surge protection device shall include a visual indicator for “fault/no protection” indication.
4. Manufacturer: Pheonix Contact, Edco, Thor Systems or approved equal.

F. Power Supplies

1. Provide power supplies as required for the various components and functions of this contract.
2. Required Features:
 - a. Provide power for 2-wire transmitter loops using 4-20mA_{dc} current signals.
 - b. Input Voltage: 115 VAC.
 - c. Output Voltage: 24V to 45V DC, or 12V to 16V DC, as required.
 - d. Voltage Regulation: ± 5 percent.
 - e. Fusing: 115 VAC line.
 - f. Loop circuits: Suitable for 1 loop circuit only.
 - g. Mounting: Suitable for wall mounting inside of panel enclosure.
3. Manufacturers:
 - a. Allen-Bradley Bulletin 1606.
 - b. Moore Industries.
 - c. Or approved equal.

G. Lighting Kit: Provide a 120VAC, LED light fixture inside the enclosure. Each light shall include a manual on/off toggle switch and a 120VAC convenience outlet.

H. Uninterruptible Power Supply (UPS).

1. General: Provide a UPS to supply power to the control panel’s associated PLC, radio, and internal power supplies during failure of normal power. Maintain battery power to load for 30-minute duration with "no breaks," or interruptions.

Upon return of normal ac power, automatically equalize recharge batteries and revert to floating condition.

2. Enclosures: Free standing enclosures sized to house both the batteries and the electronics. DIN rail mounted units may be used when loads/battery time comply with specification requirements.
3. Rectifier/Charger: Solid state rectifiers/charger sized to supply dc power to both the batteries and the static inverter. Equip with automatic shutdown to prevent discharging the batteries completely.
4. Static Inverter: Single phase solid-state static inverter to supply regulated ac output.
5. Batteries: Sealed, maintenance-free lead acid batteries.
6. Detachable line cord and NEMA 5-20R output receptacles.
7. Available Manufacturers: Subject to compliance with requirements, manufacturers offering UPS systems which may be incorporated in the work include, but are not limited to, the following:
 - a. APC
 - b. Liebert
 - c. Phoenix Contact

I. Miscellaneous Equipment

1. Slotted plastic wiring ducts with snap-on covers.
2. Nylon spiral wrap wiring sheaths.
3. Nylon cable ties with screw anchors.
4. Nameplates as specified in Division 26 Section "Electrical Identification", and as shown on the Plans.
5. Stainless steel screws, fasteners, and miscellaneous hardware unless otherwise noted.

2.03 SHOP FABRICATION

- A. Fully assemble and test each panel at the factory prior to shipment.
- B. As a minimum, test all wiring circuits for conductivity and demonstrate that all specified functions can be performed.

- C. Identify all components with laminated plastic nameplates.
- D. Provide all devices, electrical hardware, wiring, support hardware, fasteners and other components required to make the control enclosures complete and workable units.
- E. Estimated Size: Minimum sizes are shown on the Drawings. Contractor shall furnish enclosures of the size and quantity required to house the manufacturers' equipment supplied and all other electrical components installed in the enclosures.
- F. Provide stainless steel quick-release latching clamps on three sides of each door and pad-lockable hasp and staple on all panels.
- G. All hardware on the enclosures including hinges, pins, clamps, nuts, bolts, washers, screws, etc., shall be stainless steel.
- H. Design panels so that conduits and wiring enter and leave through the bottom of the enclosures, unless noted otherwise.
- I. Component Arrangement
 - 1. Group all like components.
 - 2. Place all internal components on sub-panels.
 - 3. Arrange all components to allow easy access for connections and service, and to allow removal without affecting other components.
- J. Component Installation
 - 1. Make all panel cutouts carefully and leave no visible gaps between components and panels.
 - 2. Mount all components plumb and square.
 - 3. Attach all components and nameplates with stainless steel machine screws into drilled and tapped holes.
 - 4. Support and restrain all components to prevent movement.
 - 5. Attach all relays to mounting strips or rails.
- K. Wiring
 - 1. Route wiring horizontally or vertically.
 - 2. Protect wiring to door-mounted devices with spiral nylon sheath.
 - 3. Separate alternating current (ac) and direct current (dc) wiring a minimum of 4 inches.

4. Label all wires at each termination with a unique number.
5. Label each terminal with a unique number.
6. Terminate all external wiring on terminal blocks.
7. Terminate all internal wiring on terminal blocks or device terminals.
8. Group all externally powered wiring and terminate on knife disconnect isolating terminal blocks.
9. Terminate all wiring to devices powered from the control panel on fused terminal blocks.
10. All fused terminal blocks shall include blown fuse indication.
11. Color code all internal wiring as follows:
 - a. Line Voltage ac Power and Control: Black.
 - b. AC Control Circuits (less than 50 volts): Red.
 - c. DC Wiring: Blue (positive), brown (negative).
 - d. Externally Powered Wiring: Yellow.
 - e. Neutral Conductors: White.
 - f. Equipment Grounding Conductors: Green.
12. Route all wiring on sub-panels through plastic wiring ducts with removable covers.
13. Support all wiring to prevent movement or sagging.
14. Secure all cable ties with bolted or screwed mounting plates.
15. Provide a warning sign, placed in a conspicuous location in the interior of the panel, identifying yellow wiring as being powered from an external source and warning that disconnecting power to the panel will not de-energize externally powered wiring.

L. Panel Grounding

1. Provide ground studs factory welded to the enclosure and the enclosure door.
2. Provide tinned copper braided ground strap between enclosure and door.

3. Provide a minimum #8 AWG ground wire from sub-panel to enclosure mounting stud.
4. Ground control power transformer secondary directly to sub-panel immediately adjacent to transformer.
5. Where signal cable shields are to be grounded in the control panel, connect to the equipment ground bus.
6. Connect all DC commons to the low-level isolated dc ground bus.

2.04 EXTRA MATERIALS

A. Spare Parts: The Contractor shall provide uninstalled spare parts to the Owner to facilitate proper maintenance and minimize downtime of the PLC system.

1. Quantity: Provide spares for each type listed below equal to 10 percent of the total of each type used in the system rounded up to the next whole number.
 - a. Control Relay
 - b. Power Supply
 - c. Pilot Light
 - d. Selector Switch
 - e. Pushbutton
 - f. Fuses
 - g. Terminal Block
2. Replacements: Any spare part used during the start-up, demonstration, and warranty period shall be replaced by the Contractor at no additional cost.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. General: Install equipment as indicated, in accordance with manufacturer's written instructions, and with recognized industry practices.
- B. Examination
 1. Verification of Conditions: Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Discrepancies: In the event any discrepancies are discovered, immediately notify the Owner's Representative in writing. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

C. Preparation

1. Protection.
 - a. All equipment and materials shall be packed at the factory to protect each item from damage during shipment and storage.
 - b. Provide blocking and cushioning materials to prevent damage during shipment.
 - c. Provide temporary lifting lugs on shipping package as needed.
 - d. Include approximately 1 pint of touch-up paint for each finish color in shipment.
2. Surface Preparation: The work shall be carefully laid out in advance. Where cutting, drilling, etc., of floors, walls, ceilings, or other surfaces is necessary, this work shall be carefully done. Any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved, and at no additional cost to the Owner.

D. Application

1. Enclosure, Cabinets, Console Installation.
 - a. Locate as shown on the contract drawings. Freestanding enclosures and consoles require an Electrical Equipment Pad provided and installed by this Contractor. Refer to detail on Drawings.
 - b. Floor-mounted control panels shall be installed utilizing all stainless steel hardware consisting of concrete anchor and machine bolt assembly.
 - c. Wall-mounted panels shall be offset from walls with standoffs. Wall-mounted panels requiring freestanding mounting shall be supported on stainless steel strut with cross bracing and stainless steel hardware.
 - d. Seal all conduit entrances watertight.

3.02 FIELD QUALITY CONTROL

- A. Tests: Upon completion of all inspections and prior to acceptance by the Owner, perform the field tests outlined in Sections 40 9X XX.

- B. Inspection: Upon completion of this portion of the work, the Contractor shall provide for the services of a qualified representative of the manufacturer to inspect and approve the installation.

END OF SECTION 40 95 13

SECTION 41 22 23.19
HOISTING EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide and test hoisting equipment and appurtenances as indicated and in compliance with Contract Documents.
 - 1. Hoist capacities and operating data are as specified and indicated on the drawings.

1.02 REFERENCES:

- A. American Bearing Manufacturers Association (ABMA):
 - 1. 9: Load Ratings and Fatigue Life for Ball Bearings.
 - 2. 11: Load Ratings and Fatigue Life for Roller Bearings.
- B. American Society of mechanical Engineers (ASME):
 - 1. B30.16: Overhead Hoists (Underhung) Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings
- C. American Welding Society (AWS):
 - 1. D1.1: Structural Welding Code Aluminum.
- D. Occupational Safety and Hazard Association (OSHA):
 - 1. 29 CFR 1910.179: Overhead and Gantry Cranes.

1.03 SUBMITTALS:

- A. Submit the following shop drawings in accordance with Section 01 33 00:
 - 1. Data regarding hoisting equipment characteristics and performance:
 - 2. Certified setting plans, with tolerances, for anchor bolts.
 - 3. Manufacturer's literature as needed to supplement certified data.
 - 4. Operating and maintenance instructions and parts lists.
 - 5. Listing of reference installations as specified with contact names and telephone numbers.

6. List of recommended spare parts other than those specified.
 7. Shop and field inspection reports.
 8. Qualifications of field service engineer.
 9. Recommendations for short and long-term storage.
 10. Shop and field testing procedures, equipment to be used.
 11. Special tools.
 12. Number of service person-days provided and per diem field service rate.
 13. Manufacturer's product data, specifications and color charts for shop painting.
 14. The latest ISO 9001 series certification.
 15. Provide Certificate of Responsibility. See Section 01 33 00 for Certificate form.
 16. Provide scaled drawing height and weight of equipment serviced by the hoisting equipment including hook height and travel dimensions.
 17. Material Certification:
 - a. Provide certification from the equipment manufacturer that the materials of construction specified are recommended and designed for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and designed for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.
 - b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and designed for the service conditions specified and indicated.
- B. A copy of the contract mechanical process drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with "No changes required" or provide a statement that no changes are required.
1. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.

- C. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
 - 1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
 - 2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.04 SPARE PARTS:

- A. Comply with the requirements specified in Section 01 61 00.
- B. Provide spare parts that are identical to and interchangeable with similar parts installed.

1.05 QUALITY ASSURANCE:

- A. Comply with the requirements specified in Section 01 43 00.
- B. Permanently mark the capacity of the hoist and trolley on each hoist, in easy to read letters and in a prominent position.
- C. Provide only safety type hooks.
- D. Provide hoists so that hook can reach the floor at the lowest level of the lift.
- E. Do not use hoists for construction purposes of any nature.
- F. Hoists shall be manufacturer's standard cataloged product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.
- G. Welding: In accordance with American Welding Society Code D1.1.
- H. Provide shop tests as specified.
- I. Hoisting equipment manufacturer shall provide hoists regardless of manufacturer as a complete integrated package to ensure coordination, compatibility and operation of the systems.
- J. Services of Manufacturer's Representative as stated in Section 01 43 00 and as specified herein.

K. Provide services of factory-trained Service Technician, specifically trained on type of equipment specified:

1. Service Technician must be present on site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.
2. Installation: Inspect grouting, location of anchor bolts; setting, leveling, alignment, and field erection:
 - a. 2 person-days.
3. Functional Testing: Calibrate, check alignment and perform a functional test. Tests to include all items specified.
 - a. 1 person-days.
4. Performance Testing: Field performance test equipment specified.
 - a. 1 person-days.
5. Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classroom sessions.
 - a. 1 person-days.
6. Credit to the Owner, all unused service person-days specified above, at the manufacturer's published field service rate.
7. Any additional time required of the factory trained service technician to assist in placing the equipment in operation, or testing or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.

L. Manufacturer of hoisting equipment shall have a minimum of five (5) operating installations with hoists of the size specified and in the same service as specified operating for not less than five (5) years.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Comply with the requirements specified in Section 01 66 10.

PART 2 - PRODUCTS

2.01 PORTABLE CRANES:

A. Portable Crane Manufacturers:

1. Thern, Inc., Commander
 2. Or approved equal.
- B. Two (2) complete sets of portable davit cranes shall be provided. Davit cranes shall be made of Stainless Steel-Grade 316 and have the following lift capacities with the boom fully extended:
1. Submersible Mixers: 610 lbs.
 2. Submersible Propeller Pumps: 893 lbs.
- C. Design Factor: davit crane shall be designed with an ultimate design factor exceeding 3:1 for all components, in all boom positions. This factor includes lifting winch, wire rope, crane base and crane base extension.
- D. Proof Testing: davit crane shall be individually proof tested by manufacturer to 125% of rated load.
- E. Portability: davit crane shall have the ability to be completely assembled and disassembled without tools, with a total weight not to exceed 180 lbs. (exclusive of lifting winch, wire rope, and pedestal base). The crane shall break down into transportable components.
- F. Hook Reach: boom shall have variable lengths allowing the following reaches when boom is horizontal and fully extended:
1. Submersible Mixers: 4'-0" measured from pedestal center to hook center.
 2. Submersible Propeller Pumps: 4'-0" measured from pedestal center to hook center.
- G. Hook Height: hook height shall be adjustable by moving the boom up or down between 0 and 45 degrees above horizontal, that must allow to reach 72 inches high above top of the T-wall concrete with the boom fully extended. Contractor shall be responsible to coordinate final dimensions upon final approvals of pumps and mixers.
- H. Clearance: minimum height of the boom shall be 50 inches and must clear the handrail between mounting surface and the underside of the boom in all configurations. Contractor shall be responsible to coordinate final dimensions upon final approvals of pumps and mixers.
- I. Boom Angle: boom angle shall be adjustable at all times, including when under full rated load with a hand operated screw jack acting to raise or lower the boom between horizontal and 45 degrees from vertical.
- J. Boom Sheave: wire rope shall pass over a sheave at the end of the boom. Sheave shall have a bronze bearing.

K. Winches:

1. A total of two (2) davit cranes are proposed and each davit crane shall be equipped with a dedicated enclosed sealed lifting winch. Lifting winch mounting surface shall be located on the boom. The lifting winch will be powered by manual hand crank and have available hex adapter to use electric drill to operate the lifting winch.
2. Lifting winch Location: lifting winches shall be located such that the center point of the drive shaft is behind centerline of the mast.
3. The lifting winch load capacity, to be appropriately sized to match that of the davit crane.
4. Lifting winch shall facilitate cable attachment via a ball swaged cable end fitting. Connection must allow quick attachment and detachment of wire rope.
5. Lifting winch shall have an epoxy paint finish or stainless steel as recommended by the manufacturer.
6. Drum size min 3" dia. for first wire rope layer. Storing capacity, no less than 36 feet of wire rope.
7. Lifting winch gear ratio no less than 24:1.
8. Wire rope construction ASTM A276 shall be 7 x 19 type 316 stainless steel cable. Minimum wire rope diameter is 1/4". Provide wire rope and cable holder winch (total of 42) at each mixer and IMLR pump location. Cable holder winch shall be of stainless steel and include a hand crank. Install cable holder winch on to the handrail with stainless steel U-bolts as recommended by the manufacturer.
9. With approval by Engineer, mark an easily visible reference point on each wire rope to assist operating personnel in determining when the mixer has been lowered completely into the aeration tank in order to prevent too much slack and the cable drifting into the mixer blades. Reference point on the wire should be in correlated to a permanent feature above the water surface of the tank (example: the top of the T-wall).
10. Uppermost section of the lifting cable wire rope while not in use shall be tightly wound around the pipe section of the cable holder winch and secured with pipe clamps as shown on the drawings and per manufacturer's instructions. To prevent the wire rope from tangling in the mixer's propeller, the wire rope shall be pulled tightly vertical with no slack between the mixer/pump and the cable holder winch.
11. Bottom termination of the wire rope shall end with stainless steel 316 thimble and shackle allowing easy attachment to the mixer's lifting eye. The top termination must end with swaged ball fitting compatible with the lifting winch reel.

12. Rotation: boom and outer mast must rotate 360 degrees on tapered roller bearings and needle bearings, with a rotational handle attached to outer mast to facilitate rotation. Outer mast shall lock in one of 30-degree incremental positions with locking pin. Rotational stop shall limit rotation in 30-degree increments.
13. Fastening Pins: crane components shall be fastened together using stainless steel clevis style pins secured with lynch pins. Lynch pins must be attached permanently to the main structure of the crane with lanyards.
- L. Nametag: davit crane shall be labeled with a non-corrosive metal identification plate labeled or imprinted with the manufacturer's name, model number, serial number, capacity rating, maximum horizontal and vertical range and other essential information.

2.02 PEDESTAL BASES

- A. Davit crane pedestal bases (total of 11) shall be made by the same manufacturer as the davit lifting equipment.
- B. Davit crane base pedestals shall be mounted on the concrete using stainless steel anchor bolts.
- C. Base must be fabricated from AISI 316L stainless steel. Base must be strong enough to support crane and full load and ensure adequate safety factor.
- D. Base pedestal shall allow davit crane mast to be installed and removed easily, with no tools required. Pedestal style base must allow for safe walkway after removing the crane.
- E. Bearing surfaces: base shall have a self-lubricating bearing sleeve to support mast rotation while also having a pin at the bottom of the base to positively engage the base to the mast.
- F. Base must have removable covering cap to prevent water or debris entering and blocking the hollow section of base. Cap must be permanently attached to the base top while the davit crane is not in use.

2.03 SHOP PAINTING:

- A. Primer and Finish Paint: Shop apply to all exterior ferrous surfaces, high solids epoxy in accordance with Section 09 91 10.
- B. Surface preparation, mixing and application and safety requirements shall be in accordance with the paint manufacturer's printed instructions and as specified.
- C. Ferrous surfaces which are not to be painted shall be given a shop applied coat of grease or rust resistant coating.

- D. Provide additional shop paint coating for touch-up to all surfaces after installation and testing is completed and equipment accepted.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install items in accordance with manufacturer's printed instructions and as indicated and specified.
- B. Do not use cast fittings.

3.02 FIELD TESTING:

- A. Provide as specified herein. Perform testing in accordance with OSHA 29 CFR 1910.179 and as specified herein.
- B. After installation of equipment, and after inspection, operation, testing and adjustment have been completed by manufacturer's field service technician, conduct test for each crane in presence of the Engineer to determine its ability to operate at rated capacity under conditions specified and indicated. During tests, observe and record capacity. Promptly correct or replace all equipment not conforming to the requirements of this section revealed by or noted during tests, at no additional cost to the Owner, and repeat tests until specified results are obtained. Contractor to provide all labor, weights and materials for conducting tests.
 - 1. Provide a 60 minute test for each crane.
 - 2. Running test shall consist of moving crane through two complete cycles. The first cycle will be with no load. For the second cycle, the unit will be loaded with 100 percent of the specified load rating.
 - 3. Test and simulate all limit switches, locking and safety devices.
- C. Make all adjustments to place equipment in specified working order at time of above tests.
- D. After three (3) unsuccessful testing attempts, remove and replace equipment at no additional cost to the Owner with equipment that will meet all requirements specified and indicated.

3.03 FIELD TOUCH-UP PAINTING:

- A. After installation and testing, apply touch-up paint to all scratched, abraded and damaged shop painted surfaces. Coating type and color shall match shop painting.

3.04 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01 77 00.

END OF SECTION 41 22 23.19

SECTION 43 21 00.04

SUBMERSIBLE AXIAL FLOW PUMPS AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide and test submersible axial flow pumps, motors, discharge tubes, discharge fittings, variable frequency drives and appurtenances as indicated and in compliance with Contract Documents.

1.02 REFERENCES:

- A. American National Standards Institute (ANSI):

- 1. S1.11: Standard Octave-Band and Fractional-Octave-Band and Digital Filters.

- B. American Society of Mechanical Engineers (ASME):

- 1. B16.1: Standard for Cast Iron Pipe Flanges and Flanged Fittings, 125 lb.

- C. ASTM International (ASTM):

- 1. A36: Standard Specification for Carbon Structural Steel.
 - 2. A48: Standard Specification for Gray Iron Castings.
 - 3. A283: Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
 - 4. A743: Standard Specification for Castings, Iron-Chromium, Iron-Chromium Nickel, Corrosion Resistant, for General Application.
 - 5. B148: Standard Specification for Aluminum-Bronze Sand Castings

- D. Hydraulic Institute (HI):

- 1. Current Standards.
 - 2. 9.6.4: Rotodynamic Pumps for Vibration Measurements and Allowable Values
 - 3. 11.6: Rotodynamic Submersible Pumps for Mechanical and Electrical Acceptance Tests
 - 4. 14.6: Rotodynamic Pumps for Hydraulic Performance Acceptance Tests

- E. International Electrotechnical Commission:

1. IEC60034

F. National Electrical Manufacturers Association (NEMA):

1. MG1: Motors and Generators, comply with Part 31.

1.03 SUBMITTALS:

A. Submit the following shop drawings in accordance with Section 01 33 00:

1. Data regarding pump and motor characteristics and performance:

a. Prior to fabrication and testing, provide guaranteed performance curves based on actual factory tests of mechanically duplicate pumps, showing they meet indicated and specified requirements for head, capacity, horsepower, wire to water efficiency and NPSH3.

(1) For units of same size and type, provide curves for a single unit only.

b. Provide catalog performance curves at maximum pump speed indicated and specified for each service showing maximum and minimum impeller diameters available, impeller blade angle, allowable operating region (AOR) and preferred operating region (POR) and best efficiency point (BEP).

c. Results of factory performance tests as specified.

d. Submit curves for guaranteed performance, and factory performance tests on 8-1/2-inch by 11-inch sheets, one curve per sheet.

2. Characteristic curves for variable speed pumps for maximum pump speed and for speeds required to obtain minimum pump flow and head conditions specified and indicated. Identify curves by speed and provide all curves on one sheet. Provide NPSH3, wire to water efficiency and power curve for each speed.

3. Shop drawing data for accessory items.

4. Certified setting plans, with tolerances, for anchor bolts and seismic calculations for anchor bolts

5. Tolerances for tube setting in pump bay

6. Carrier cable system and supports

7. Impeller and impeller blade details, angle, N_s and N_{ss}

8. Recommended minimum water level

9. Internal losses from the inlet bell to a minimum of 1.50 ft above the top of the motor for range of flow specified and indicated

10. Motor monitoring systems and alarm and shutdown settings
11. Manufacturer's literature as needed to supplement certified data.
12. Operating and maintenance instructions and general arrangement drawings with parts lists.
13. Equipment Weights and lifting recommendations
14. Listing of reference installations as specified with contact names and telephone numbers.
15. Certified results of dynamic balancing.
16. Bearing temperature operating range for the service conditions specified.
17. List of recommended spare parts other than those specified.
18. Factory and field inspection reports.
19. Bearing Life: Certified by the pump manufacturer including design data.
20. Pump factory test results.
21. Motor factory test results.
22. Qualifications of field service technician.
23. Recommendations for short and long-term storage.
24. Resonant frequency analysis.
25. Factory testing procedures, pump and piping set up, equipment and instrumentation to be used and ANSI/HI testing tolerances to be followed.
26. Field testing procedures, pump and piping set up, equipment and instrumentation to be used and testing tolerances to be followed.
27. Special tools.
28. Number of field service person-days provided and per diem field service rate.
29. Manufacturer's product data, specifications and color charts for factory painting.
30. Provide a listing of the materials recommended for each service specified and indicated. Provide documentation showing compatibility with process fluid and service specified and indicated.
31. The latest ISO 9001 series certification.

32. Provide a drawing for each pump service showing the pumps, motors, hoists and bridge cranes including equipment weights, lifting attachments, slings and clearances for equipment removal and maintenance.
 33. Pump, Motor and Variable Frequency Drive Drive Coordination Certificate Form
 34. Completed Pre-Testing Checklist Form
 35. Material Certification:
 - a. Provide certification from the equipment manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the OWNER.
 - b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.
- B. A copy of the contract mechanical process, electrical and instrumentation drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with “No changes required” or provide a statement that no changes are required.
1. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.
- C. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
 2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.04 SPARE PARTS:

- A. Comply with the requirements specified in Section 01 61 00.
- B. Provide spare parts that are identical to and interchangeable with similar parts installed.
 - 1. For each pump:
 - a. One set mechanical seals.
 - 2. For each set of pumps of the same size and performance.
 - a. One set of all special tools required.

1.05 QUALITY ASSURANCE:

- A. Comply with the requirements specified in Section 01 43 00.
- B. Pumps shall be the product of one manufacturer.
- C. Pumps shall be manufacturer's standard cataloged product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.
- D. Welding: In accordance with latest applicable American Welding Society Code or equivalent.
- E. Factory tests as specified.
- F. The Contractor must obtain the pumps, motors, discharge columns, discharge fittings, external bellmouths and appurtenances from the pump manufacturer, as a complete and integrated package to insure proper coordination and compatibility and operation of the system.
 - 1. Variable frequency drives can be supplied by the Contractor or the pump manufacturer at the Contractor's option. The pumping system must be a complete and integrated package to insure proper coordination and compatibility and operation of the system.
 - a. The Contractor shall coordinate the variable frequency drive with the pump and motor manufacturer and submit as part of the shop drawings a written statement signed by the Contractor, pump manufacturer, motor manufacturer and variable frequency drive manufacturer that the variable frequency drive manufacturer has received the required information from the pump and motor manufacturers and that all parties have reviewed the system and coordinated the equipment selection. Also include all motor data and information that has been used for the coordination.
 - b. Provide variable frequency drives in accordance with Section 26 29 23.

- G. Factory testing as specified and in accordance with Section 43 21 00.90.
- H. Progress/Coordination Meetings:
 - 1. Provide a bi-weekly call to discuss the following:
 - a. Shop drawing status and comment resolutions
 - b. Factory and field testing schedule and procedures
- I. Services of Manufacturer's Representative as stated in Section 01 43 00 and as specified herein.
- J. Provide services of factory-trained Service Technician, specifically trained on type of equipment specified:
 - 1. Service Technician must have a minimum of five (5) years of experience, all within the last seven (7) years, on the type and size of equipment.
 - 2. Service Technician must be present on site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.
 - 3. Installation: Inspect dimensions of the intake, clearance between pump suction and intake floor, installation of floor cones and fillets, grouting, location of anchor bolts; setting, leveling, alignment, field erection; carrier cable and power and control cable tension, monitoring devices and sensors; cable arrangement and potential for damage during pump operation; coordination of piping, electrical and miscellaneous utility connection:
 - a. 2 person-days
 - 4. Functional Testing: Calibrate, check alignment and perform a functional test with water. Verify power supply amperage and sensor monitoring. Tests to include all items specified.
 - a. 2 person-days
 - 5. Field Performance Testing: Field performance test equipment specified.
 - a. 2 person-days
 - 6. Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classroom sessions.
 - a. 1 person-days

7. Provide a service technician for 1 trip for 2 days to be called for by the Owner within 6 to 11 months after substantial completion.
 8. Credit to the Owner, all unused service person-days specified above, at the manufacturer's published field service rate.
 9. Any additional time required of the factory trained service technician to assist in placing the equipment in operation, or testing or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.
- K. Manufacturer of pumps shall have a minimum of ten (10) operating installations with pumps of the size specified or larger and in the same service as specified operating for not less than ten (10) years.
- L. If equipment proposed is heavier or taller, than specified and indicated; provide all structural, architectural, mechanical, electrical and plumbing revisions at no additional cost to the Owner.
1. If equipment is heavier or taller than specified, the Contractor shall provide all hoisting equipment sized and located to maintain the minimum safety factor between the specified maximum equipment weight and the lifting system capacity of the hoisting equipment indicated and specified.
- M. For variable speed pump systems the pump manufacturer must perform an analysis of the combined motor and pump assembly for resonant frequency or their harmonics independent of a structure. For discharge columns suspended over 16.4 feet, pump manufacture to provide a structural dynamic analysis in addition to the pump and motor lateral and torsional analysis.
1. Submit a copy of all calculations for the record.
 2. If a structural dynamic analysis is performed, significant resonant point frequencies must be 20 percent over or under the pump operating speed range. Should calculations indicate the probability of encountering such frequencies within the speed range required, provide all additional supporting devices necessary to affect the unit mass, and raise or lower resonant point as necessary or demonstrate through forced response analysis compliance with the vibration acceptance criteria as per ANSI/HI 9.6.4 Rotodynamic Pumps for Vibration Measurements and Allowable Values.
 3. Provide and install such additional devices at no additional cost to the Owner.
- 1.06 DELIVERY, STORAGE AND HANDLING:
- A. Comply with the requirements specified in Section 01 66 10.

1.07 PUMP INTAKE DESIGN:

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION:

- A. Pump capacities and operating data are indicated in the Process Pump Schedule.
- B. Pump capacities and operating data are indicated in the Process Pump Schedule.
- C. Internal Mixed Liquor Return (IMLR) Pumps: Pumps are located downstream of a influent screens with 3/8-in clear openings between bars, detritus tanks, and primary settling tanks.
- D. Design Heads:
 - 1. The head requirements indicated are the heads required at 1.5 feet (450 mm) above the top of the pump motor as it sits in its discharge tube.
- E. Equipment Limitations:
 - 1. Pumps Internal Mixed Liquor Return:
 - a. Maximum Total Pump, Motor and cabling Weight: 320 lbs
 - b. Discharge tube diameter Range at the pump and motor: 12-inch minimum, 24-inch maximum
 - c. Pump Discharge: 16-in
 - d. Maximum Pump and Motor Assembly Height: 36 inches
- F. Coordinate pump dimensions and weights with hoists and bridge cranes as specified in Sections 41 22 23.19 and 41 22 13.13 respectively and as indicated.

2.02 MANUFACTURERS:

- A. Submersible Axial Flow Pumps:
 - 1. KSB
 - 2. Xylem/Flygt
 - 3. Indar
 - 4. Hidrosta/Bedford
 - 5. Or approved equal in accordance with Section 01 25 00.

2.03 SEISMIC DESIGN REQUIREMENTS:

- A. Conform to the requirements indicated on the structural drawings and as specified in Section 01 41 20.
- B. The Contractor shall conform to the seismic design requirements for this project and for the work of this specification section.
- C. Provide all equipment bases, anchorage, supports and foundations designed in accordance with the seismic requirements indicated and specified.
- D. Additionally, provide with the Certificate of Unit Responsibility, certification for all equipment signed by a registered structural engineer stating that computations were performed and that all components have been sized for the seismic forces specified and indicated.

2.04 PUMP CONSTRUCTION:

- A. Pumps: Submersible axial flow pumps, driven as indicated in the Process Pump Schedule.
- B. Axial propeller or axial mixed flow design as indicated in the Process Pump Schedule
- C. Pump configuration as indicated in the Process Pump Schedule.
- D. Design and proportion all parts of pump for the service specified and indicated.
- E. Provide pumps and motors capable of submergence to 65 feet.
- F. Equip pumping assemblies with all specified and required accessories, including lifting attachments, cable strain relief system, floor cones and discharge pressure gauges.
- G. Apply a never seize compound to all bolts.
- H. Provide the pumps installed vertically in a discharge column or concrete discharge column as indicated and specified.
- I. Provide metal to metal contact between machined surfaces for sealing design for the pump and motor assembly.
 - 1. Provide mating surfaces machined and fitted with Nitrile or Viton rubber O-rings.
 - 2. Provide controlled compression of rubber O-rings in two planes and O-ring contact of four sides without requiring a specific torque limit.
 - 3. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression and secondary sealing compounds are not acceptable.
- J. Dynamically balance the rotating assemblies (impeller, shaft and rotor).

K. Discharge Column:

1. Provide the design such that the pumps will be automatically connect to the discharge column when lowered into place and in accordance with the pump manufacturer's instructions.
 - a. If required, provide a device that prohibits rotational movement of the pumping unit inside the tube.
 - b. Provide the O-ring on a 45 degree conical surface to ensure concentric positioning of the pump in the discharge column while at the same time it provide a leak -free seal between the pump and discharge column.
 - c. Provide the ability to install and remove the pump assembly for inspection and service without the need to enter the pump column or intake.
 - d. Provide a system such that the pumps do not require any bolts, nuts, or fasteners for connection to the discharge column.
2. Material:
 - a. Minimum Thickness: 0.50 inch minimum wall thickness
 - b. Carbon Steel, ASTM A36 rolled and longitudinally welded
 - (1) Painted inside and out as specified.
3. Provide a diameter within the range specified and indicated.
 - a. Pumps with a discharge tube diameter less than specified and indicated are not acceptable.
4. Discharge Arrangement:
 - a. Provide a closed top design discharge column as indicated
 - (1) Provide a gasketed discharge tube with a tee fitting and cover including the following:
 - (a) Cover with lifting handles
 - (b) Connection for lifting cables
 - (c) Provide side cable entry provisions and watertight seals of the manufacturers standard.
 - b. Discharge column cover: Provide a circular single or two piece design.

- (1) Provide a watertight cover with a flexible rubber gasket, O-ring, or profile gasket.
- (2) Provide a bracket on the bottom of the cover to hold the carrier cable turnbuckle.
- (3) Provide the cover fastened to the column with Type 316 stainless steel bolts.
- (4) Provide covers utilizing a lateral cable duct, assembly frame, pressure plate and sealing module. Lateral ducts to provide strain relief and protect against kinking and twisting.
 - (a) Roxtec or acceptable equivalent product.

c. Discharge column cover: Provide a circular single or two piece design.

- (1) Provide a watertight cover with a flexible rubber gasket, O-ring, or profile gasket.
- (2) Provide a bracket on the bottom of the cover to hold the carrier cable turnbuckle.
- (3) Provide the cover fastened to the column with Type 316 stainless steel bolts.
- (4) Provide covers utilizing a lateral cable duct, assembly frame, pressure plate and sealing module. Lateral ducts to provide strain relief and protect against kinking and twisting.
 - (a) Roxtec or acceptable equivalent product.

5. Provide an open top flower pot type discharge and flare fitting as indicated
6. Provide a support soleplate at the elevation indicated, welded to the discharge tube to support the discharge tube and the pump and motor assembly. Grout in place and anchor the pump tube soleplate.
7. Provide discharge tube stabilizer brackets, as required, for connection of discharge column to back wall of intake or wet well.

L. Pump Casing and Impeller:

1. Materials:
 - a. Impeller: Duplex Stainless Steel ASTM A 890 CD 4 MCuN
 - b. Pump Casing: Cast Iron, ASTM A48, Class 30B

- c. Casing Wearing Ring/Liner: Stainless Steel, ASTM A276, Type 316
 - d. Pump Bellmouth: Cast Iron, ASTM A48, Class 30B
 - e. Bearing bracket/housing/cover: Cast Iron ASTM A48 Class 40
 - f. Shaft ASTM A276 Type 420
 - g. O-Rings: Nitrile Butadiene Rubber (NBR)
 - h. Hardware: ASTM A276 Type 316 stainless steel.
 - i. Fabricated casings are not acceptable.
- 2. Provide a single piece cast impeller, material as specified with smooth surfaces.
 - a. Impeller Type: Open, axial propeller or mixed flow design. selected to optimize pump performance and efficiency.
 - b. Blade pitch and resulting performance must be within 95% of the motor power rating.
 - c. Provide the impeller locked to the shaft with a Type 316L stainless steel key and lock nut designed to not loosen, but be removable for maintenance.
 - d. The impeller must be capable of handling the service and conditions as specified and indicated.
 - e. Fabricated impellers are not acceptable.
 - 3. Statically and dynamically balance each impeller to ISO 21940-11 Grade G2.5.

M. Pump Casing and External Bellmouth:

- 1. Provide a pump casing and inlet bellmouth consisting of two separate pieces, machined and bolted together for pump maintenance.
- 2. Provide a stainless steel casing wearing ring/liner
- 3. Provide straightening vanes in the bellmouth to deliver a smooth hydraulic velocity and directional transition into the pump casing and impeller with a minimum of turbulence.
- 4. Provide the pump casing and diffuser section include directional vanes to deliver the flow of water into the discharge column to maximize the hydraulic efficiency and minimize exit losses from the pump.
- 5. Pump designed without straightening vanes and directional vanes are not acceptable.

6. Suction bells which are accessory items, and are not an integral part of the pump assembly are not acceptable.
7. Fabricated steel or stainless steel pumps are not acceptable.

N. Pump Tube Intake Bell:

1. Provide a pump intake bell of the size specified.
2. Mount to the pump tube inlet with a flange.
3. Bell Design:
 - a. OD: 16-inch
 - b. Provide a smooth radius
 - c. Nominal height: 16 inches
4. Material:
 - a. Stainless Steel Type 316L
 - (1) Bell: 1/8-in thick
 - (2) Flange: Minimum 3/8-in thick
 - (3) Bead blasted
 - b. Hardware: ASTM A276 Type 316 stainless steel.

O. Wear Ring:

1. Provide a stainless steel wear ring to protect the inside diameter of the inlet bellmouth nozzle against cavitation and abrasive wear. Provide the wear ring with grooves for flushing for stormwater applications to maximum pump life and continuing high efficiencies.
2. Provide the wear ring / bellmouth bolted to the pump casing.
3. Provide the wear ring designed to be replaced without having to remove the impeller.

P. Shaft:

1. Provide a one piece integral pump and motor shaft.
2. Provide shaft designed to meet the maximum torque required at any normal start-up condition or operating point as specified and indicated.

3. Maximum deflection: 0.002 inches at the lower seal.
4. Provide each pump shaft with a polished finish and machined shoulders to accommodate bearings, seals and impeller.
5. Carbon steel shafts, chrome plated shafts and multi piece friction welded shafts are not acceptable.

Q. Mechanical Seals:

1. Provide the critical area of the impeller shaft sealed by two tandem, independent, mechanical shaft seals, with their own spring system.
 - a. Pump Side Stationary and Rotating Faces: Silicon-carbide
 - b. Motor Side Stationary and Rotating Faces: Silicon-carbide and Carbon
 - c. Springs: Type 316 stainless steel.
 - d. Elastomers: Viton.
 - e. Oil (seal lubrication): Ecologically safe, mineral or paraffin based
2. Provide seals that do not require maintenance or adjustment, but the ability to inspect, check and replace.
3. Provide seals that are a non-proprietary in design, and available commercially.
4. Provide an oil-filled chamber to separate the seals and provide lubrication.
 - a. Provide a drain and inspection plug with positive anti-leak seal, accessible from outside the pump casing.
5. Provide the oil chamber capable of being inspected and maintained without having to take the pump apart. Pumps without this feature are not acceptable
6. Conventional double mechanical seals with a single or multiple springs acting in opposed direction, cartridge-type mechanical seals; seals with materials other than those specified; seals using the impeller hub as a mounting surface are not acceptable.

2.05 PUMP AND MOTOR BEARING ARRANGEMENT

- A. Provide the shaft rotating on a minimum of three (3) permanently lubricated bearings and of sufficient size to transmit full driver output with a maximum deflection of 0.002 inches measured at the lower mechanical seal.
 1. Upper Bearing: Cylindrical roller bearing

2. Lower Bearing: Two single row angular contact bearings and one deep groove, single row, ball bearing.
3. Provide the bearing system capable of handling all up and down vertical thrust loads plus any radial loads.
4. Provide bearings that are maintenance free, grease lubricated with a minimum B-10 bearing life of 100,000 hours at all anticipated axial and radial loads.

2.06 MOTORS:

- A. Provide motors designed in accordance with IEC60034 and comply with NEMA MG1 Part 31.
- B. Provide in accordance with Section 26 20 10 where applicable.
- C. Horsepower rating of motors: Not less than maximum brake horsepower requirements of pumps under any condition of operation specified and indicated without operating in the motor service factor.
- D. Motor Enclosure: Provide type as indicated
 1. Hazardous Locations: Explosion proof submersible approved by Factory Mutual or UL Listed as explosion proof for use in NEC Class 1, Division 2, Group A, B, C & D hazardous locations.
 2. Motor Speed: Provide as indicated, speeds higher than indicated are not acceptable.
 - a. Speeds slower than specified and indicated may be acceptable and all changes are the Contractors responsibility. All work associated with any design and construction changes due to changes to a slower pump and motor speed shall be at no additional cost to the OWNER and not considered cause for any claim of schedule delay or extension to the contract duration.
 3. Operate without overheating at the speeds specified and indicated.
- E. Service Factor: 1.15, with 1.0 inverter duty rating for pumps equipped with VFDs.
- F. Voltage tolerance of +/- 10 percent from nameplate rated voltage.
- G. Provide motors suitable for operation on all modern PWM type variable frequency drives.
- H. Minimum Motor Efficiencies:
 1. 100 percent Load: 86 percent
 2. 75 percent Load: 84 percent
 3. 50 percent Load: 82 percent

4. 25 percent Load: 80 percent
- I. Rating: 460V, 3-phase, 60 Hertz.
- J. Site Altitude: 600 feet above sea level.
- K. Submersible Motors:
 1. Squirrel-cage induction shell type design (NEMA B type), housed in an air filled, watertight chamber.
 2. Provide the stator windings, insulation materials and stator leads rated for Class H (180 degrees C) temperature, and insulated with moisture resistant Class H polyester resin varnish using the Current-UV-Dip-Impregnation method resulting in a winding fill factor of at least 95%. Provide motors designed to operate at full load with a class F temperature rise.
 3. Provide the stator heat-shrink fitted into the stator housing.
 4. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable.
 5. Provide the motor designed for continuous duty operation, handling pumped media of up to 40 degree C.
 6. Provide motor capable of ten (10) evenly spaced starts per hour at maximum speed.
 7. Materials:
 - a. Housing:
 - (1) ASTM A48 Class 40 cast iron
 - b. Rotor bars and short circuit rings: Aluminum or copper.
 8. Dynamically balance rotating assembly to meet ISO 21940-11 G6.3 or better to prevent vibration during pumping operation.
 9. All hardware: Type 316 stainless steel.
 10. Power and Control Cables:
 - a. Provide all cables of multi-conductor SOW-A or W of sufficient length to extend from pump motor to a junction box as indicated without splicing.
 - b. Provide cable size in accordance with NEC specifications.
 - c. Provide the outer jacket of the cable of oil resistant chloroprene rubber and capable of continuous submerged operation to a depth of 65 feet.

- d. Provide shielded motor power and control cable. Provide shield composed of braided strands of tinned copper between inner sheath and outer jacket.
11. Cable Entry/Junction Chamber:
- a. Provide cable terminal box on top of motor housing, with cable entry sealed to insure that no entry of moisture is possible into the high-voltage motor/terminal area even if the cable is damaged or severed below water level.
 - b. Cable entries providing only rubber grommet (external cable jacket) seals are not acceptable.
12. Provide the power and control cables with strain relief mounted to the pump lifting lug.
13. Thermal Protection:
- a. Provide temperature monitoring devices in motor windings for use in conjunction with and supplemental to external motor overload protection.
 - b. Provide and arrange controls to shut down pump should any of the monitors detect high temperature and automatically reset once motor temperature returns to normal.
 - c. Provide temperature monitors set at levels recommended by pump manufacturer.
 - d. Provide a temperature monitor for the lower bearing. Sensor to be a resistance type (RTD) temperature sensor with a linear relationship between temperature and resistance.
 - e. Provide a temperature monitor for the upper bearing. Sensor to be a resistance type (RTD) temperature sensor with a linear relationship between temperature and resistance.
14. Seal Failure Early Warning System:
- a. Provide a moisture detector in the motor's stator cavity which allows a control panel mounted relay to indicate leakage into the motor.
 - b. Additionally provide a Type 316 stainless steel mechanical float in a separate leakage collection chamber to indicate seal leakage prior to its penetration of the lower bearing assembly.
 - c. Moisture detection to alarm the condition and shut down the pump.
15. Provide a vibration monitor installed in the bearing bracket.
- a. Sensor: A vibration velocity transducer delivering a 4 to 20 mA output

- b. Interface directly to vibration indicator & relay.

2.07 PUMP MONITORING:

- A. Provide all relays required for monitoring all motor sensors.
- B. Provide the relays installed by the Contractor in the motor control panel and wired in accordance with pump manufacturer's instructions.
- C. Provide relays mounted with standard 12-pin socket bases and operate on available control voltage of 24-240 VAC. If relays require an input voltage that is not available in the motor control panel, provide a transformer with fused input. Provide relays with a power consumption of no more than 2.8 watts and UL approved. Provide relays modular in design, with each relay monitoring no more than two motor sensor functions.
 - 1. Provide each relay module to include a dual color (red/green) LED to indicate the status of each monitored sensor. Green will indicate "status OK"; red will indicate a failure or alarm condition.
 - 2. A self-corrected fault will allow the relay output contacts to reset, and cause the LED to change from a steady alarm indication to a flashing signal. The LED continues to flash until locally cleared, providing the operator an indication of a potential intermittent fault.
 - 3. Provide each relay to include a power-on LED and both "test" and "reset" pushbuttons.
- D. Provide an independent fail-safe (switch on power loss) form-C output contact for each monitored sensor to provide a normally-open / normally-closed dry contact to initiate a remote alarm device or shut down the motor. Provide contacts rated for 5 amps at 120 volt.

2.08 CARRIER CABLE:

- A. Provide a Type 316 stainless steel carrier cable system with each pump, to restrain the power and control cables during pumping operation.
- B. Provide a system such that the power and control cables cannot constantly move around violently in the high velocity flow while the pump is operating. The constant movement of the cable may cause the copper wire cores to fatigue.
- C. Provide the carrier cable also to be used for installation and removal of the pump and eliminating any need to enter the discharge column or intake.
- D. Provide the carrier cable system consisting of Type 316 stainless steel shackles on each end, Type 316 stainless steel lifting cable, and Type 316 stainless steel carrier lifting eyes with the number of eyes to be determined by any lifting clearance constraints due to hoist, bridge crane or building limits.

- E. Provide one shackle attached to a Type 316 stainless steel turnbuckle and the other end to the pump lifting lug.
- F. Provide an EPDM spacer between the power, control, and carrier cable for protection against binding and abrasion. Secure the spacer power/control/carrier cable bundle with a clamp at regular intervals.

2.09 SHOP PAINTING:

- A. Primer and Finish Paint: Shop apply to all exterior ferrous surfaces and interior of column and discharge head, NSF 61 high solids epoxy in accordance with Section 09 91 10.
- B. Ferrous surfaces which are not to be painted shall be given a shop applied coat of grease or rust resistant coating.
- C. Provide additional shop paint coating for touch-up to all surfaces after installation and testing is completed and equipment accepted.

2.10 FACTORY TESTING:

- A. Provide factory testing in accordance with Section 43 21 00.90.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install items in accordance with shop drawings, manufacturer's printed instructions and as indicated.
- B. Install pumping units and align.

3.02 FIELD TESTING:

- A. Comply with the requirements specified in Section 01 75 13 and as specified herein.
- B. Test piping connections to prove the pump discharge head nozzle is installed with the pipe in a free supported state and without need to apply vertical or horizontal pressure to align piping with pump nozzles. This must be performed and the piping system and supports acceptable prior to any field performance testing.
- C. Field testing will not be conducted without an accepted procedure, calibration certificates for all testing equipment, gauges and flow meters and a completed and signed pretesting check list. See Division 01 for checklist.
- D. After installation of pumping equipment, and after inspection, operation, testing and adjustment have been completed by the manufacturer's field service technician, conduct running test for each pump in presence of the Engineer to determine its ability to operate

within the vibration and temperature limits specified, and to deliver its rated capacity under specified conditions.

1. During tests, observe and record head, capacity, motor inputs and vibration.
 - a. Provide vibration signature test data for each pump and motor assembly.
 - b. Test Duration: Determined by the Engineer, but not less than two (2) hours of continuous operation at each condition specified and indicated.
 2. Run each pump for minimum one hour or until motor bearing temperature has stabilized prior to taking temperature readings of the motors.
 3. Immediately correct or replace all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.
 4. Repeat tests until specified results are obtained.
 5. Contractor to provide all water labor, piping, equipment, flow meters and test gauges for conducting tests.
 - a. Contractor shall provide calibrated test gauges for all permanently installed gauges and portable calibrated flow meters for all pumping systems even in those cases where permanent flow meters are installed.
 - b. All calibrations must be within 30 days of the field testing.
 - c. The testing will not be started and will not be accepted until the calibrated testing equipment stated above is operational and all certifications have been submitted.
 - d. Contractor is responsible for delivery and disposal of water used for testing.
- E. Make all adjustments necessary to place equipment in specified working order at time of above tests.
- F. Test pump on product only. If product is not available, test with water. Water for testing furnished by Contractor.
- G. Remove all replace equipment at no additional cost to the Owner with equipment that will meet all requirements specified and indicated if unable to demonstrate to the satisfaction of the Engineer that equipment will perform the service specified, indicated and as submitted.

3.03 FIELD TOUCH-UP PAINTING

- A. After installation and testing, apply touch-up paint to all scratched, abraded and damaged shop painted surfaces. Coating type and color shall match shop painting.

3.04 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01 77 00.

END OF SECTION 43 21 00.04

SECTION 44 42 46.03

SUBMERSIBLE MIXERS AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide and test submersible mixers, motors and appurtenances as indicated and in compliance with Contract Documents.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM) Publications:

- 1. A36: Standard Specification for Carbon Structural Steel
- 2. A48: Standard Specification for Gray Iron Castings
- 3. A276: Specification for Stainless Steel Bars and Shapes.

- B. American Iron and Steel Institute (AISI) Standards.

- 1. 329: Stainless steel.
- 2. 410: Stainless steel.
- 3. A48-40B: Propeller – Stainless Steel

- C. Anti-Friction Bearing Manufacturers Association (AFBMA).

1.03 SUBMITTALS:

- A. Submit following Section 01 33 00:

- 1. Certified shop and erection drawings. Contractor shall submit electronic files of the proposed equipment in the capacity, size and arrangement as indicated and specified.
- 2. Data regarding mixing equipment, drive and motor characteristics and performance:
 - a. Prior to fabrication and testing provide guaranteed performance curves based on actual shop or field tests of mechanically duplicate equipment showing they meet indicated and specified requirements for capacity, and horsepower.

- (1) For units of the same size, and type, provide curves for a single unit only.
 - b. Results of shop performance tests as specified.
 - c. Submit curves for guaranteed performance and shop performance tests on 8-1/2 inch by 11-inch (A4) sheets; one curve per sheet.
3. Shop drawing data for accessory items.
 4. Certified setting plans, with tolerances, for anchor bolts.
 5. Manufacturer's literature as needed to supplement certified data.
 6. Operating and maintenance instructions and parts list.
 7. Listing of reference installations as specified with contact names and telephone numbers.
 8. Bearing temperature operating range for the service conditions specified.
 9. Motor data.
 10. Recommended spare parts other than those specified.
 11. Recommendations for short and long term storage.
 12. Recommended baffle design, if baffles are required.
 13. Hoist data and dimensional data.
 14. Qualifications of Field Service Engineer.
 15. Tag numbers for all equipment.
 16. Special tools.
 17. Number of service person-days provided and per diem field service rate.
 18. Certified test reports verifying quality of gears in Gear Reduction Units.
 19. Motor shop test results.
 20. Field inspection/testing reports.
 21. Certified mixer shop and model test results.
 22. Shop and field testing procedures and equipment to be used including the details of all equipment and testing set-up

23. Provide scaled drawings showing each mixer location with full movement of hoist and any obstruction(s).
 24. Schematic control and power wiring diagrams.
 25. The latest ISO 9001 series certification or quality system plan.
 26. Material Certification
 - a. Provide certification from the equipment manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.
 - b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.
- B. A copy of the contract mechanical process, electrical and instrumentation drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with “No changes required” or provide a statement that no changes are required.
1. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.
- C. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
 2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.04 SPARE PARTS:

- A. Comply with the requirements specified in Section 01 61 00.
- B. Provide spare parts that are identical to and interchangeable with similar parts installed
 - 1. For each mixer:
 - a. Two sets of grease and oil seals.
 - b. Two sets of gaskets.
 - 2. One set of all special tools required.

1.05 QUALITY ASSURANCE:

- A. Comply with the requirements specified in Section 01 43 00.
- B. Submersible mixers to be the product of one manufacturer.
- C. Submersible mixers to be manufacturer's standard cataloged product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.
- D. Gears: Inspected and certified, before assembly.
- E. Welding: In accordance with latest applicable American Welding Society Code or equivalent.
- F. The Contractor shall obtain the mixer submersible mixers, motors, cables, masts, controls and control panels, from a single submersible mixer manufacturer as a complete and integrated package to insure proper coordination, compatibility and operation of the equipment.
- G. Service of Manufacturer's Representative as stated in Section 01 43 00 and as specified herein.
- H. Provide services of factory-trained Service Technician, specifically trained on type of equipment specified.
 - 1. Service Technician must be present on site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve the Contractor of the obligation to provide sufficient services to place equipment in operation as specified.
 - 2. Installation: Inspect location of anchor bolts, setting, leveling, alignment, field erection, etc.; coordination of piping, electrical and miscellaneous utility connections; but not less than:

- a. 2 person-days
 - 3. Field and Functional Testing: Calibrate, check, align and perform functional testing with water: Tests to include all items specified.
 - a. 3 person-days
 - b. Provide letters from Contractor certifying that the field and functional testing has been completed and that the equipment is operational and ready for field performance testing.
 - 4. Performance Testing: Field performance test equipment as specified.
 - a. 2 person-days per system
 - 5. Vendor Training: Provide classroom and field operation and maintenance instructions, including all slides, videos, handouts and preparation to lead and teach classroom sessions:
 - a. 2 person-day.
 - 6. Credit to the Owner, all unused service person-days specified above, at the manufacturer's published field service rate.
 - 7. Any additional time required of the factory trained service technician to assist in placing the equipment in operation, or testing or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.
 - I. Manufacturer of submersible mixers must have a minimum of five (5) years of successful operating experience with the size and type of mixer and service conditions specified and indicated.
- 1.06 DELIVERY, STORAGE AND HANDLING:
- A. Comply with the requirements specified in Section 01 66 10.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION:

- A. Mixer and operating tank data are indicated in the Mixing Equipment Schedule and as specified herein.
- B. Provide mixers capable of operation within maximum and minimum liquid levels of tank as specified and indicated.

- C. Mixers are normally to be operated automatically and provided with a manual control device.
- D. Service:
 - 1. Anoxic Selector Tank and Aeration Tank Anoxic Zones: Provide maximum number of mixers per zone as specified and indicated designed to maintain solids in suspension in the tanks. Design mixer to operate in the tanks as indicated.
- E. Provide mixer complete with local control panel.

2.02 MANUFACTURERS:

- A. ABS
- B. KSB
- C. Flygt
- D. Landia
- E. EMU

2.03 SUBMERSIBLE MIXER CONSTRUCTION:

- A. Design submersible mixers and appurtenances for long, continuous, and uninterrupted service; easy adjustment and replacement of parts:
 - 1. Steel members: Minimum 1/4-inch thickness.
 - 2. Bolts: Minimum 1/2-inch diameter.
- B. Structural Steel: Provide in accordance with ASTM A36.
- C. Iron Castings: Provide in accordance with ASTM A48 Class 40.
- D. Provide Type 316 stainless steel for fasteners and hardware.
- E. Stainless steel in accordance with AISI 329, AISI 410.
- F. Provide an epoxy coating of a minimum thickness of 0.010 inches to protect all surfaces coming into contact with sewage, other than stainless steel.

2.04 SUBMERSIBLE MIXERS:

- A. Provide components of each mixer, including motor capable of continuous underwater operation while propeller blade is completely submerged.

- B. Components of mixer, including motor, capable of continuous operation completely unsubmerged for a minimum of 2 hours.
- C. Motor Housing:
 - 1. Material: Type 316 stainless steel with cast iron motor end caps at mounting end and Type 316 stainless steel at propeller end.
 - 2. Material: ASTM A48 Class 30 Cast Iron.
 - 3. Machine and fit watertight joints with viton "O" rings.
 - 4. Bolts and hardware: Type 316 stainless steel.
- D. Seals:
 - 1. Provide each mixer with two sets of independent Type 316 stainless steel mechanical seals with silicon carbide seal face material running in an oil bath.
 - 2. Propeller shaft: Provide end face type mechanical seals.
 - a. Provide seals with a positively driven rotary face ring.
 - (1) Seals without a positively driven face ring are not acceptable.
 - 3. Provide seals that can be readily inspected and replaced.
 - 4. Provide two separate seal oil chambers for shaft sealings system.
 - a. Provide drain and inspection ports and plugs with positive anti-leak seal. All ports and plugs to be accessible from the outside of the mixer assembly.
- E. Propeller:
 - 1. Type: single, non-clogging two or three vane, backward curved design.
 - 2. Material: Type 316 Stainless Steel, Fiberglass reinforced epoxy resin, or Closed Cell Polyurethane.
 - 3. Propeller shall be based on requirements of tank geometry to optimize mixing and energy consumption.
 - 4. Dynamically balance each propeller.
 - 5. Secure to shaft with a friction clutch device. Provide friction clutch to act as a safety device against object jamming the propeller.
 - 6. Propeller shall be of large diameter and large blade surface area type insuring soft sludge treatment and maximum propeller efficiency.

7. Mixers with propeller shrouds shall not be accepted.
8. Propeller blades shall be non-clogging, backward curved design starting at the flange. Propeller shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in normal sewage applications.

F. Propeller/Motor Shaft:

1. Material: ASTM A276 Type 316 stainless steel.
2. Spur gear shaft and propeller shaft shall each be supported by two additional bearing sets sized to provide 100,000 hours.
3. Spur gear and propeller shaft bearings shall be open type, lubricated by the gear box oil.

G. Motor:

1. Provide in accordance with Section 26 00 00 and as specified and indicated.
2. Provide a submersible, asynchronous speed type, housed in an air filled watertight chamber.
 - a. Oil filled motors are not acceptable.
3. Service Factor: 1.15.
4. Class F insulation to a temperature of 311 degrees F.
5. Stator: Dipped and baked three times in Class F varnish.
6. Provide motors capable of 24 hour continuous duty, capable of sustaining 20 evenly spaced starts per hour.
7. Provide junction chamber with watertight cable attachment.
8. Rotor bars and short circuit rings: aluminum.
9. Motor shaft: ASTM A276 Type 420 stainless steel.
10. Provide two permanently lubricated motor bearings:
 - a. Minimum L-10 life: 100,000 hours at full load.
11. Provide thermal sensors to monitor stator temperatures. Provide stator with two thermal switches imbedded in the end coils of the stator winding.
12. Provide motor moisture detector mounted in housing.

13. Rating: 480 volt, 3-phase, 60 Hertz.
14. Provide each mixer, with appurtenances and cable, capable of continuous submergence without loss of watertight integrity to a depth of 65 feet.

H. Cable entry:

1. System shall be field replaceable.
2. Provide the cable entry as an integral part of the stator casing.
3. Provide a cable entry composed of a conical cable holder with a flange bearing against a shoulder in the stator-casing opening.
4. Provide cable entry cone of Cast Iron AISI A48-40B.
5. Provide cable cast into the cable entry cone in order to provide a leak proof, torque-free seal at the cable entrance.

I. Gear Reduction Unit:

1. Type: Double Reduction Inline.
 - a. Propeller and motor centerline shaft shall match.
2. Provide gear reduction unit with gears designed for a minimum of 100,000 hours of operation.
3. Provide with a parallel gear shaft with separate support bearings to isolate the motor shaft from all axial and radial loads on the propeller unit.
4. Gears shall operate in an oil-filled chamber with drain and inspection plug.
 - a. Plugs shall each contain a positive anti-leak seal.

2.05 GUIDE RAIL SYSTEM:

- A. Provide a Type 316 stainless steel guide rail system used to support each mixer during operation and guide each unit during installation and during lubrication/preventative maintenance, and inspection.
 1. The assembly shall consist of a bottom bearing console, stop console, guide rail, fixing bracket and guide holder assembly.
 2. Provide bottom assembly bolted to floor of tank.
 3. Guide rails shall be designed to absorb thrust of the mixer.

- B. Provide mixer stop console fastened to the guide rail at a position specified by the manufacturer.

2.06 CONTROL SYSTEM:

- A. Provide control panels for the mixers as specified and indicated.
1. Enclosure: NEMA 4X Type 316L stainless steel.
 2. Provide enclosure with reset buttons, switches, contacts, and all necessary appurtenances, completely factory wire to provide a coordinated and operating set of controls.
 3. Magnetic motor starters with 3-pole overload protection and manual reset provided within Motor Control Centers specified under Division 26.
 4. RUN-OFF-AUTO selector switches.
 5. Alarms:
 - a. Individually sense. Provide reset controls for:
 - (1) High temperature, each motor.
 - (2) Moisture detection, each motor.
 - b. Provide dry alarm contacts for remote common alarm.
 6. Provide terminal board for all-external circuits.
- B. Operation:
1. In AUTO position the mixers will operate continuously.
 2. Provide shutdown of mixers on moisture detection or high stator temperature.

2.07 MIXING EQUIPMENT SCHEDULE PER TRAIN, 4 TRAINS TOTAL:

			Anaerobic Tank	Tanks 5 & 6 Anoxic Zones	Tank 7 Anoxic Zone
Zone Dimensions					
	Length	ft	80	80	80
	Width	ft	20.38	21.21	20.75
	Depth	ft	16	16	16
	Volume (each)	ft ³	26,100	27,100	26,600
	Volume (each)	gal	195,100	203,100	198,700
Mixer Parameters					

			Anaerobic Tank	Tanks 5 & 6 Anoxic Zones	Tank 7 Anoxic Zone
	No. of Mixers (each tank)	Number	2	2	2
	No. of Mixers (total)	Number	2	4	2
	Rated Power	hp	3.0	3.0	3.0
	Weight (max.)	lbs	610	610	610
	Motor Speed	rpm	1,150	1,150	1,150
	Propeller Speed	rpm	35 - 1,200	35 - 1,200	35 - 1,200
	Propeller Dia.	in	12 - 80	12 - 80	12 - 80
	No. of Blades	Number	2 - 3	2 - 3	2 - 3
	Power/Volume	hp/1000 ft ³	0.10	0.10	0.10

2.08 SHOP TESTS:

A. Motor Tests:

1. Standard commercial test.

B. Mixer Tests:

1. Provide check list showing that materials, types and ratings of the propellers, motors and electrical connections and shop test are in accordance with the contract documents.
2. Test for correct rotation and current draw.
3. Vacuum test to show mechanical integrity.
4. Test mixers immersed. After immersion test inspect mixers for oil seepage, water infiltration, insulation defects and resistance.
5. Perform a model test at the manufacturer's facility to verify mixer selections.
 - a. Provide data and calculate thrust factor for each service or mixer size.
 - b. Engineer may witness model tests.

2.09 SHOP PAINTING:

- A. Primer and Finish Paint. Shop apply to all exterior ferrous surfaces, high solids epoxy in accordance with Section 09 91 10.
- B. Ferrous surfaces which are not to be painted shall be given a shop applied coat of grease or rust resistant coating.

- C. Provide additional shop paint coating for touch up to all surfaces after installation and testing is completed and equipment is accepted.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install items in accordance with manufacturer's printed instructions, as indicated and specified.

3.02 FIELD PERFORMANCE TESTS:

- A. Comply with the requirements specified in Section 01 75 13 and as specified herein.
- B. After installation and services of manufacturer's factory trained engineer, operate each unit to demonstrate ability to continuously operate without vibration, jamming, and overheating.
- C. Operate impellers satisfactorily at least one tank drawdown cycle and take measurements of motor amperage.
- D. Operate each hoist with mixer.
- E. Make all adjustments necessary to place equipment in working order at time of testing.
- F. Test on Product only.
- G. Remove and replace equipment at no additional cost to the Owner if unable to demonstrate to the satisfaction of the Engineer that the mixer assemblies perform the services specified and that they will operate free from vibration and overheating and that the hoist system operates properly.

3.03 FIELD TOUCH-UP PAINTING:

- A. After installation and testing have been accepted, Contractor shall apply touch up paint to all scratched, abraded and damaged shop painted surfaces. Coating type and color shall match shop painting.

3.04 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01 77 00.

END OF SECTION 44 42 46.03

APPENDIX A

SELECTED 1985 RECORD DRAWINGS FOR REFERENCE

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CITY OF ELYRIA, OHIO

SET NO. _____

DEPARTMENT OF PUBLIC SERVICE

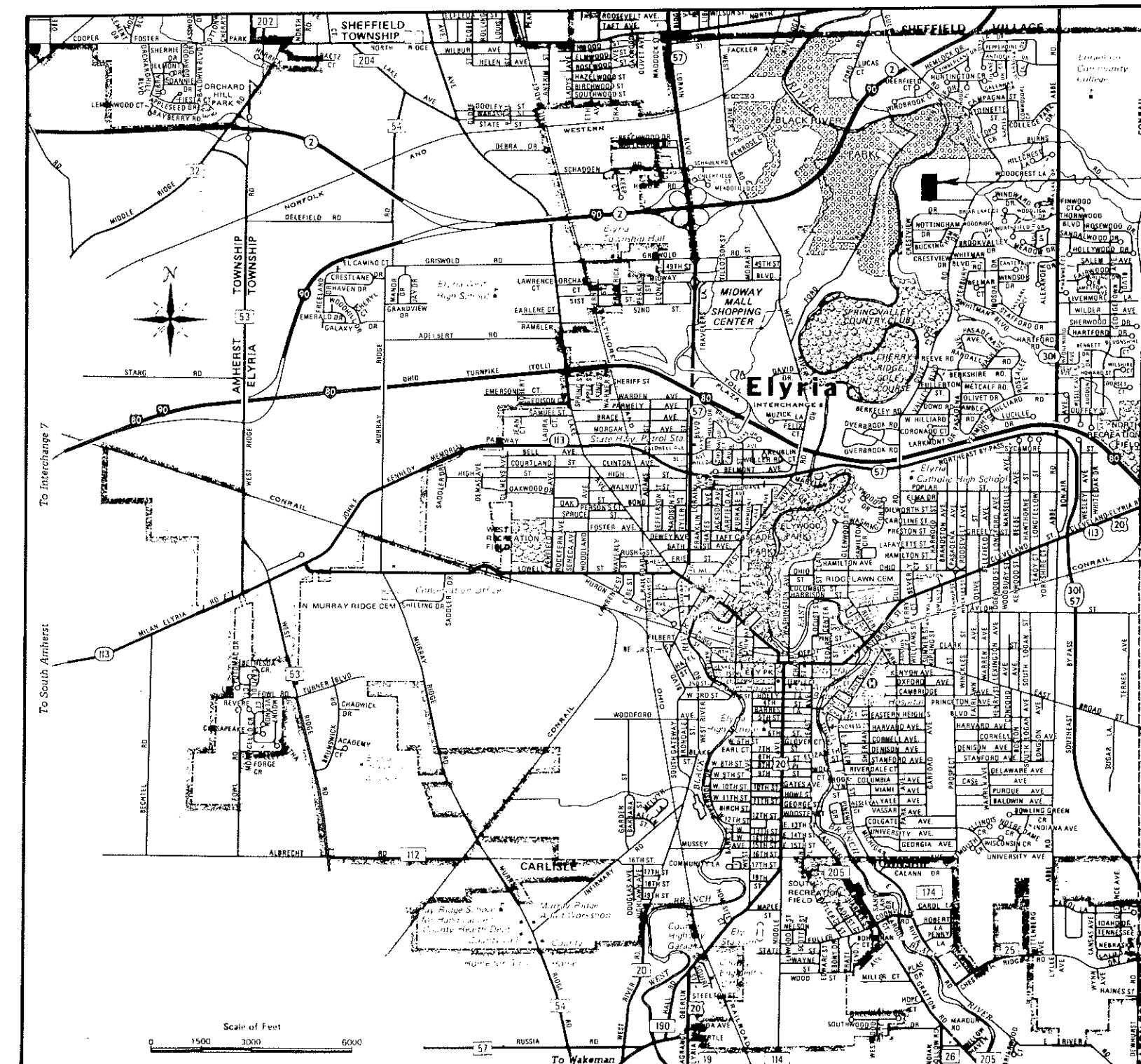
VOL. 2 OF 2

WATER POLLUTION CONTROL PLANT IMPROVEMENTS

CONTRACT 1345

VOLUME 2

NOVEMBER, 1985



WATER
POLLUTION
CONTROL
PLANT

LOCATION MAP

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SCALE IN MILES

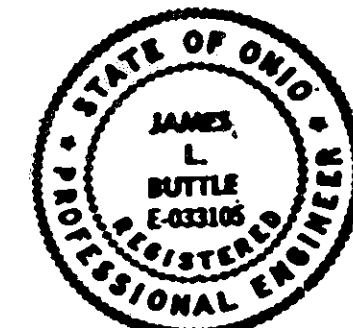
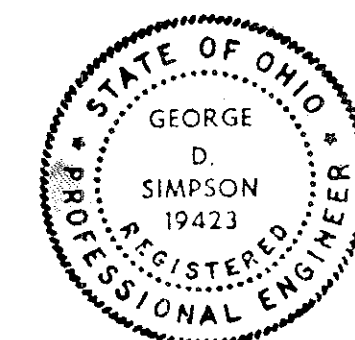
MICHAEL B. KEYS MAYOR

CHARLES R. HOAGLAND...SAFETY SERVICE DIRECTOR

LONNY G. SHIPPY.....CITY ENGINEER

HAVENS AND EMERSON, INCORPORATED

CONSULTING ENGINEERS



RECORD DRAWING

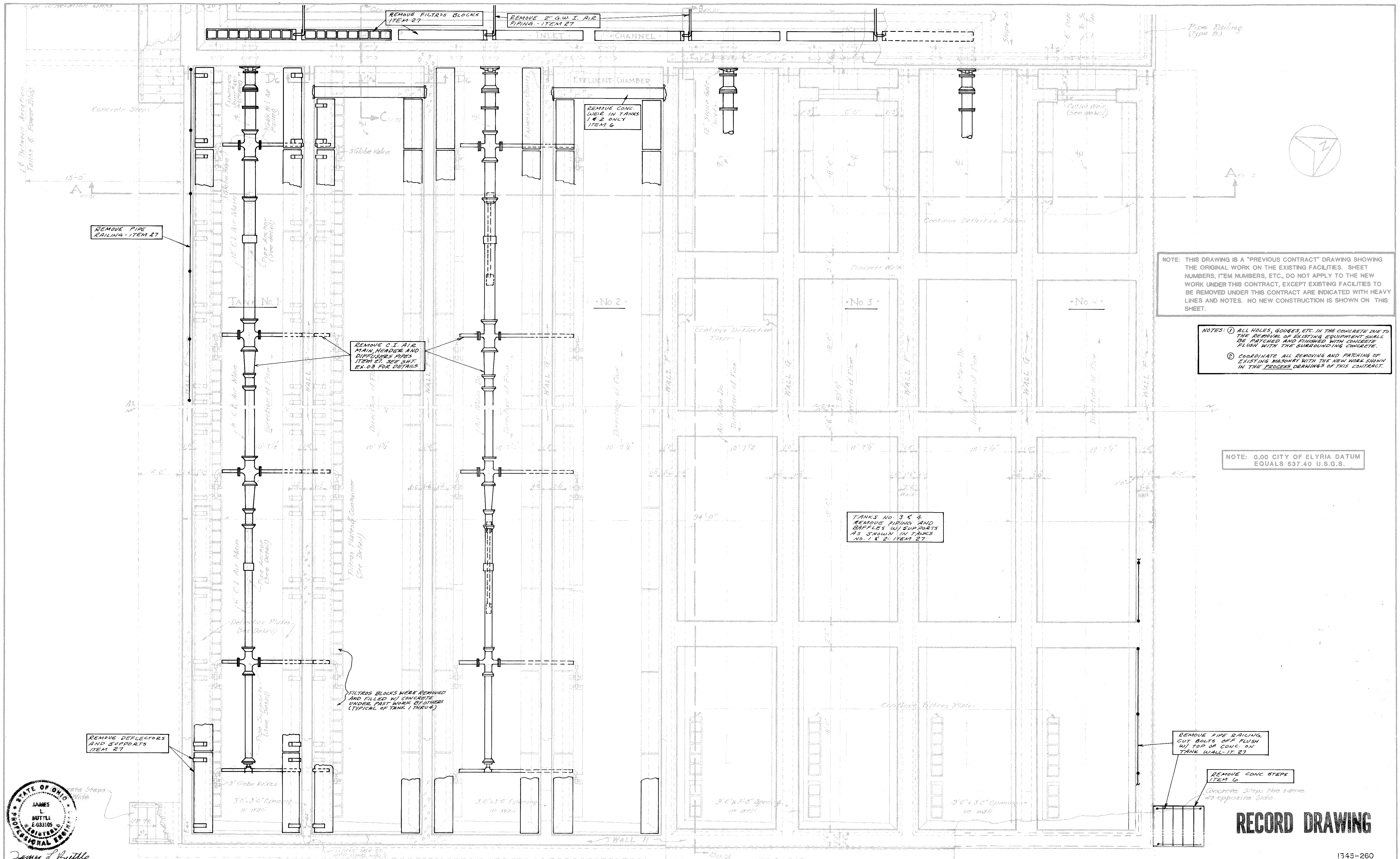
APPROVED:

Michael B. Keys
MAYOR

Charles R. Hoagland
SAFETY SERVICE DIRECTOR

Lonny G. Shippy
CITY ENGINEER

James L. Buttle
HAVENS AND EMERSON, INC.



NOTE: THIS DRAWING IS A "PREVIOUS CONTRACT" DRAWING SHOWING THE ORIGINAL WORK ON THE EXISTING FACILITIES. SHEET NUMBERS, ITEM NUMBERS, ETC., DO NOT APPLY TO THE NEW WORK UNDER THIS CONTRACT, EXCEPT EXISTING FACILITIES TO BE REMOVED UNDER THIS CONTRACT ARE INDICATED WITH HEAVY LINES AND NOTES. NO NEW CONSTRUCTION IS SHOWN ON THIS SHEET.

- NOTES: ① ALL HOLES, GOUGES, ETC. IN THE CONCRETE DUE TO THE REMOVAL OF EXISTING EQUIPMENT SHALL BE PATCHED AND FINISHED WITH CONCRETE FLUSH WITH THE SURROUNDING CONCRETE.
- ② COORDINATE ALL REMOVING AND PATCHING OF EXISTING MASONRY WITH THE NEW WORK SHOWN IN THE PROCESS DRAWINGS OF THIS CONTRACT.

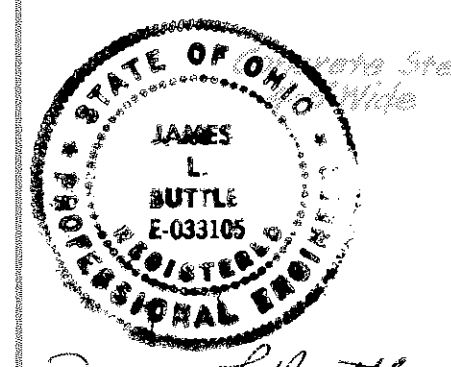
NOTE: 0.00 CITY OF ELYRIA DATUM EQUALS 537.40 U.S.G.S.

TANKS NO. 3 & 4 REMOVE PIPING AND BAFFLES W/ SUPPORTS AS SHOWN IN TANKS NO. 1 & 2. ITEM 27.

REMOVE PIPE RAILING, CUT BOLTS OFF FLUSH W/ TOP OF CONC. ON TANK WALL-IT. 27

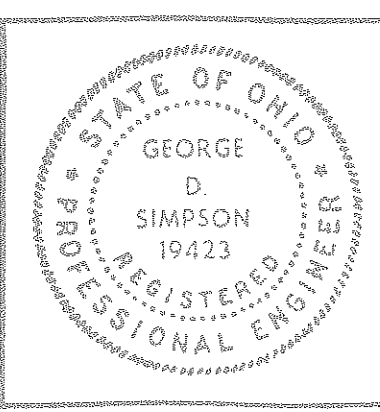
REMOVE CONC. STEPS ITEM 6
Concrete Steps the same as opposite side.

RECORD DRAWING



AS BUILT	3-8	
NO.	DESCRIPTION	DATE
REVISIONS		

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY JTB DRAWN BY RCB

APPROVED BY R.W. Keate

SUBMITTED BY L.D. Simpson
HAVENS AND EMERSON INC.

DATE 10-14-83

APPROVED BY James J. Slayton
CITY ENGINEER

DATE 11-26-85

CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE

WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5

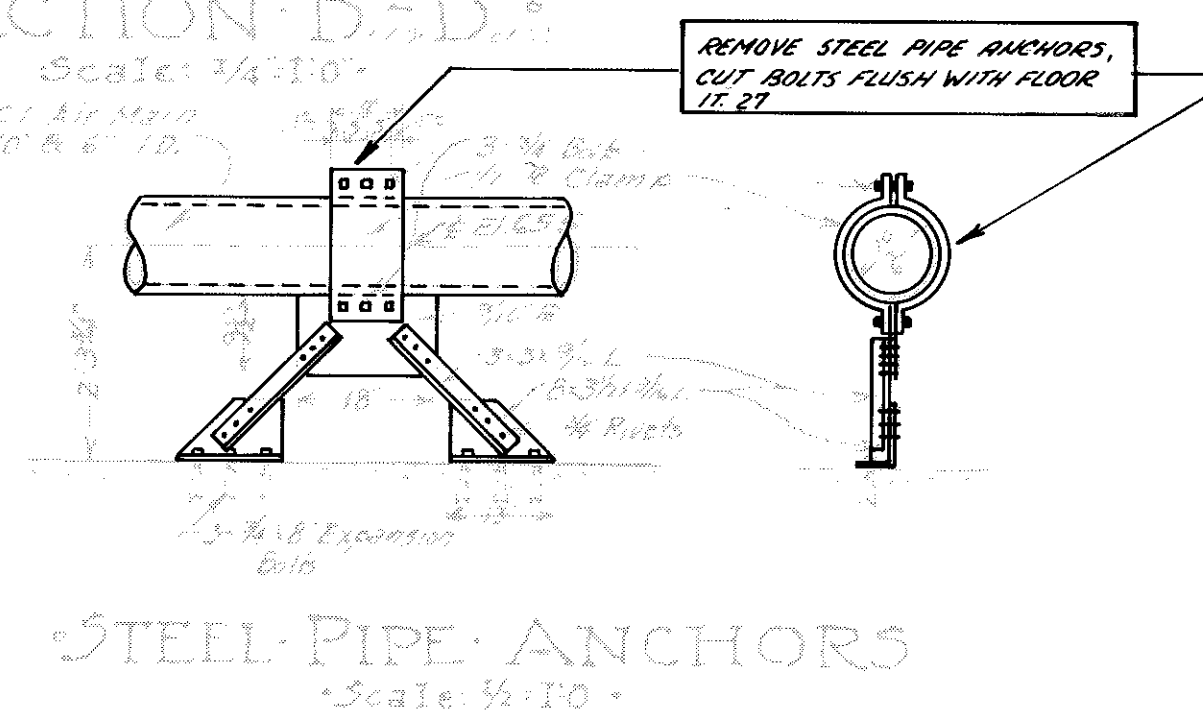
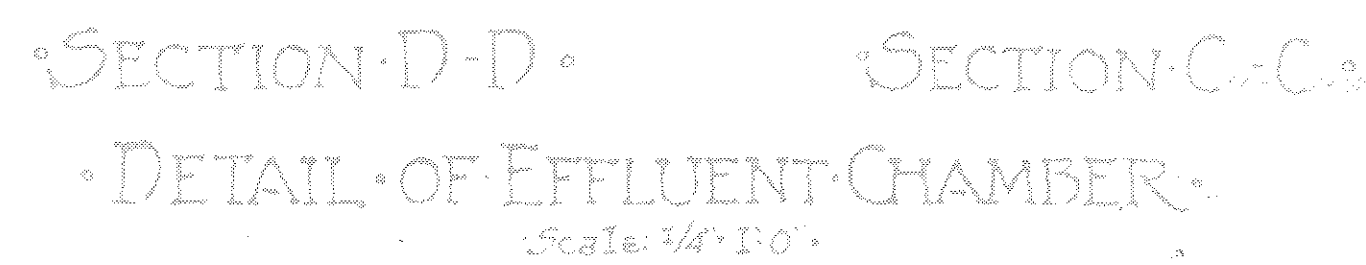
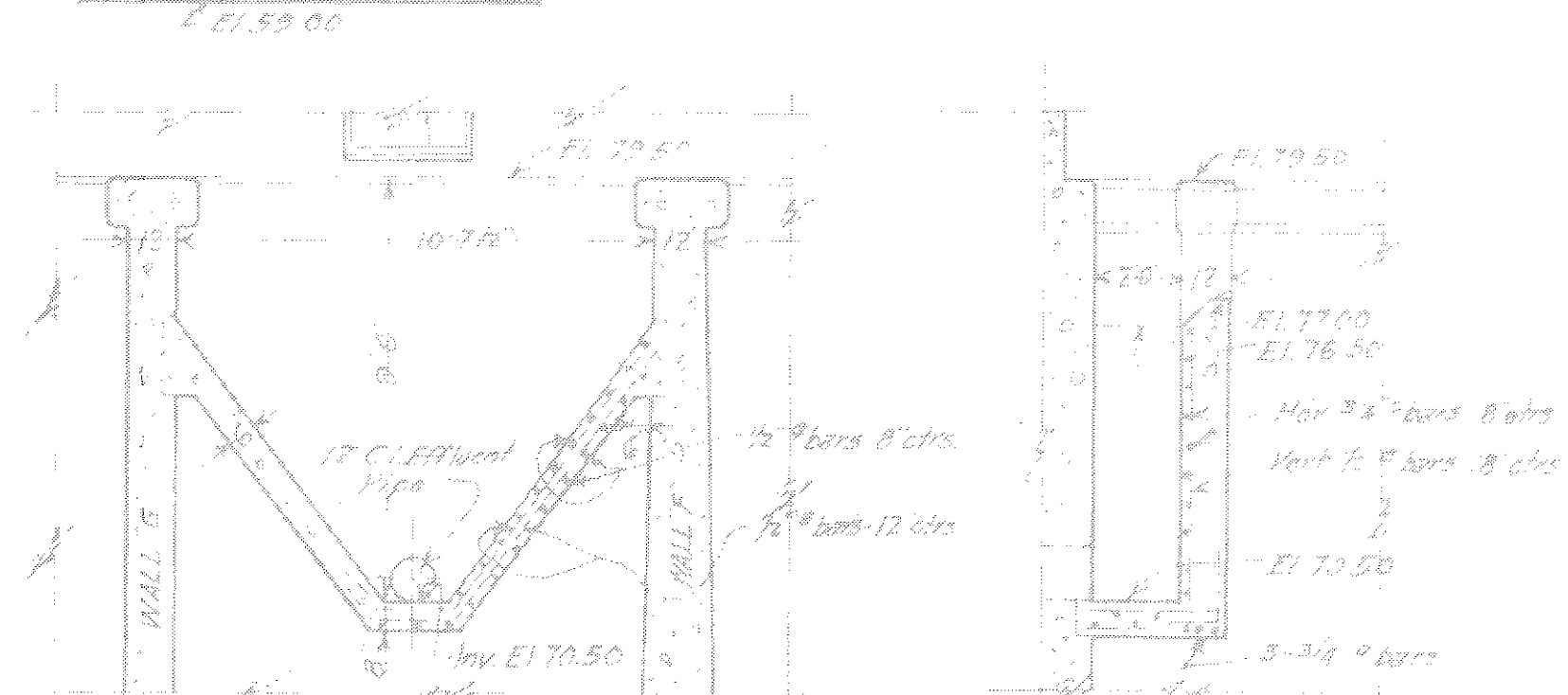
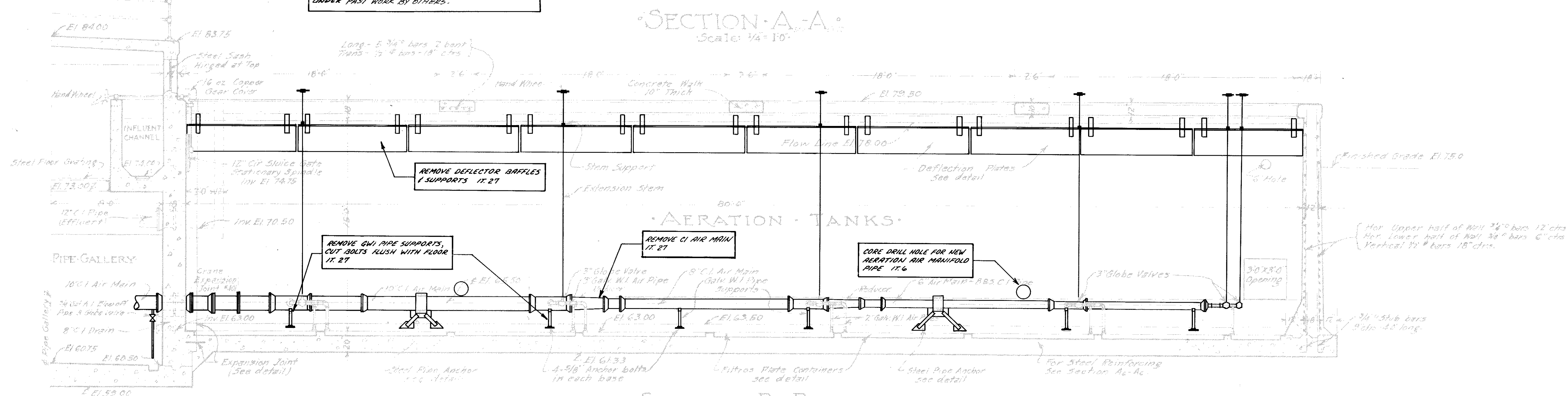
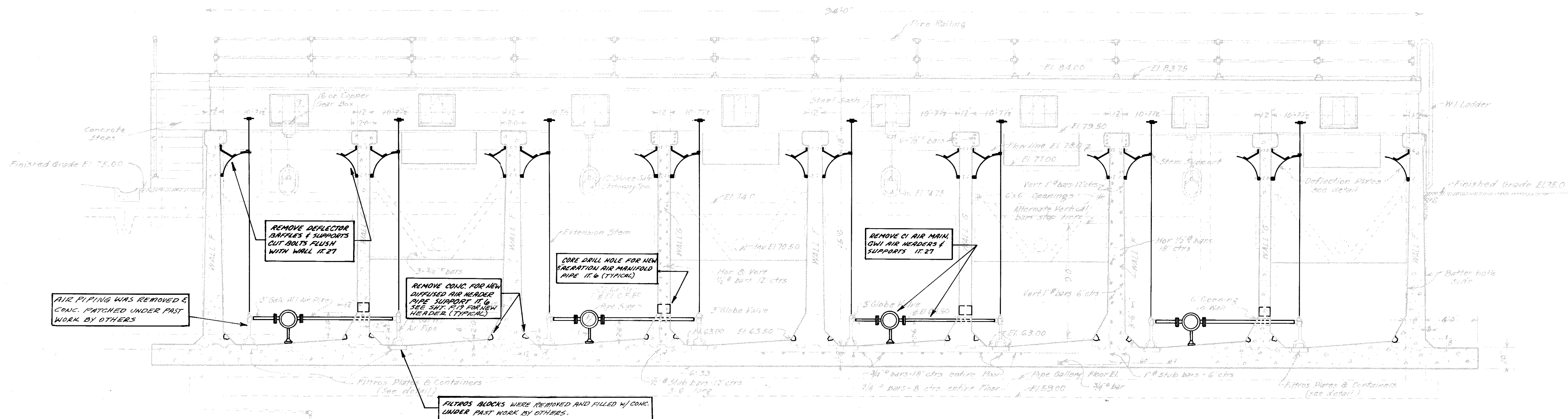
EXISTING AERATION TANKS NO. 1-4
PLAN

1345-260

SCALE
1 1/4" = 1'-0"

FILE NO.
1430-5.014

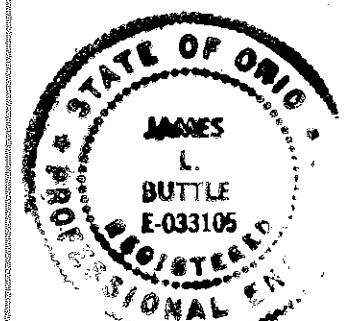
SHEET NO.
EX. 01/24



NOTE: THIS DRAWING IS A "PREVIOUS CONTRACT" DRAWING SHOWING THE ORIGINAL WORK ON THE EXISTING FACILITIES. SHEET NUMBERS, ITEM NUMBERS, ETC., DO NOT APPLY TO THE NEW WORK UNDER THIS CONTRACT, EXCEPT EXISTING FACILITIES TO BE REMOVED UNDER THIS CONTRACT ARE INDICATED WITH HEAVY LINES AND NOTES. NO NEW CONSTRUCTION IS SHOWN ON THIS SHEET.

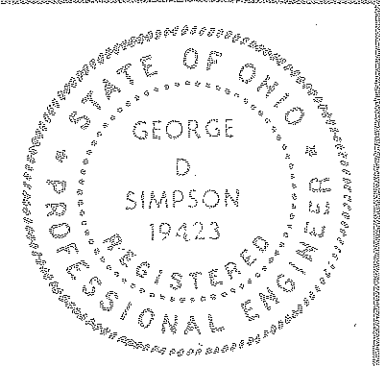
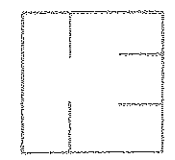
NOTE: 0.00 CITY OF ELYRIA DATUM EQUALS 537.40 U.S.G.S.

NOTES: ① ALL HOLES, GOUGES, ETC., IN THE CONCRETE DUE TO THE REMOVAL OF EXISTING EQUIPMENT SHALL BE PATCHED AND FINISHED WITH CONCRETE FLUSH WITH THE SURROUNDING CONCRETE.
② COORDINATE ALL REMOVING AND PATCHING OF EXISTING MASONRY WITH THE NEW WORK SHOWN IN THE PROCESS DRAWINGS OF THIS CONTRACT.



James L. Buttle		
	AS BUILT	3-87
NO.	DESCRIPTION	DATE
REVISIONS		

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY JTB DRAWN BY RCB
APPROVED BY R.W. Keane
SUBMITTED BY R.D. Simpson
DATE 10-14-83

APPROVED BY Lonny D. Stegman
DATE 11-26-85

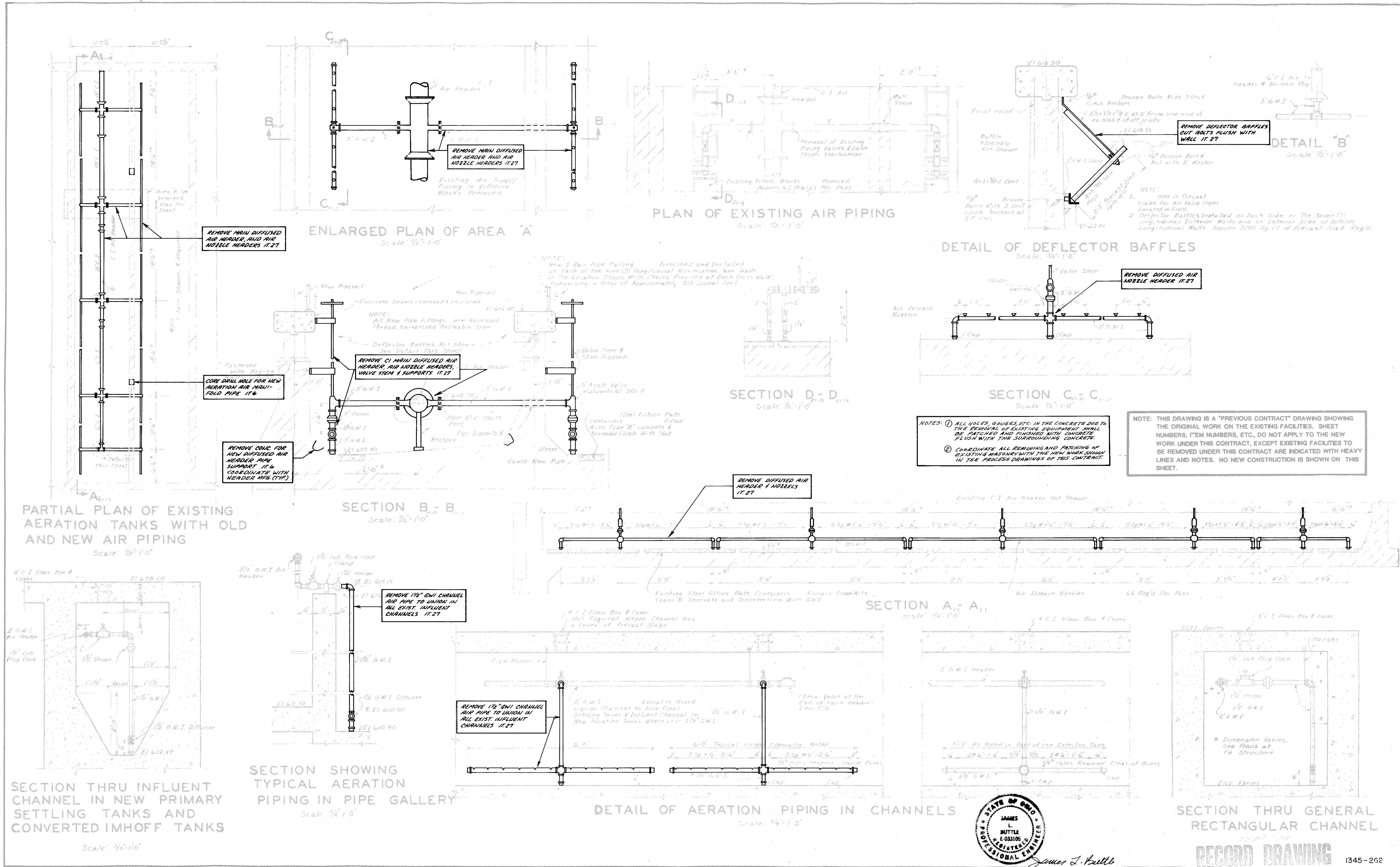
CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
EXISTING AERATION TANKS NO. 1-4
SECTIONS

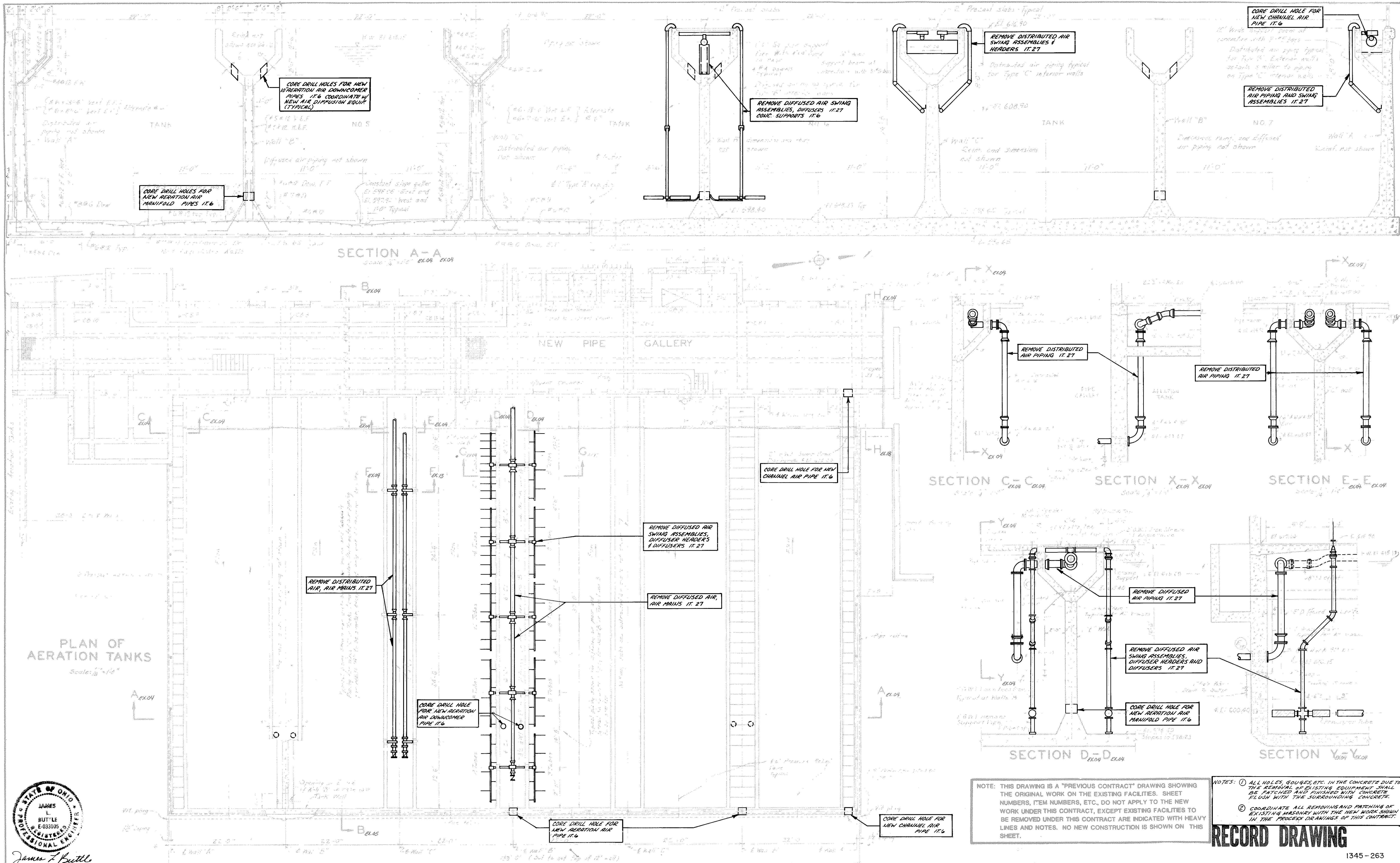
RECORD DRAWING

1345-261

SCALE AS SHOWN
FILE NO. 1430-5.015
SHEET NO. EX. 02/24



AS BUILT	3-89	HAVENS AND EMERSON INC. CONSULTING ENGINEERS	DESIGNED BY JTB DRAWN BY MR	APPROVED BY	CITY OF ELYRIA, OHIO DEPARTMENT OF PUBLIC SERVICE	SECONDARY TREATMENT EXPANSION CONTRACT 5	SCALE AS SHOWN
NO.	DESCRIPTION	DATE	APPROVED BY R.W. Keote	APPROVED BY	WATER POLLUTION CONTROL PLANT IMPROVEMENTS	EXISTING AERATION TANKS NO. 1-4 AIR PIPING	FILE NO. 1430-5.016
REVISIONS			SUBMITTED BY B.D. Simpson	DATE 11-26-85			SHEET NO. EX. 03/24
			DATE 10-14-83				



STATE OF OHIO
JAMES L. BUTTLE
REGISTERED PROFESSIONAL ENGINEER
E-033105

James L. Buttles

AS BUILT 3-89

NO.	DESCRIPTION	DATE
REVISIONS		

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS

STATE OF OHIO
GEORGE D. SIMPSON
REGISTERED PROFESSIONAL ENGINEER
19423

DESIGNED BY JTB DRAWN BY M.R.

APPROVED BY R.W. Keitz

SUBMITTED BY And. Ruppert

DATE 10-14-83

APPROVED BY Lonny J. Serrin

DATE 11-26-85

CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE

WATER POLLUTION CONTROL PLANT IMPROVEMENTS

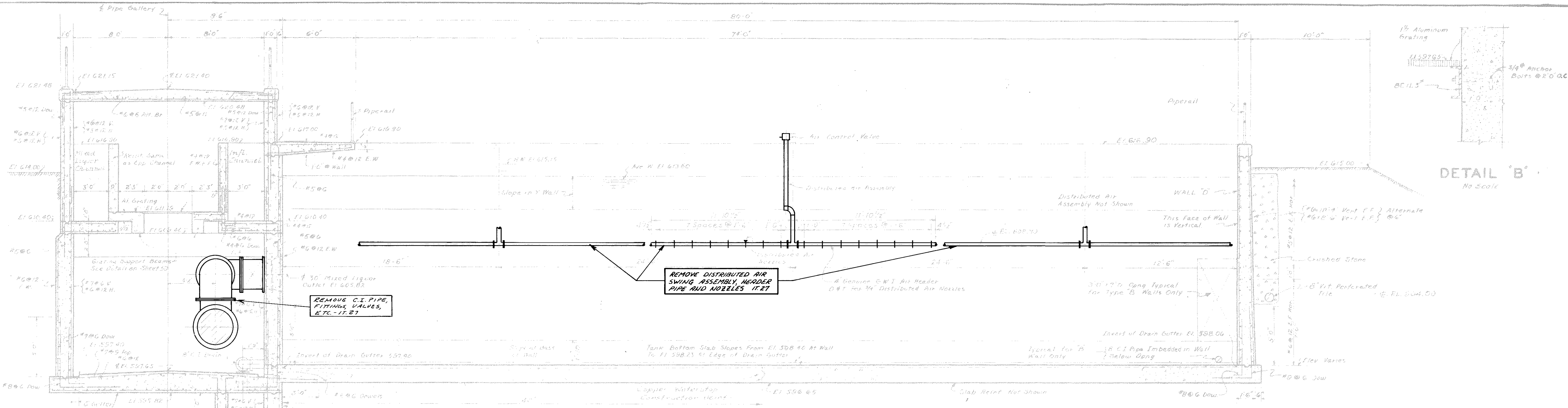
SECONDARY TREATMENT EXPANSION
CONTRACT 5

**EXISTING AERATION TANKS NO. 5-7
PLANS AND SECTIONS**

SCALE
AS SHOWN

FILE NO.
1430- 5.017

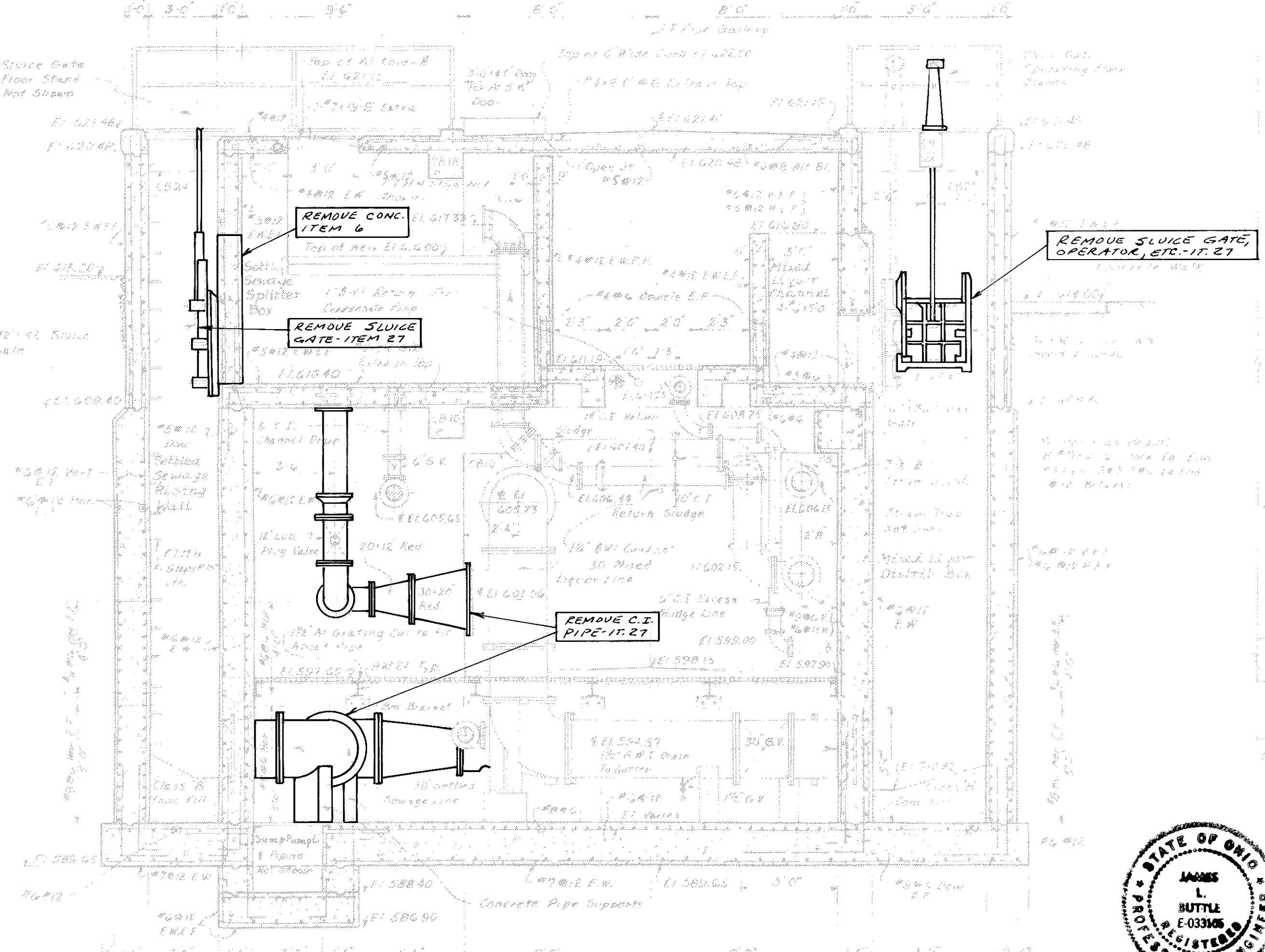
SHEET NO.
EX. 04/24



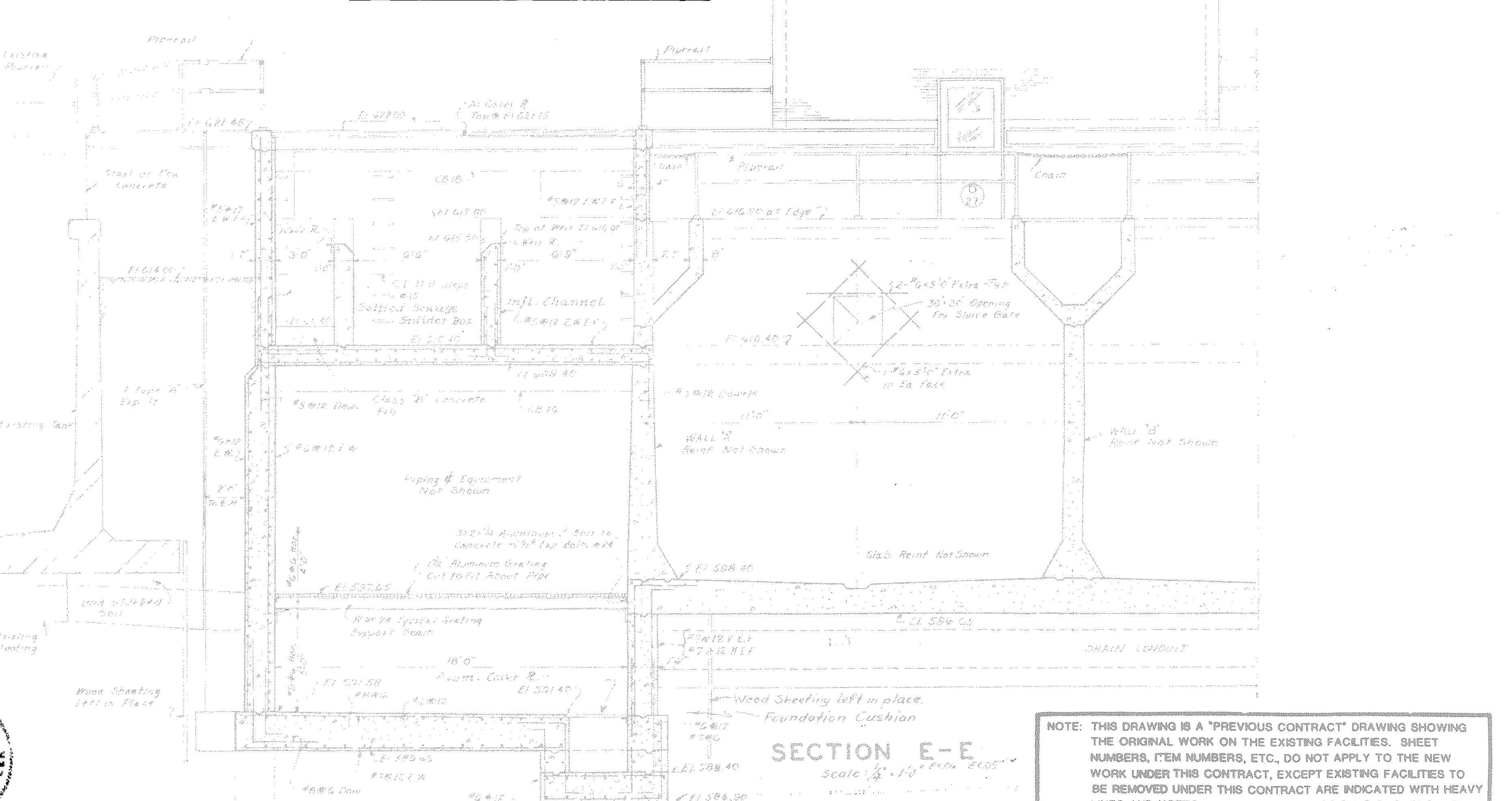
SECTION B-B
Scale: 1/4" = 1'-0"

NOTES: ① ALL HOLES, GROUDES, ETC. IN THE CONCRETE DUE TO THE REMOVAL OF EXISTING EQUIPMENT SHALL BE PATCHED AND FINISHED WITH CONCRETE FLUSH WITH THE SURROUNDING CONCRETE.
② COORDINATE ALL REMOVING AND PATCHING OF EXISTING MASONRY WITH THE NEW WORK SHOWN IN THE PROCESS DRAWINGS OF THIS CONTRACT.

DETAIL 'B'
No Scale



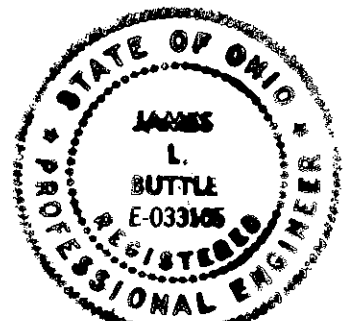
SECTION C-C
Scale: 1/4" = 1'-0"



SECTION E-E
Scale: 1/4" = 1'-0"

NOTE: THIS DRAWING IS A 'PREVIOUS CONTRACT' DRAWING SHOWING THE ORIGINAL WORK ON THE EXISTING FACILITIES. SHEET NUMBERS, ITEM NUMBERS, ETC., DO NOT APPLY TO THE NEW WORK UNDER THIS CONTRACT, EXCEPT EXISTING FACILITIES TO BE REMOVED UNDER THIS CONTRACT ARE INDICATED WITH HEAVY LINES AND NOTES. NO NEW CONSTRUCTION IS SHOWN ON THIS SHEET.

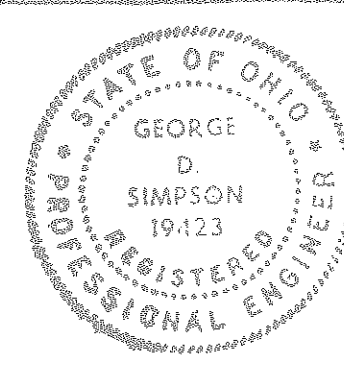
RECORD DRAWING



James L. Buttle

NO	DESCRIPTION	DATE
1	AS BUILT	3-89
2		
3		
4		
5		
6		
7		
8		
9		
10		

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



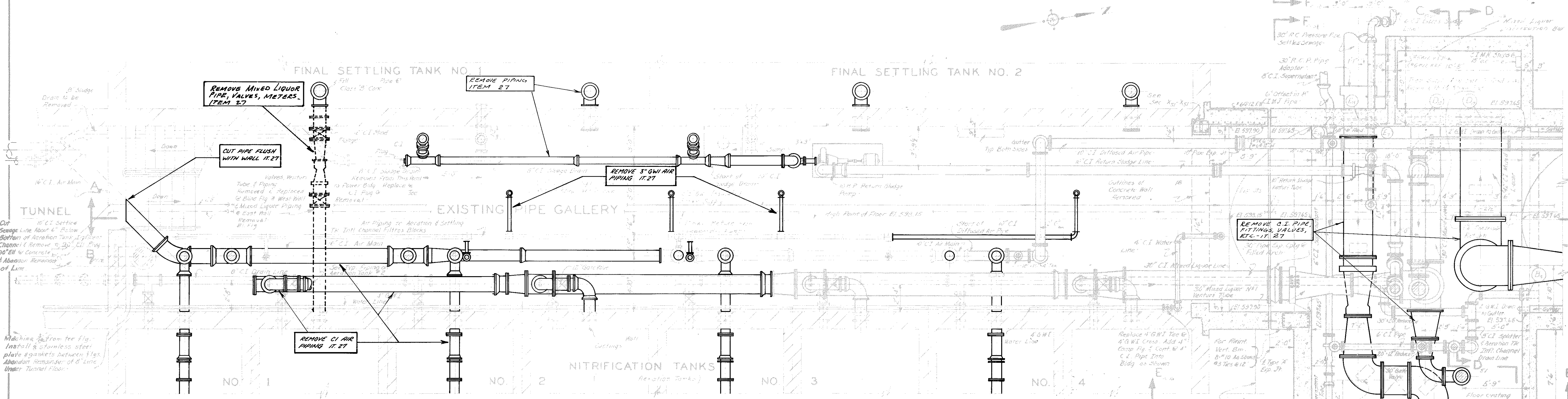
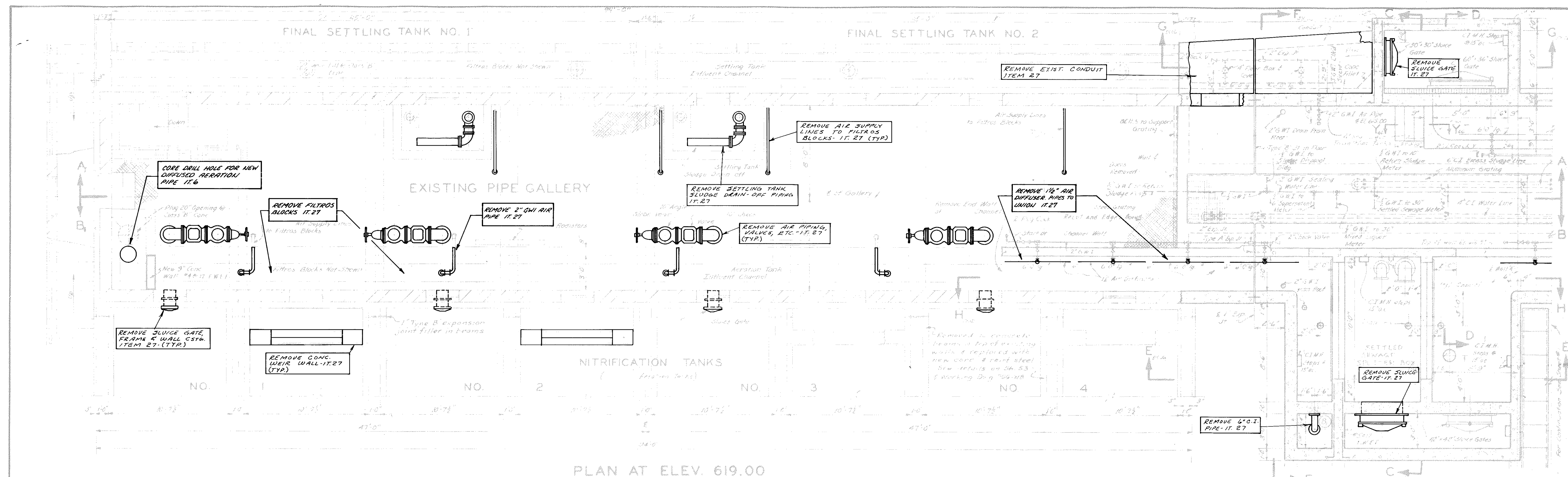
DESIGNED BY JTB DRAWN BY RcB
APPROVED BY R.W. Krotz
SUBMITTED BY A.B. Simpson
DATE 10-14-83

APPROVED BY James L. Buttle
DATE 11-26-85

CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
EXISTING AERATION TANKS NO. 5-7 SECTIONS

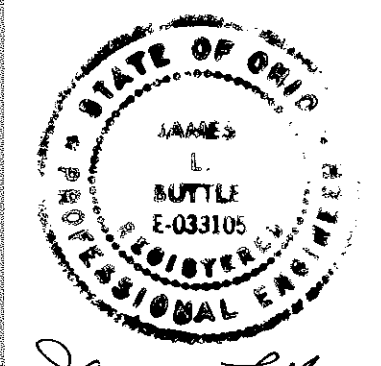
SCALE AS SHOWN
FILE NO. 1430- 5.018
SHEET NO. EX. 05/24



NOTE: THIS DRAWING IS A "PREVIOUS CONTRACT" DRAWING SHOWING THE ORIGINAL WORK ON THE EXISTING FACILITIES. SHEET NUMBERS, ITEM NUMBERS, ETC., DO NOT APPLY TO THE NEW WORK UNDER THIS CONTRACT, EXCEPT EXISTING FACILITIES TO BE REMOVED UNDER THIS CONTRACT ARE INDICATED WITH HEAVY LINES AND NOTES. NO NEW CONSTRUCTION IS SHOWN ON THIS SHEET.

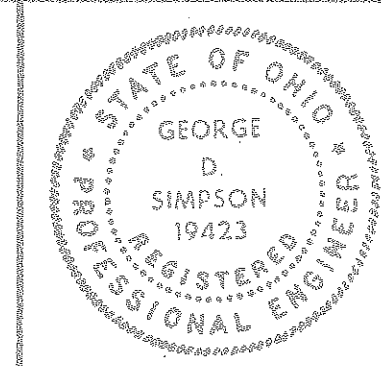
RECORD DRAWING

- NOTES:
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 2. COORDINATE ALL REMOVING AND PATCHING OF EXISTING MASONRY WITH THE NEW WORK SHOWN IN THE PROCESS DRAWINGS OF THIS CONTRACT.



James A. Buttle		
AS	BUILT	3-89
NO.	DESCRIPTION	DATE
REVISIONS		

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



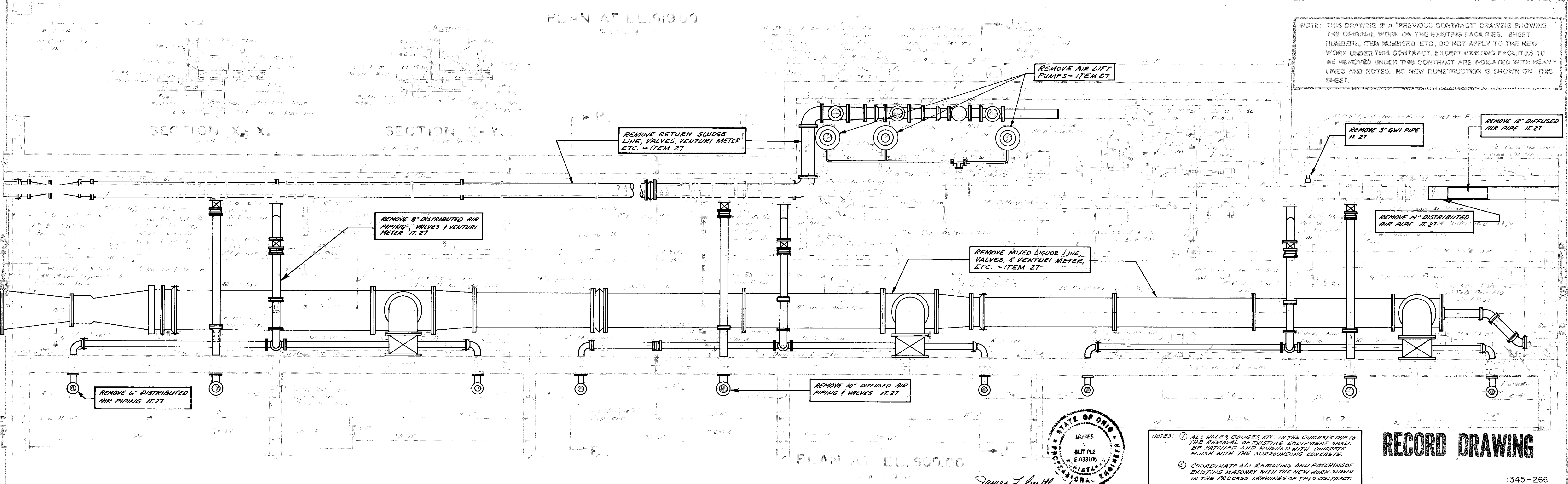
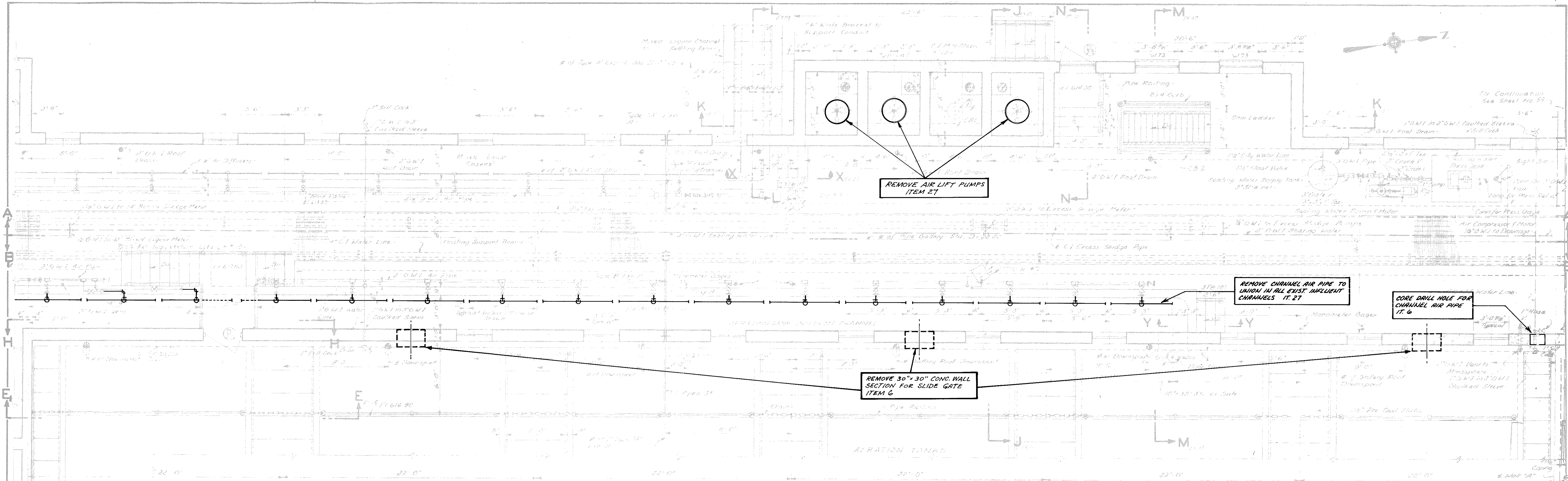
DESIGNED BY JTB DRAWN BY MR
APPROVED BY R.W. Keotz
SUBMITTED BY B.D. Simpson
DATE 10-14-83

APPROVED BY
DATE 11-26-85

CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
EXISTING AERATION PIPE GALLERY
PLANS - SOUTH HALF

SCALE 1/4" = 1'-0"
FILE NO. 1430-5.019
SHEET NO. EX. 06/24



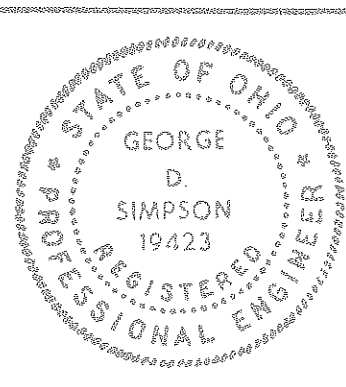
NOTE: THIS DRAWING IS A "PREVIOUS CONTRACT" DRAWING SHOWING THE ORIGINAL WORK ON THE EXISTING FACILITIES. SHEET NUMBERS, ITEM NUMBERS, ETC., DO NOT APPLY TO THE NEW WORK UNDER THIS CONTRACT, EXCEPT EXISTING FACILITIES TO BE REMOVED UNDER THIS CONTRACT ARE INDICATED WITH HEAVY LINES AND NOTES. NO NEW CONSTRUCTION IS SHOWN ON THIS SHEET.

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RECORD DRAWING

AS	BUILT	3-89
NO.	DESCRIPTION	DATE
REVISIONS		

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



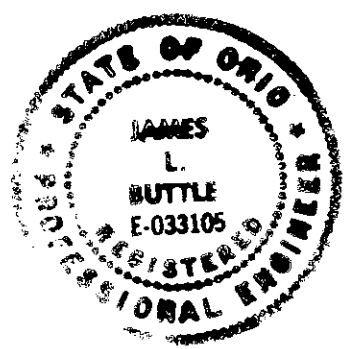
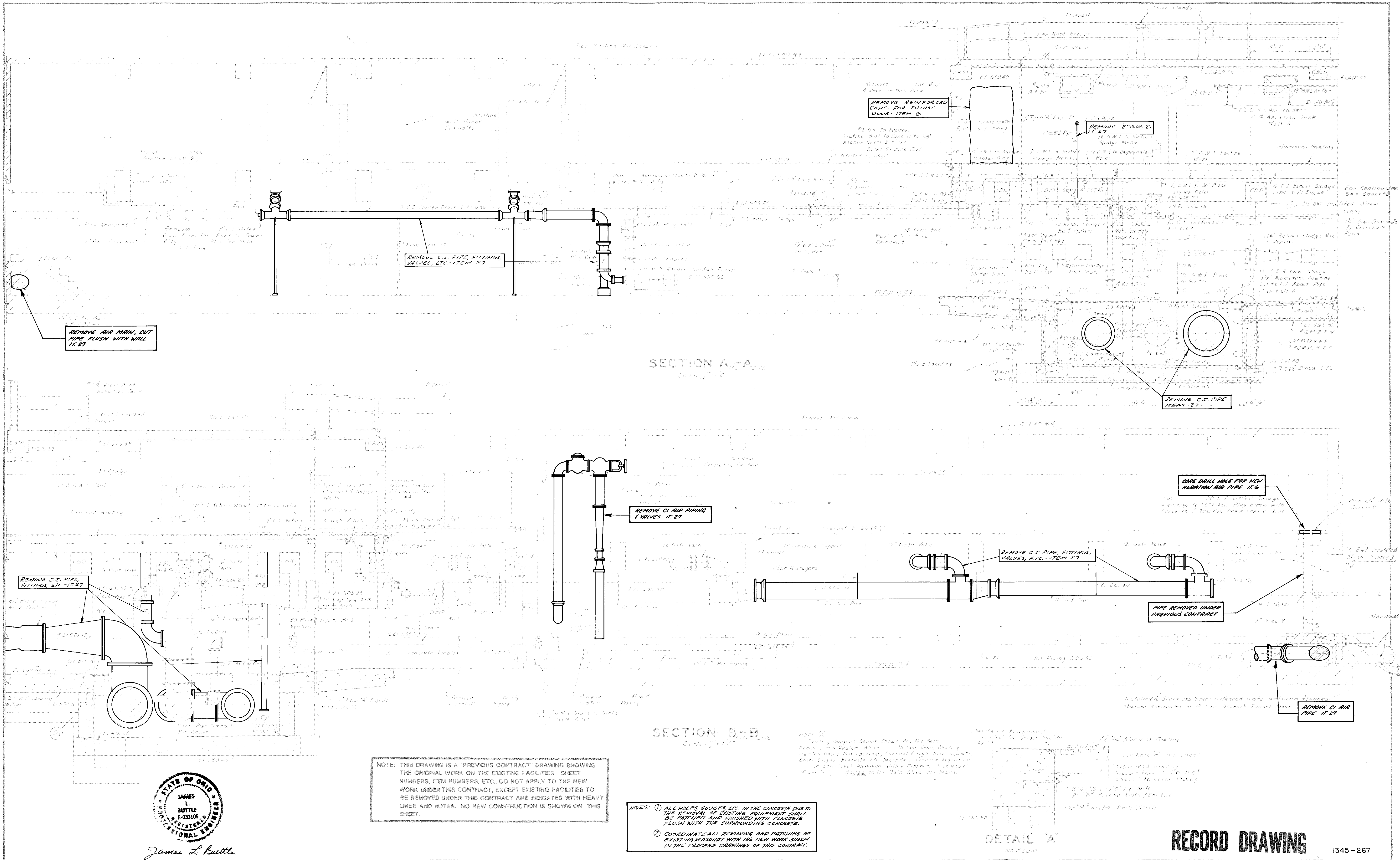
DESIGNED BY JTB. DRAWN BY MR.
APPROVED BY R.W. Keore
SUBMITTED BY K.D. Surpin
DATE 10-14-83

APPROVED BY
DATE 11-26-85

CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
EXISTING AERATION PIPE GALLERY
PLANS - NORTH HALF

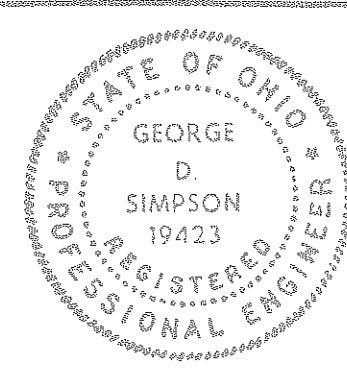
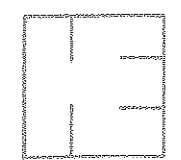
SCALE
1/4"=1'-0"
FILE NO.
1430-5.020
SHEET NO.
EX. 07/24



James L. Buttle

NO.	DESCRIPTION	DATE
AS BUILT		3-89
REVISIONS		

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY JTB DRAWN BY MR
 APPROVED BY R.V. Keon
 SUBMITTED BY B.D. Simpson
 DATE 10-14-83

APPROVED BY James L. Buttle
 CITY ENGINEER

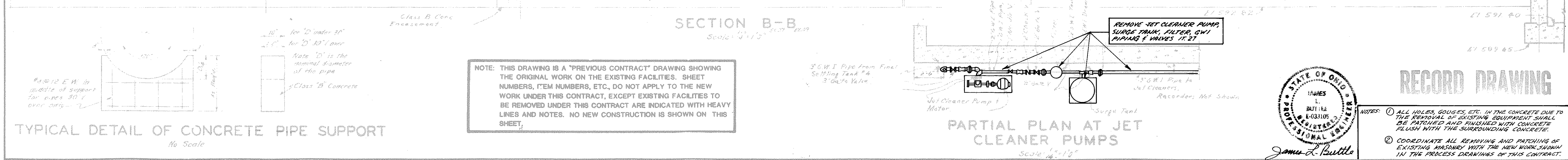
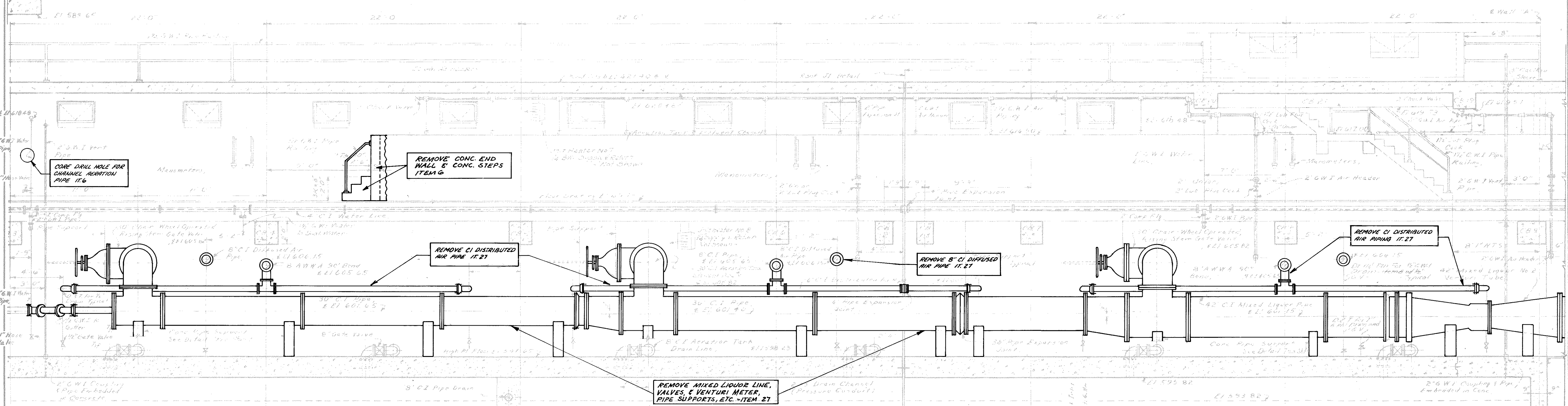
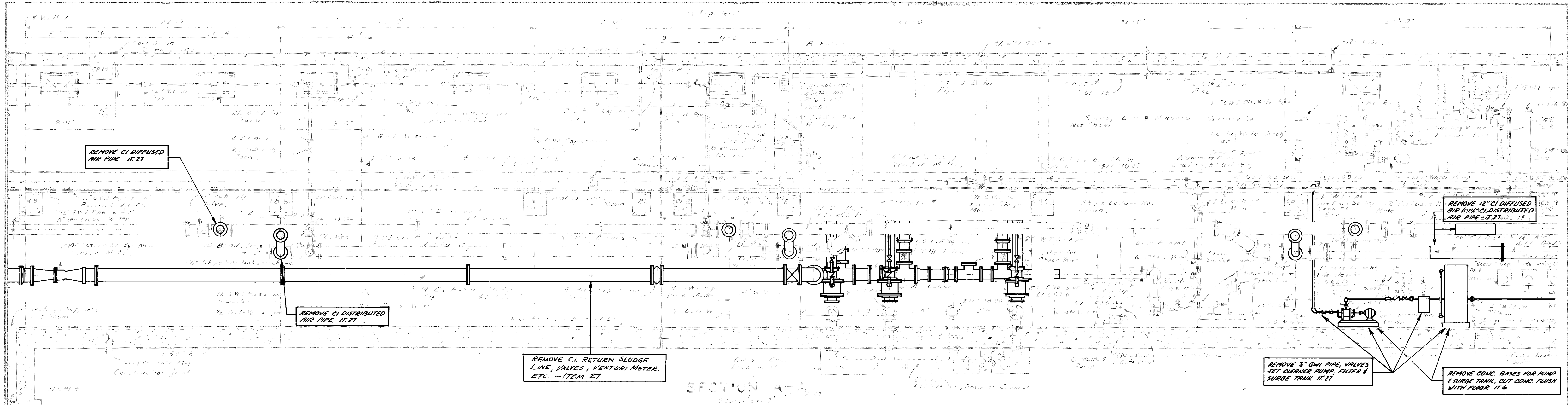
CITY OF ELYRIA, OHIO
 DEPARTMENT OF PUBLIC SERVICE
 WATER POLLUTION CONTROL PLANT
 IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
 CONTRACT 5
 EXISTING AERATION PIPE GALLERY
 SECTIONS - SOUTH HALF

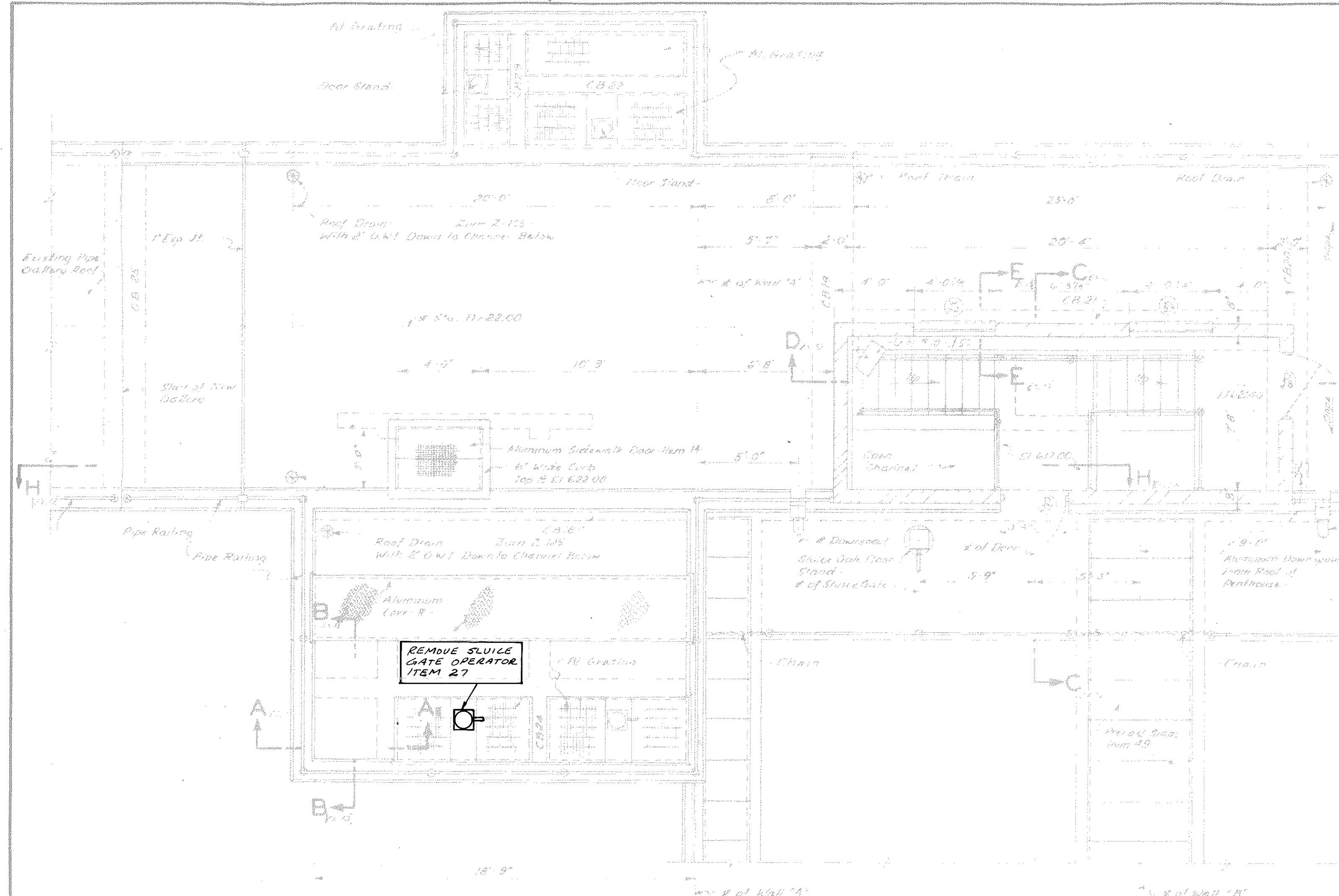
SCALE
 1/4" = 1'-0"
 FILE NO.
 1430-5.021
 SHEET NO.
 EX. 08/24

RECORD DRAWING

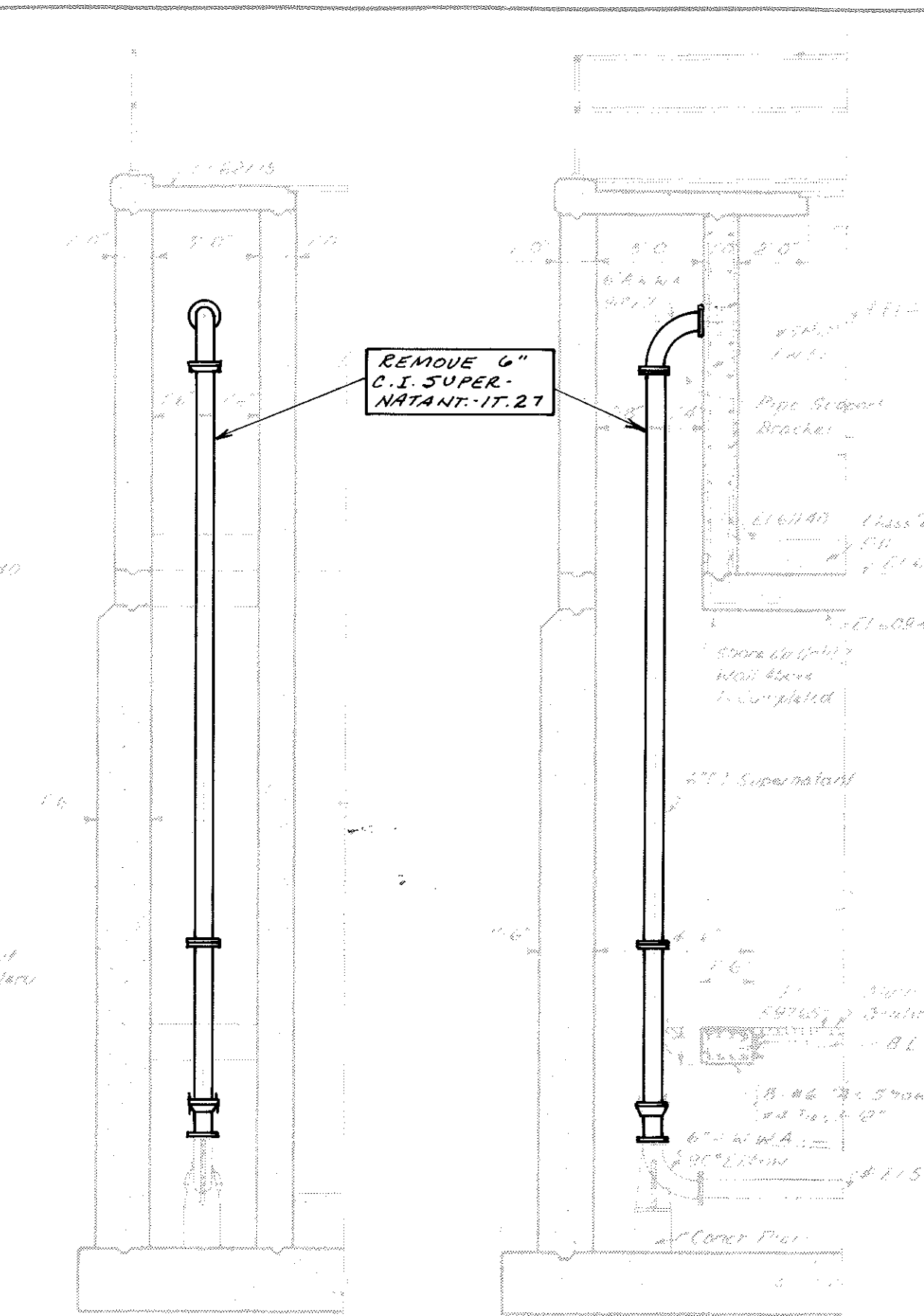
1345-267



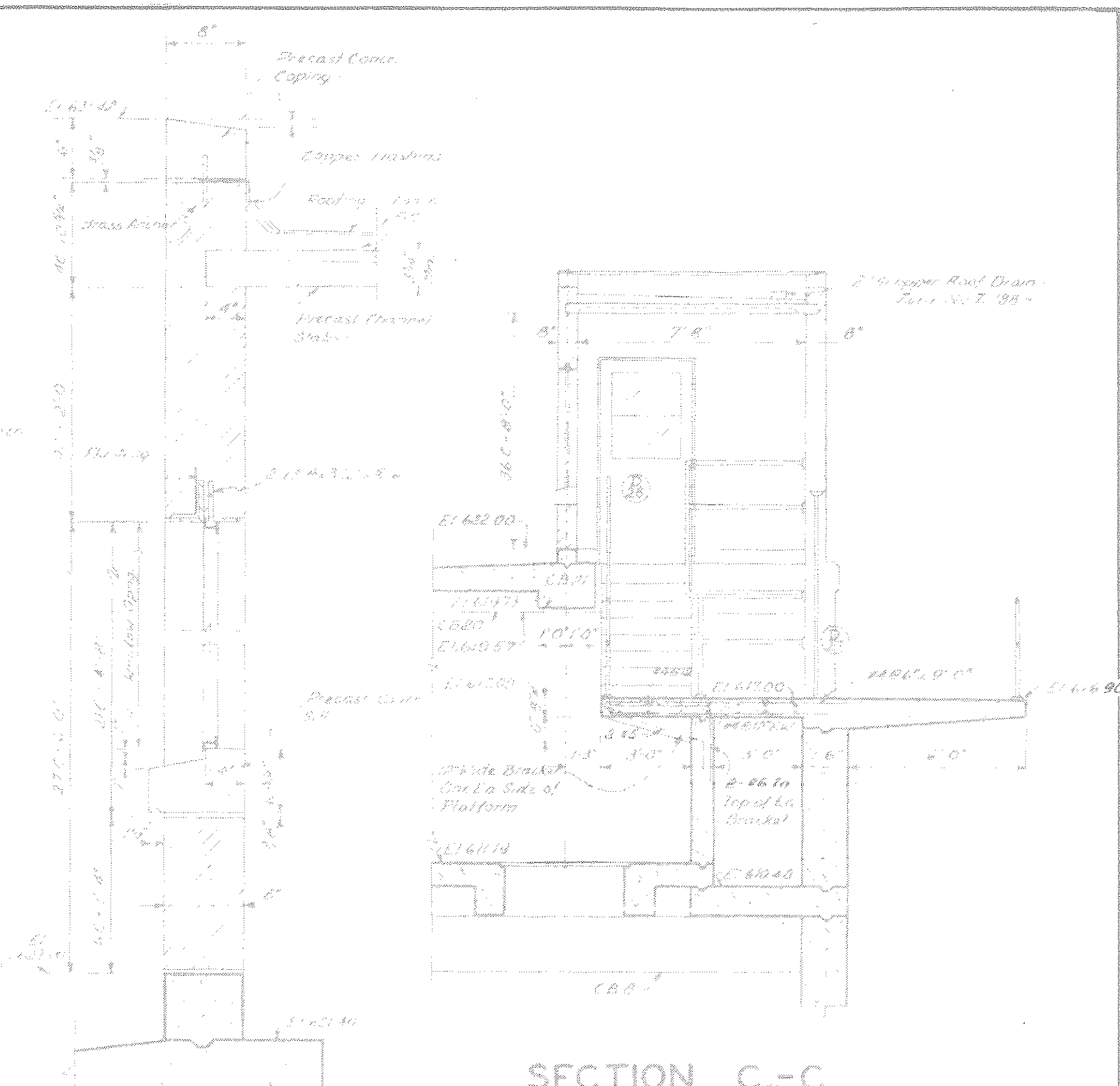
AS BUILT NO. DESCRIPTION DATE		HAVENS AND EMERSON INC. CONSULTING ENGINEERS		DESIGNED BY <u>JTB</u> DRAWN BY <u>MR</u> APPROVED BY <u>R.W. KROTZ</u> SUBMITTED BY <u>A.D. Simpson</u> DATE <u>10/14/83</u>		APPROVED BY <u>Samuel D. Smith</u> DATE <u>11-26-85</u>		CITY OF ELYRIA, OHIO DEPARTMENT OF PUBLIC SERVICE WATER POLLUTION CONTROL PLANT IMPROVEMENTS		SECONDARY TREATMENT EXPANSION CONTRACT 5 EXISTING AERATION PIPE GALLERY SECTIONS - NORTH HALF		SCALE 1/32" = 1'-0" AS SHOWN FILE NO. 1430-5.022 SHEET NO. EX. 09/24



PLAN AT EL. 628.00
Scale: 1/4" = 1'-0"

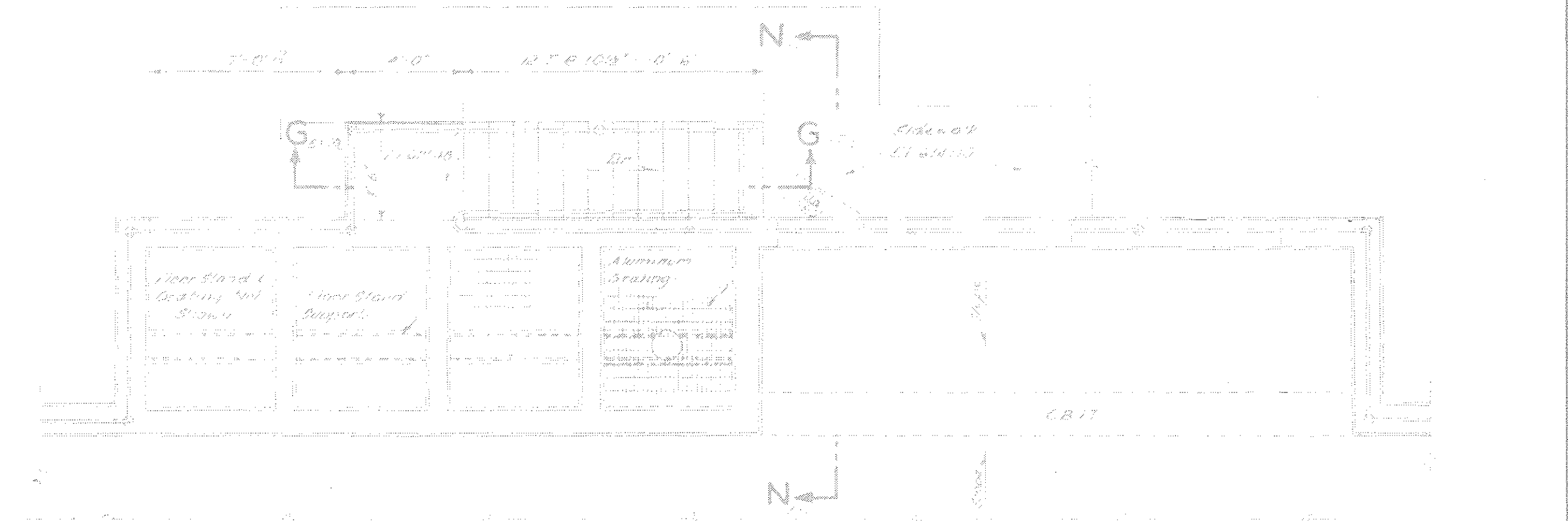


SECTION A-A, SECTION B-B
Scale: 1/4" = 1'-0"

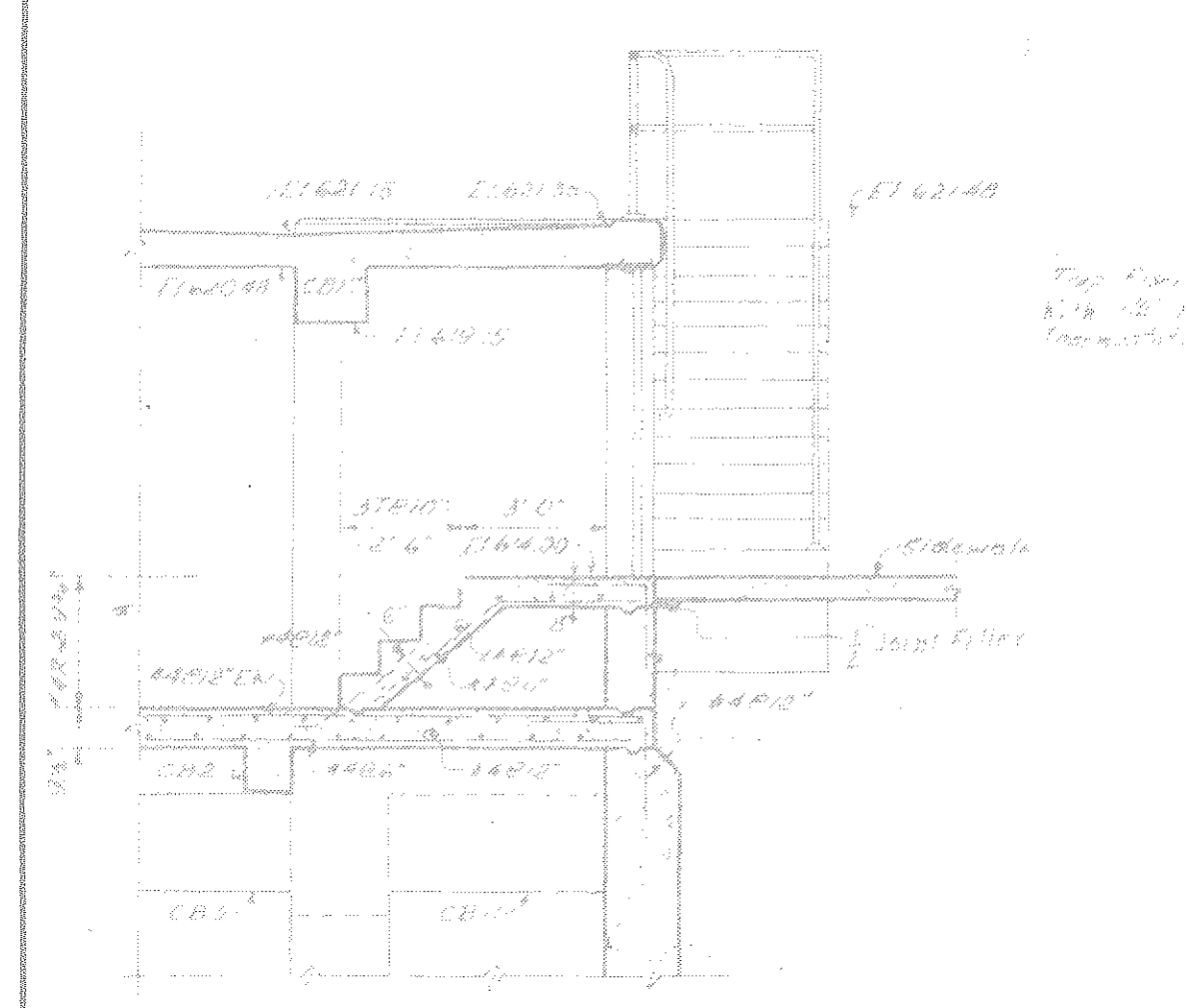


SECTION E-E
Scale: 1/4" = 1'-0"

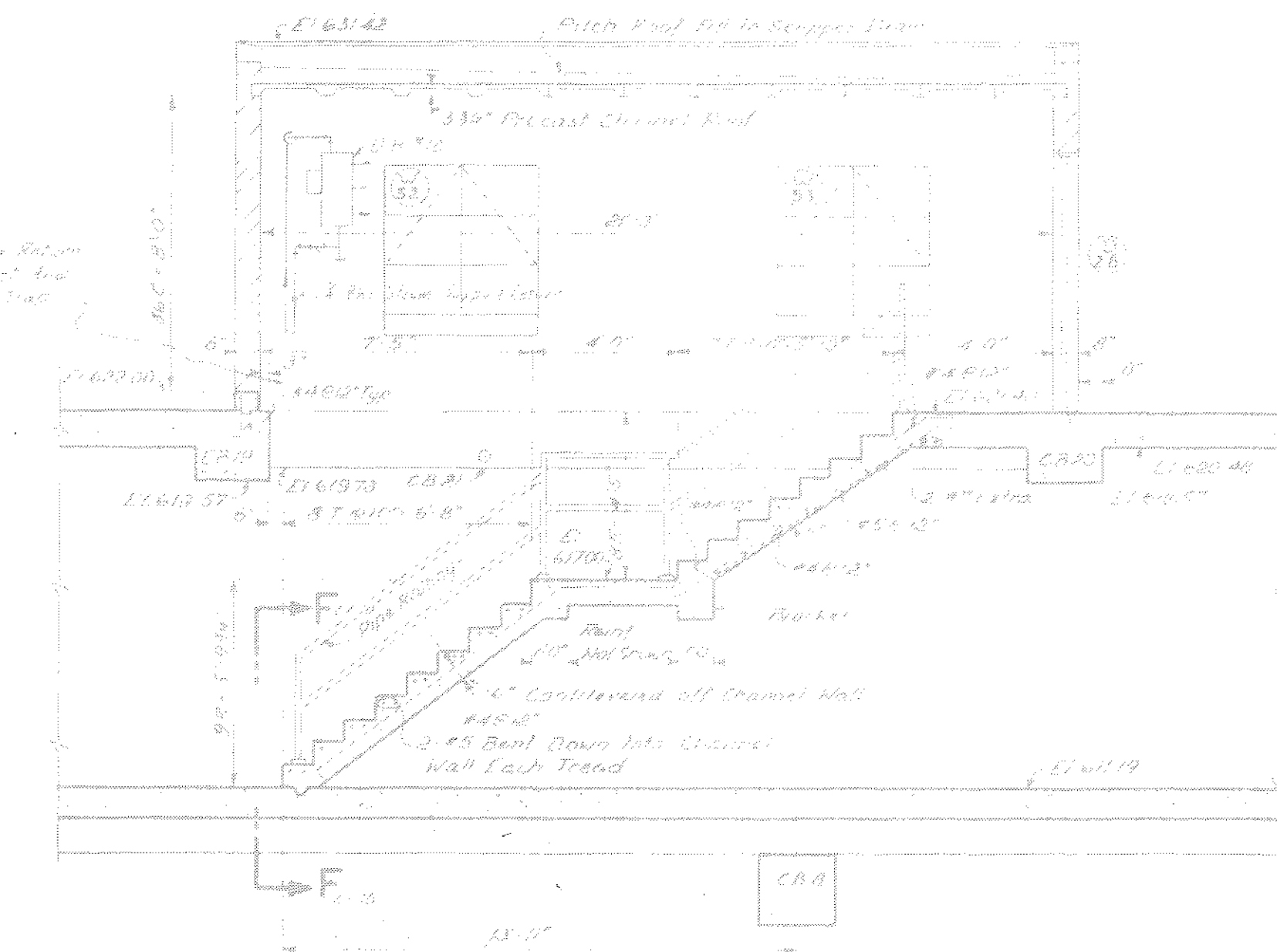
NOTES: ① ALL HOLES, GOUGES, ETC. IN THE CONCRETE DUE TO THE REMOVAL OF EXISTING EQUIPMENT SHALL BE PATCHED AND FINISHED WITH CONCRETE FLOSH WITH THE SURROUNDING CONCRETE.
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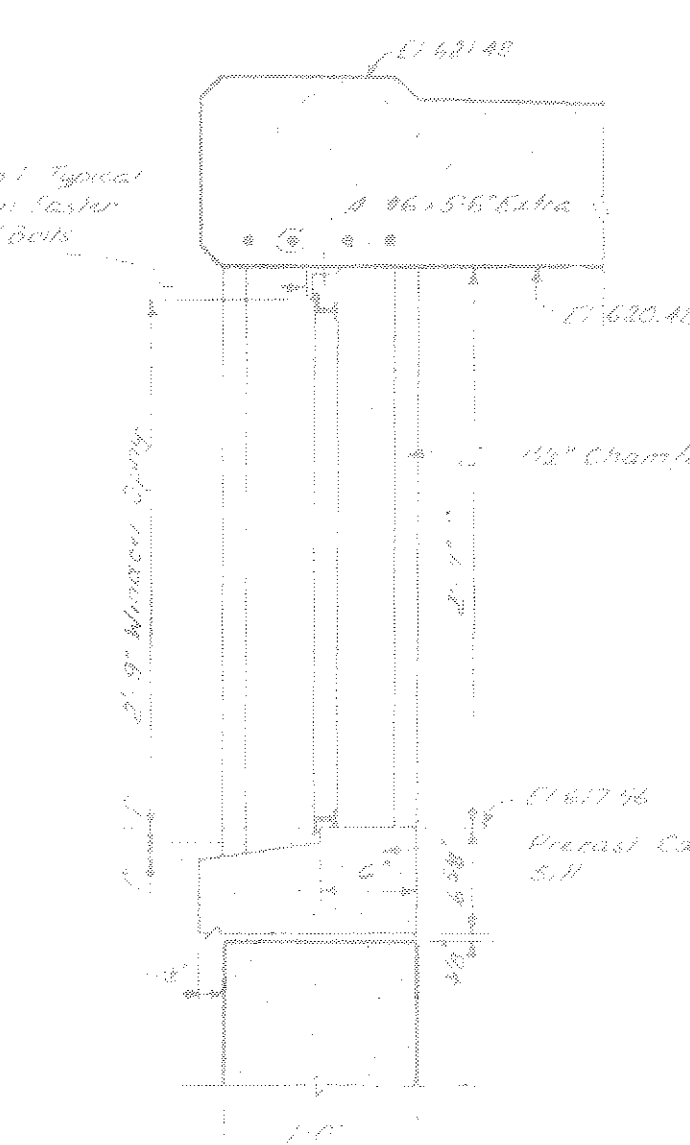
PLAN OF AIR LIFT AREA AT EL. 622.00
Scale: 1/4" = 1'-0"



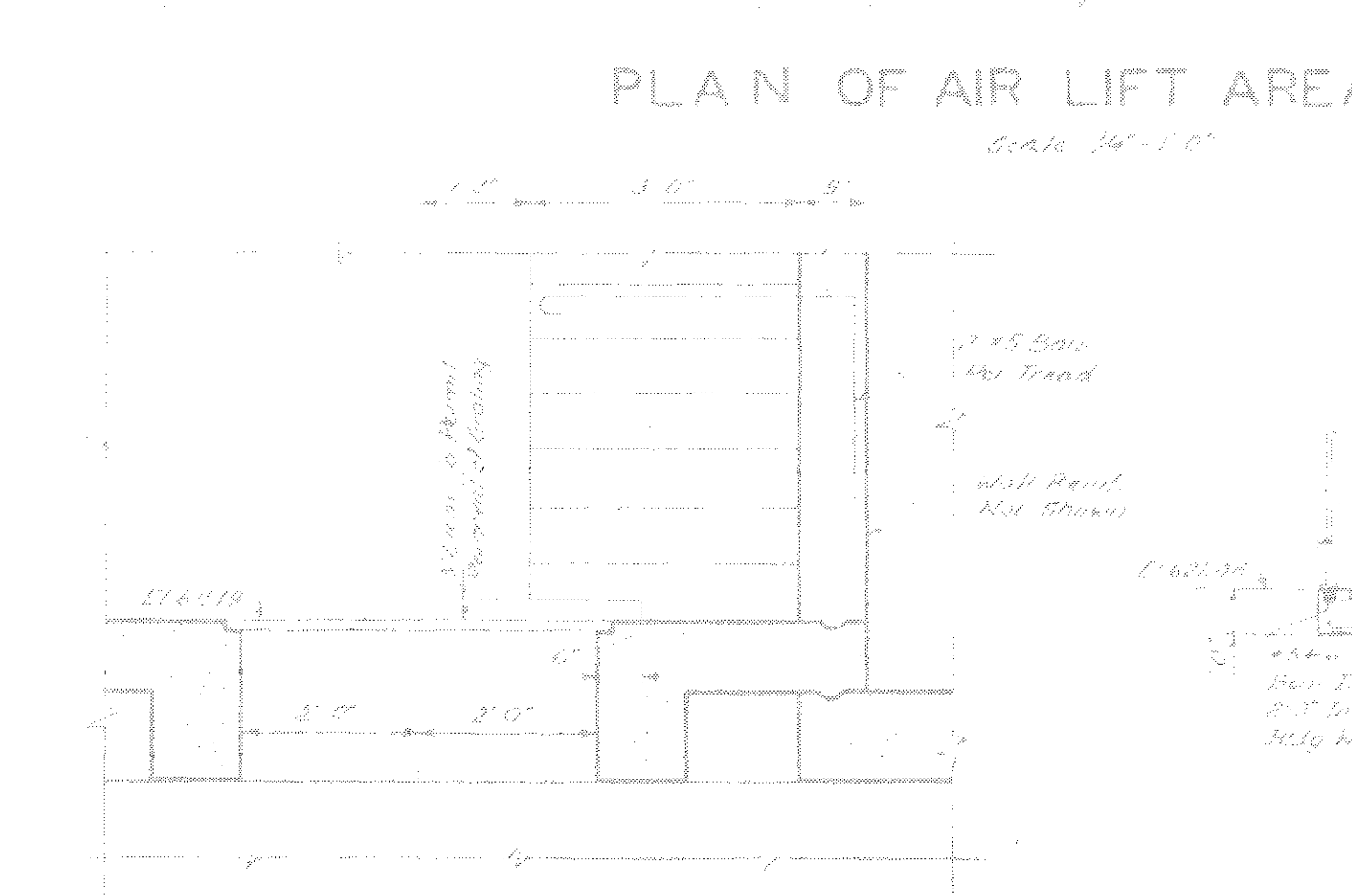
SECTION N-N
Scale: 1/4" = 1'-0"



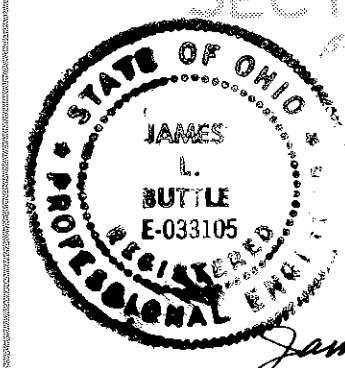
SECTION D-D
Scale: 1/4" = 1'-0"



WINDOW DETAIL
W 72, W 73

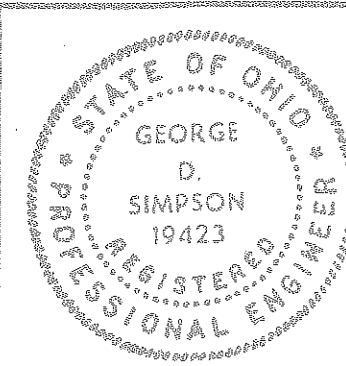


SECTION G-G
Scale: 1/4" = 1'-0"



AS BUILT	8-89

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



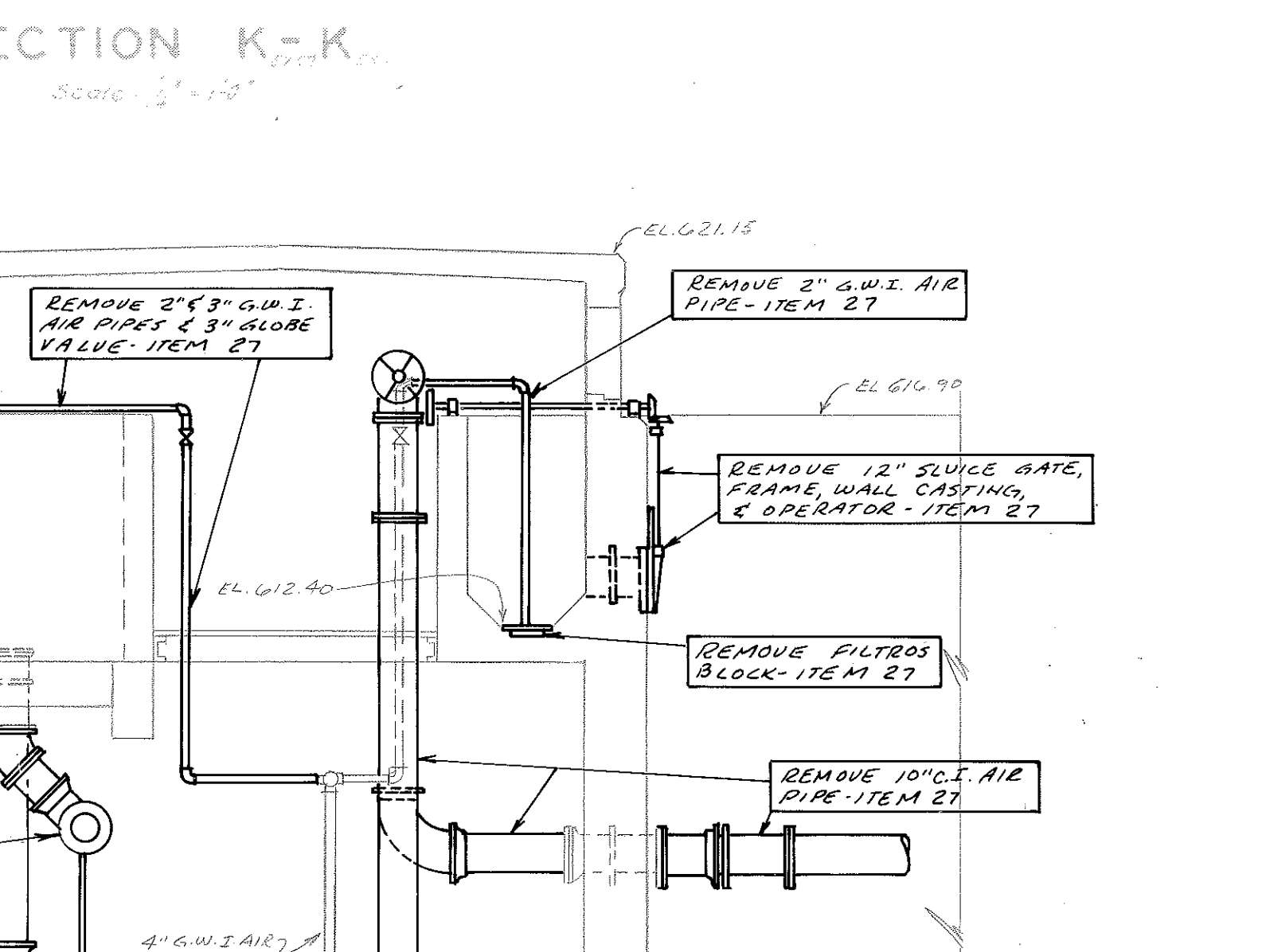
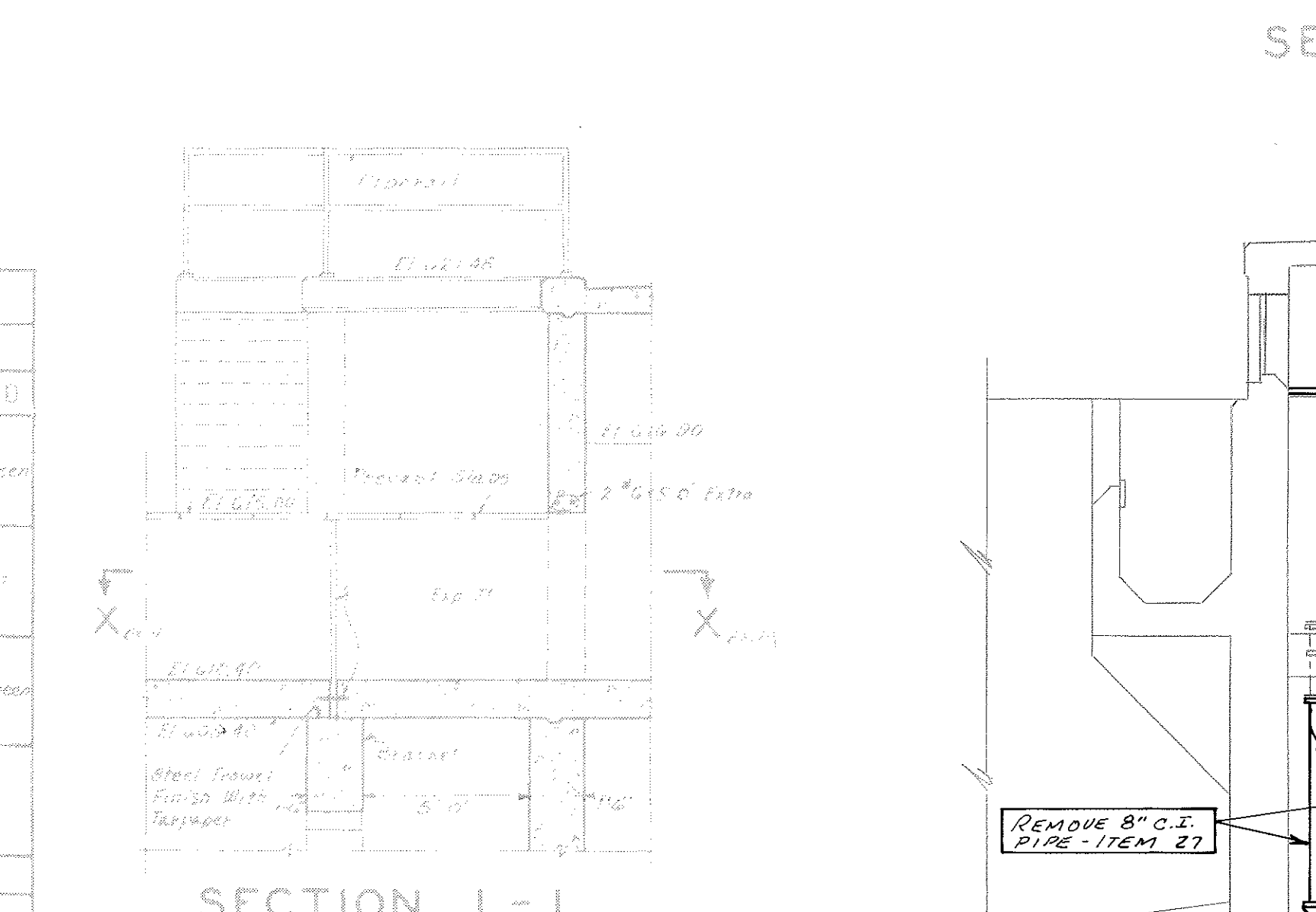
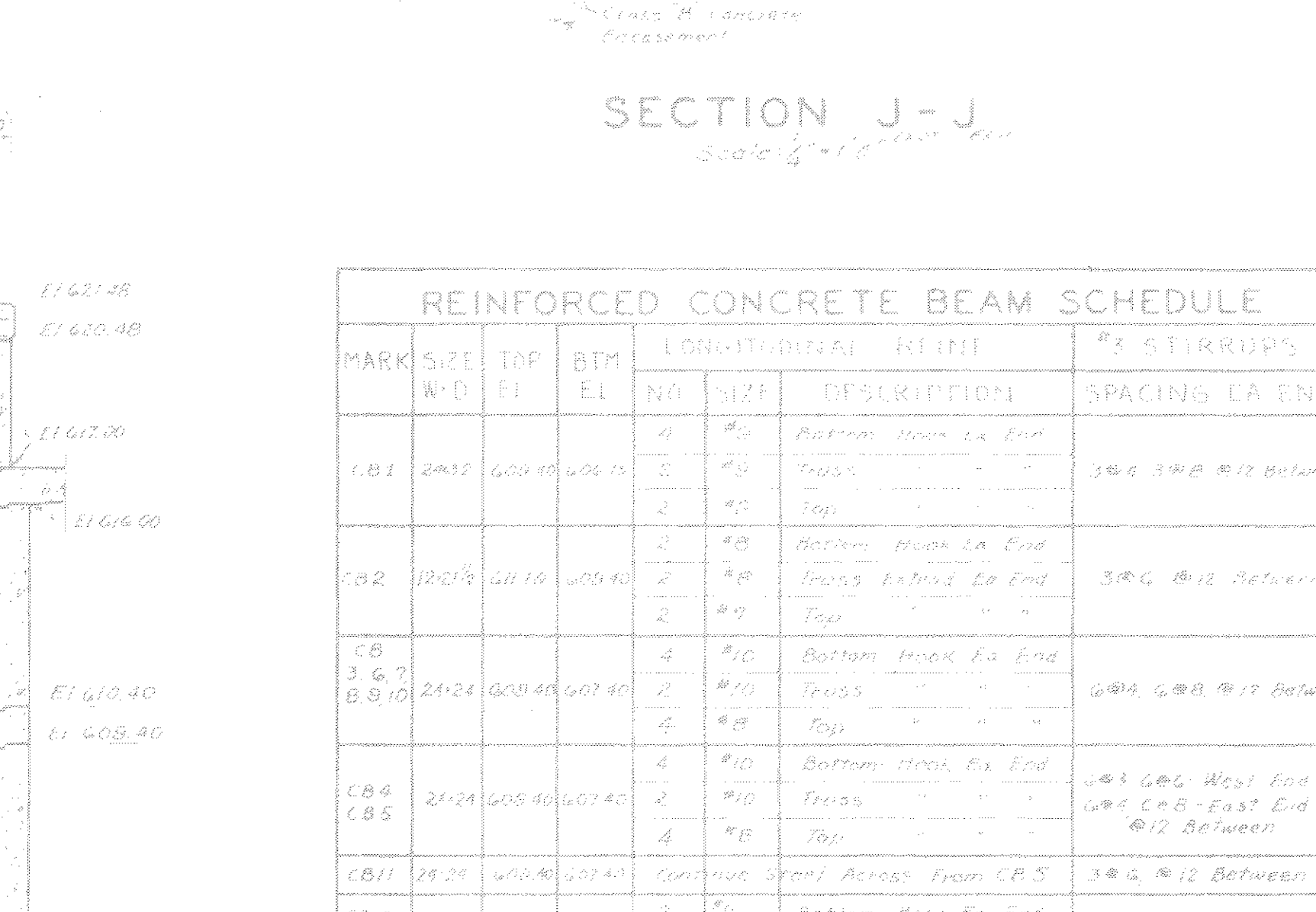
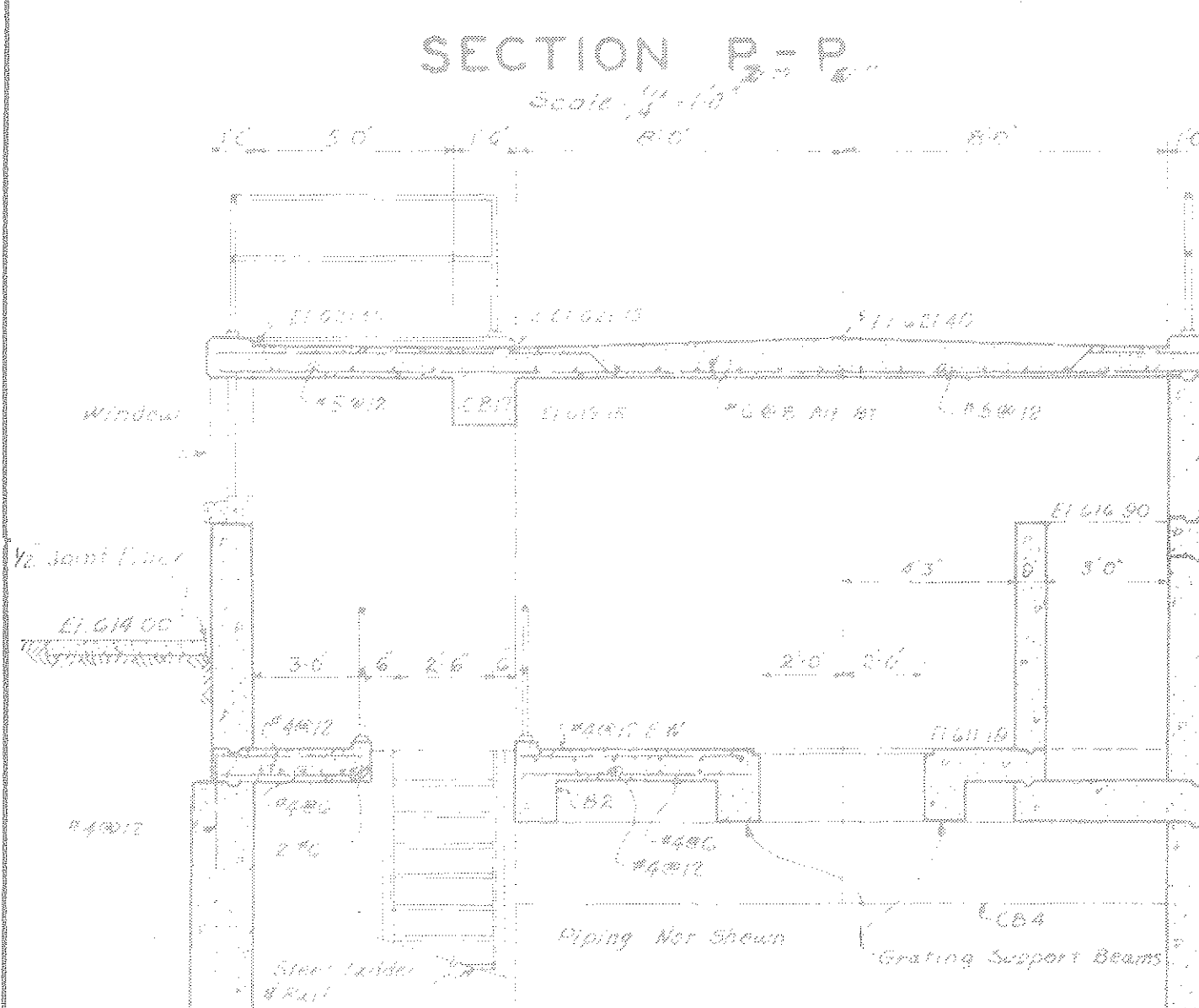
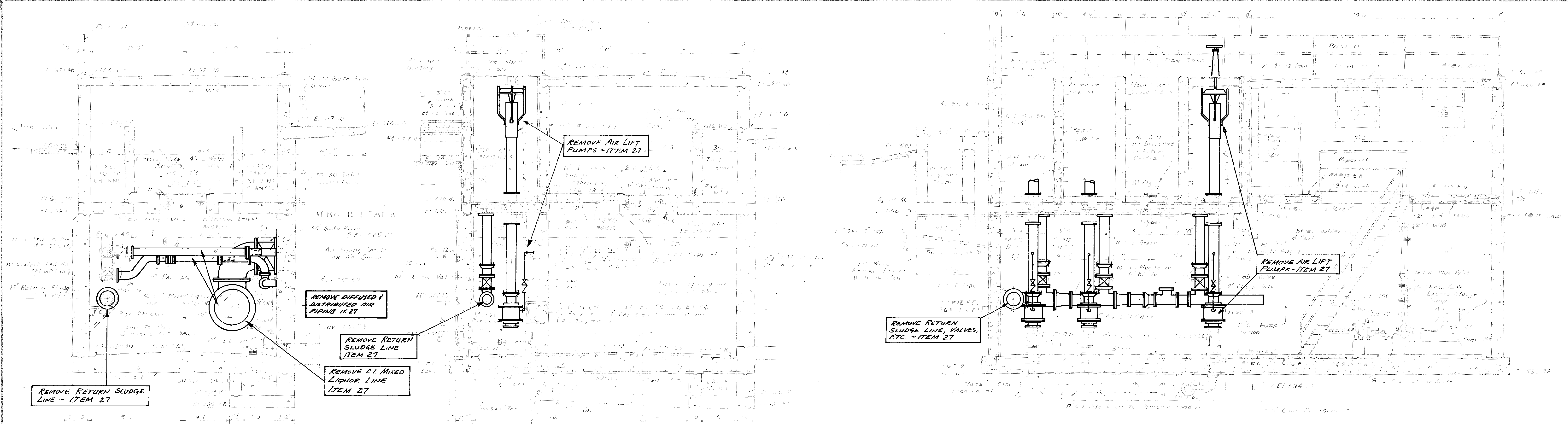
DESIGNED BY JTB DRAWN BY RCB
APPROVED BY R.W. Kott
SUBMITTED BY D.D. Harris
DATE 10-14-83

APPROVED BY George D. Simpson
CITY ENGINEER
DATE 11-26-85

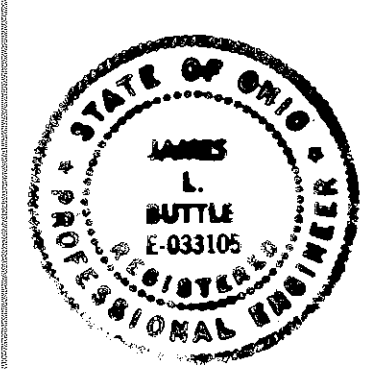
CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
EXISTING AERATION PIPE GALLERY
PLANS AND SECTIONS

SCALE
AS SHOWN
FILE NO.
1430-5.023
SHEET NO.
EX. 10/24



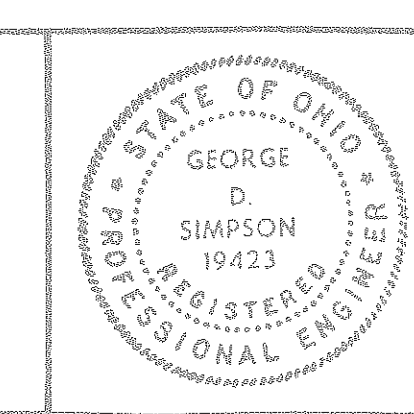
REINFORCED CONCRETE BEAM SCHEDULE									
MARK	SIZE	TOP	BOT	LONGITUDINAL BARS	#2 STIRRUPS	SPACING	CA END		
CB1	24x30	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB2	18x24	611.10	608.40	2 #8	Truss	3#4 #12 Between			
CB3	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB4	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB5	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB6	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB7	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB8	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB9	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB10	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB11	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB12	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB13	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB14	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB15	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
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CB17	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB18	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB19	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB20	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB21	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB22	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB23	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB24	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			
CB25	24x24	609.40	606.15	4 #8	Bottom Hook Ea End	3#4 #12 Between			



James L. Buttle

GRATING SUPPORT BEAMS

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY JTB DRAWN BY MR
APPROVED BY R.W. Keitz
SUBMITTED BY H.D. Simpson
DATE 10-14-83

APPROVED BY James L. Buttle
DATE 11-26-85

CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

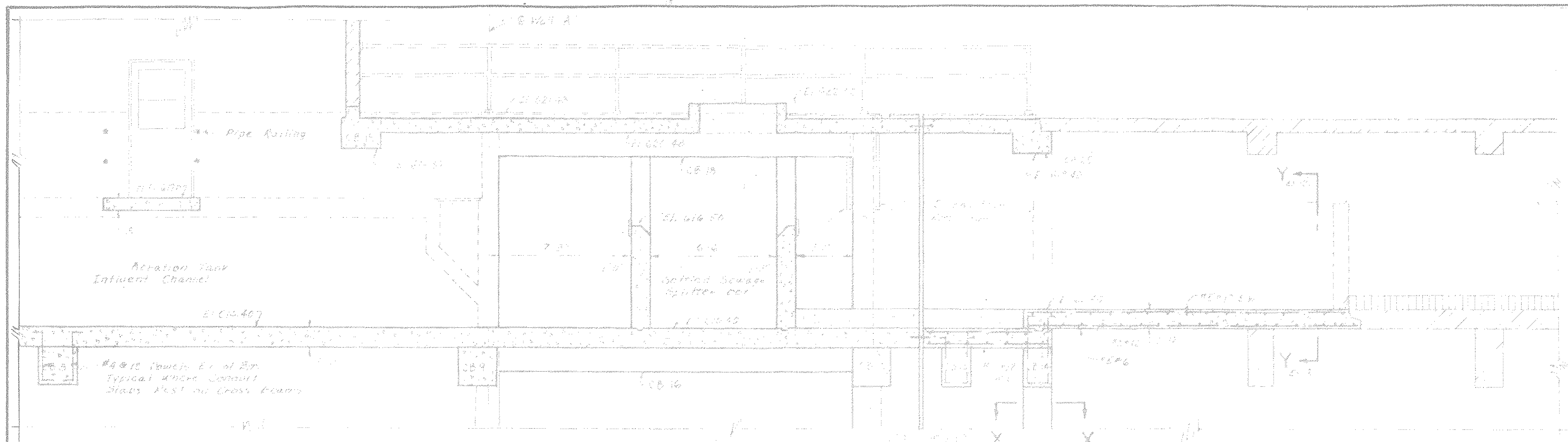
SECONDARY TREATMENT EXPANSION
CONTRACT 5
EXISTING AERATION PIPE GALLERY
SECTIONS

SCALE
AS SHOWN
FILE NO.
1430-5.024
SHEET NO.
EX. 11/24

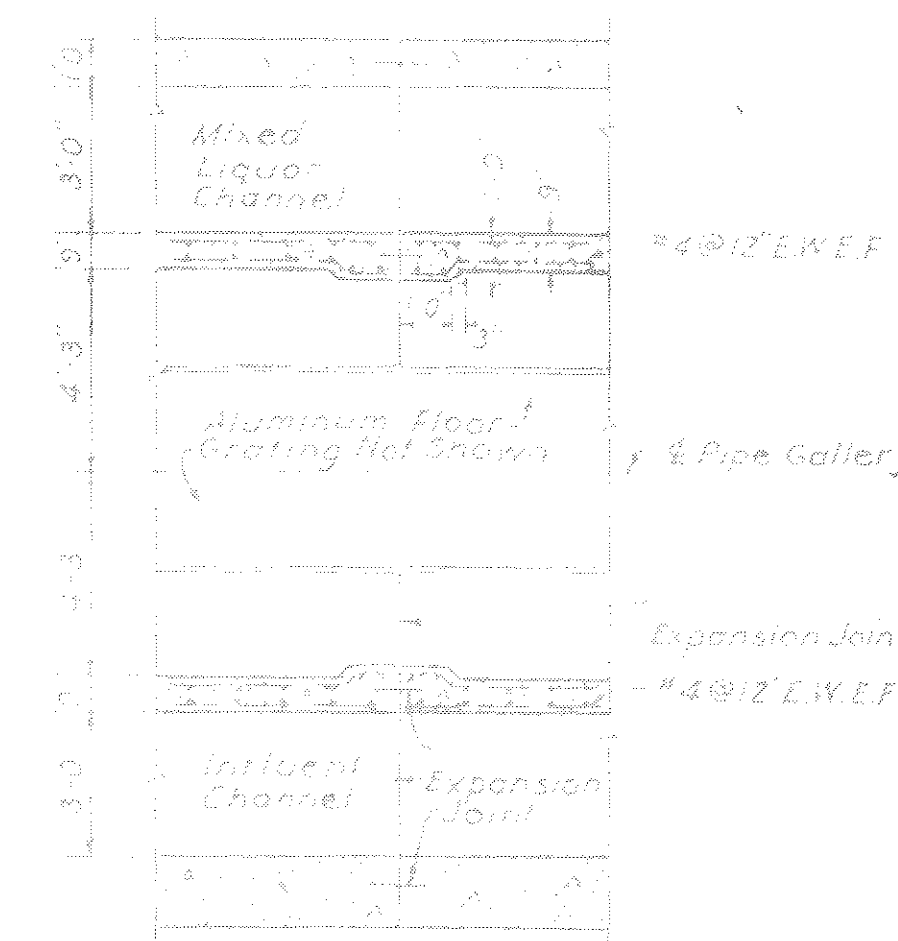
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2. COORDINATE ALL REMOVING AND PATCHING OF EXISTING MASONRY WITH THE NEW WORK SHOWN IN THE PROCESS DRAWINGS OF THIS CONTRACT.

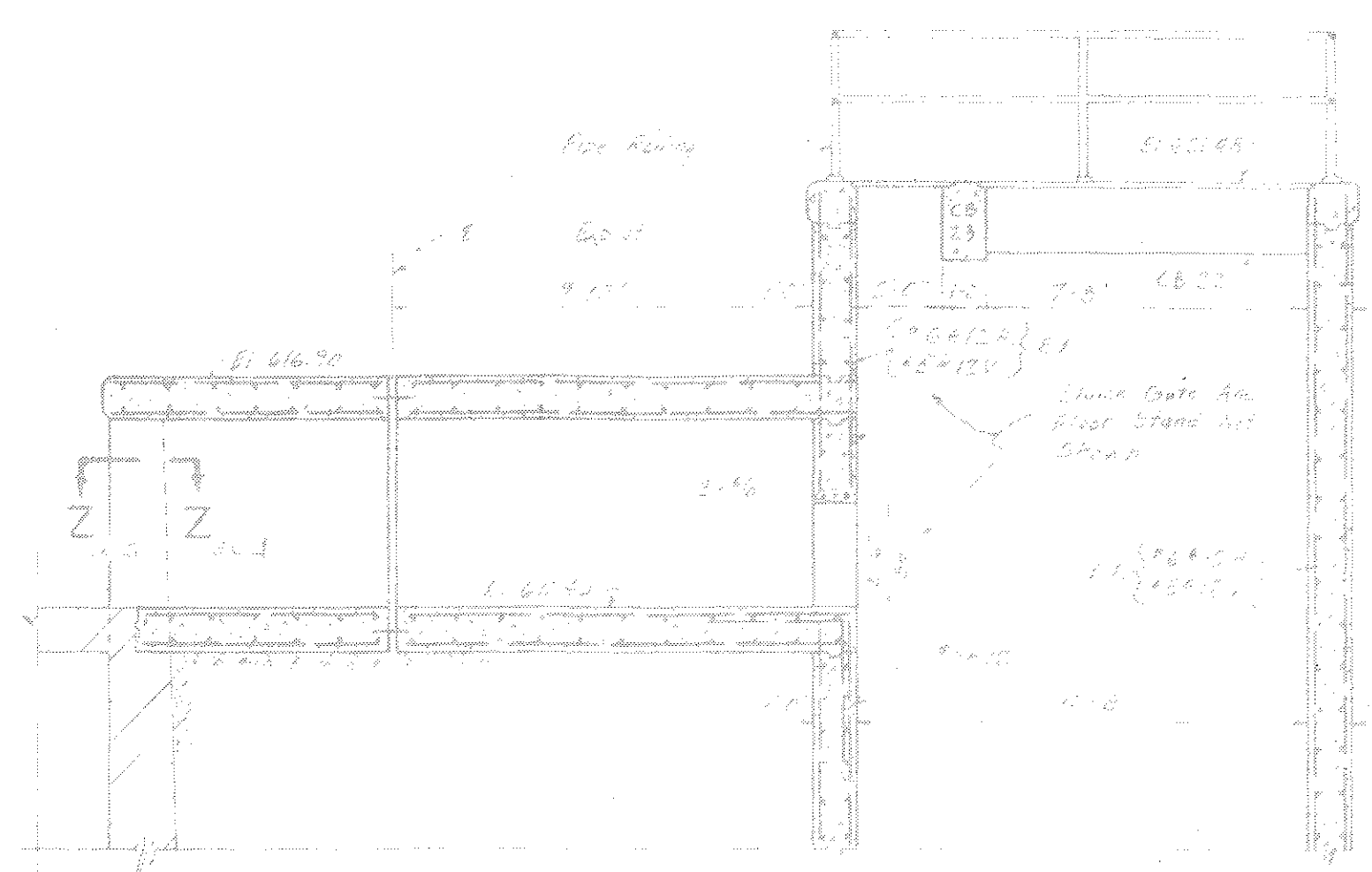
RECORD DRAWING 1346-270



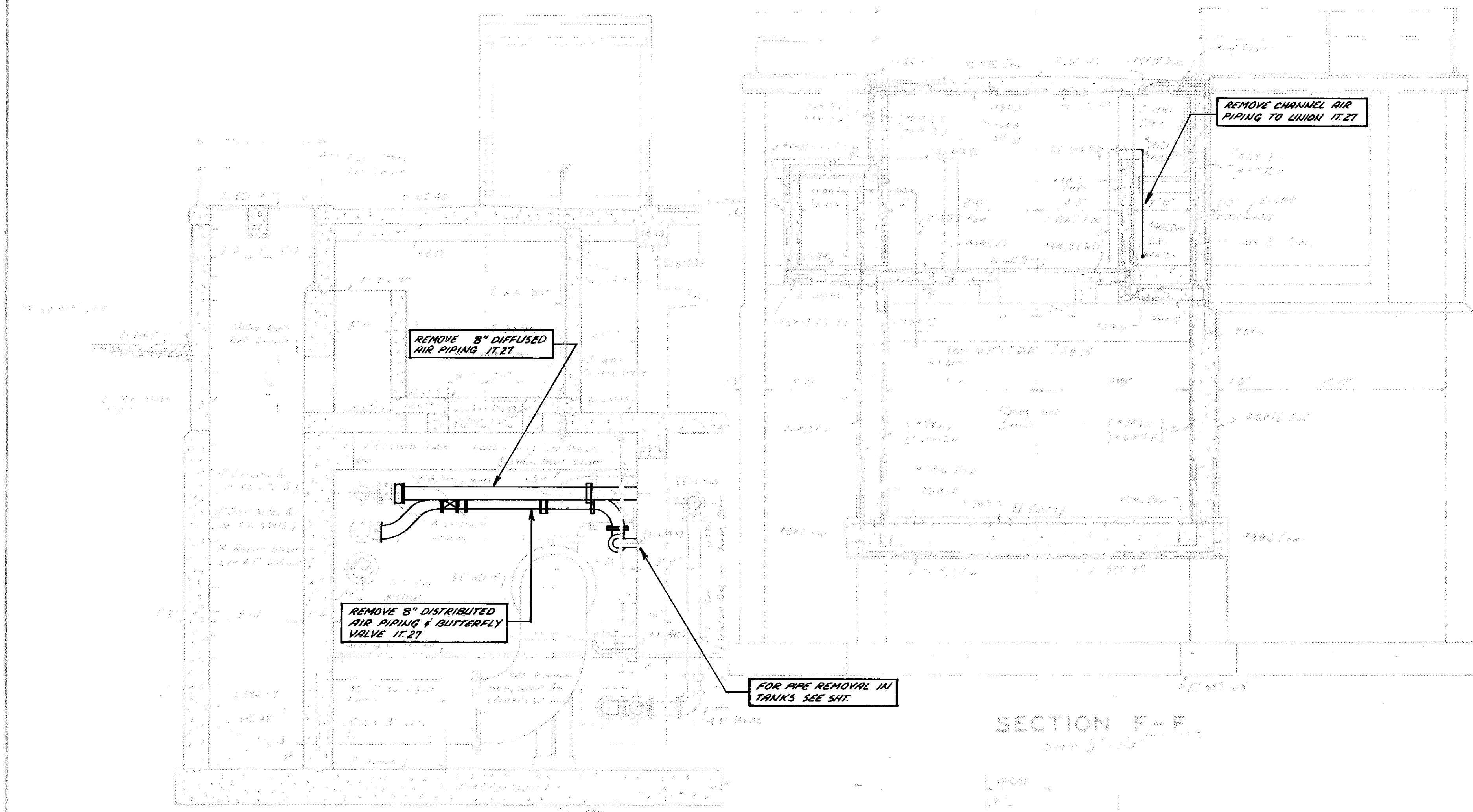
SECTION H-H
Scale: 1/4" = 1'-0"



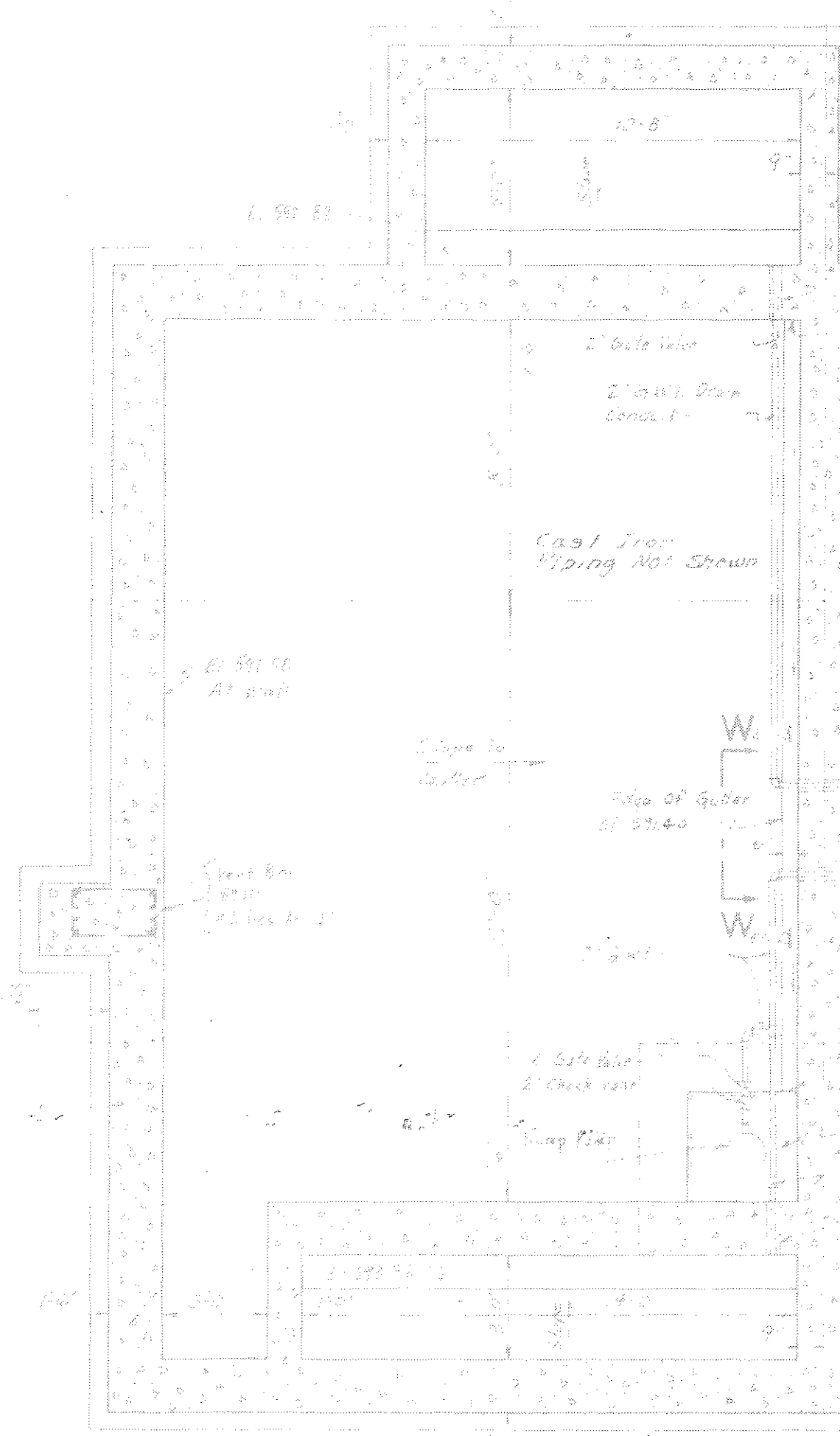
PLAN
DETAIL "B"
Not to Scale



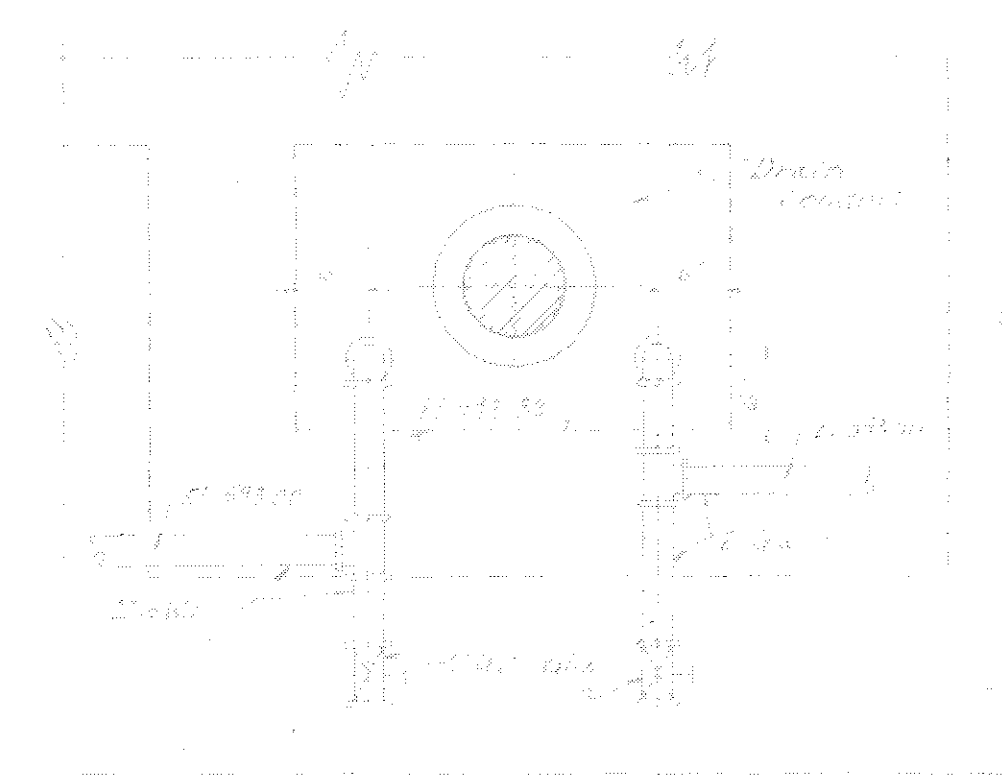
SECTION G-G
Scale: 1/4" = 1'-0"



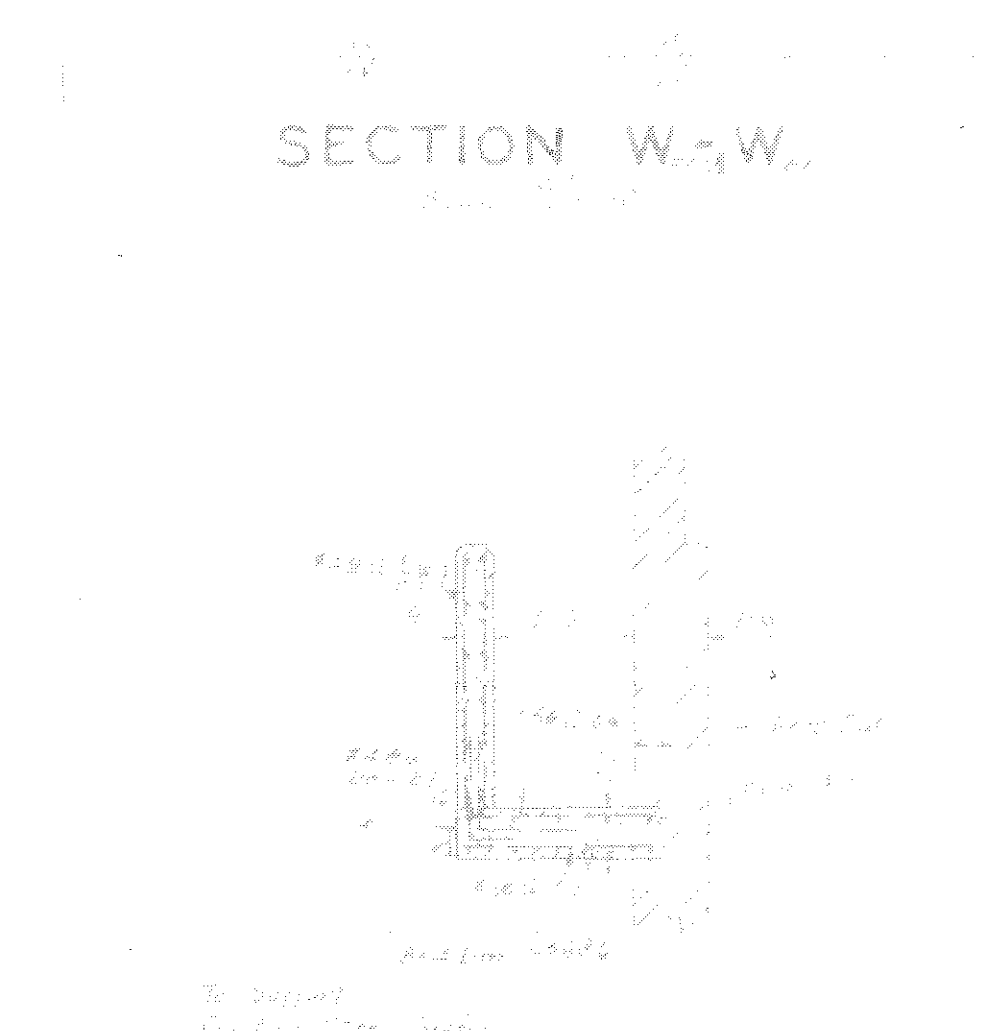
SECTION F-F
Scale: 1/4" = 1'-0"



PLAN AT ELEV. 594.00
Scale: 1/4" = 1'-0"



SECTION W-W
Scale: 1/4" = 1'-0"



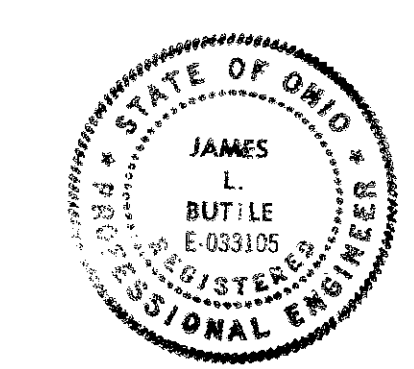
SECTION Y-Y
Scale: 1/4" = 1'-0"



SECTION D-D
Scale: 1/4" = 1'-0"



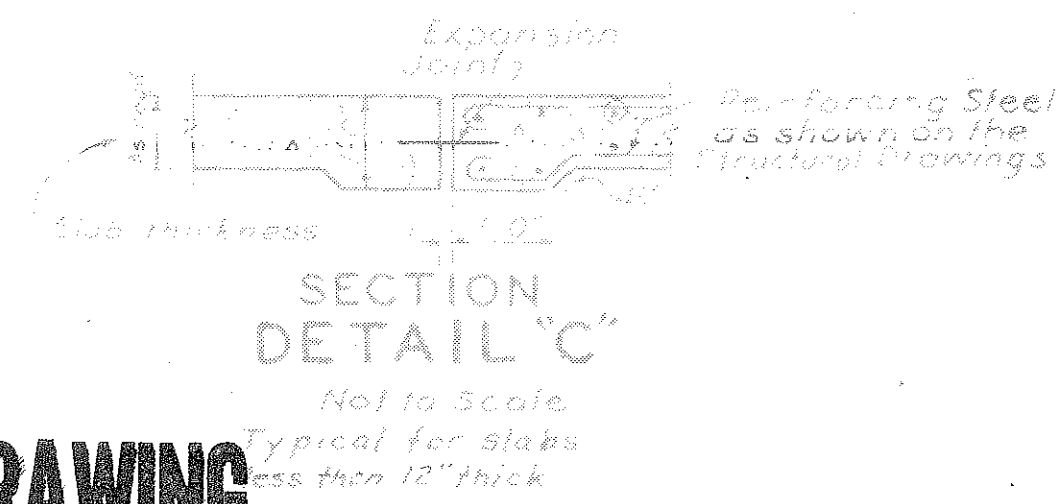
SECTION Z-Z
Scale: 1/4" = 1'-0"



James L. Buttle

NOTES: ① ALL HOLES, GAUGES, ETC. IN THE CONCRETE DUE TO THE REMOVAL OF EXISTING EQUIPMENT SHALL BE PATCHED AND FINISHED WITH CONCRETE FLUSH WITH THE SURROUNDING CONCRETE.
② COORDINATE ALL REMOVING AND PATCHING OF EXISTING MASONRY WITH THE NEW WORK SHOWN IN THE PROCESS DRAWINGS OF THIS CONTRACT.

NOTE: THIS DRAWING IS A "PREVIOUS CONTRACT" DRAWING SHOWING THE ORIGINAL WORK ON THE EXISTING FACILITIES. SHEET NUMBERS, ITEM NUMBERS, ETC., DO NOT APPLY TO THE NEW WORK UNDER THIS CONTRACT, EXCEPT EXISTING FACILITIES TO BE REMOVED UNDER THIS CONTRACT ARE INDICATED WITH HEAVY LINES AND NOTES. NO NEW CONSTRUCTION IS SHOWN ON THIS SHEET.



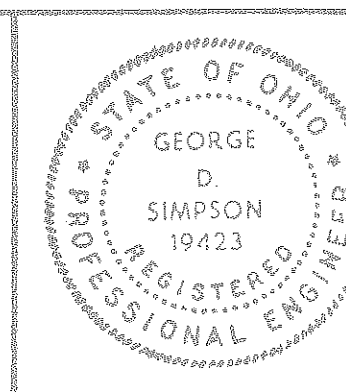
SECTION
DETAIL "C"
Not to Scale

RECORD DRAWING

1345-271

NO.	DESCRIPTION	DATE

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



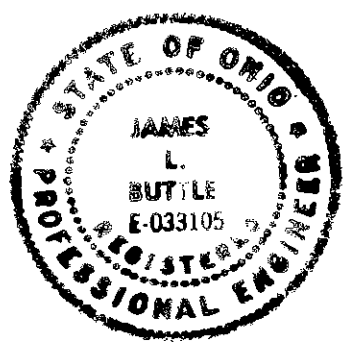
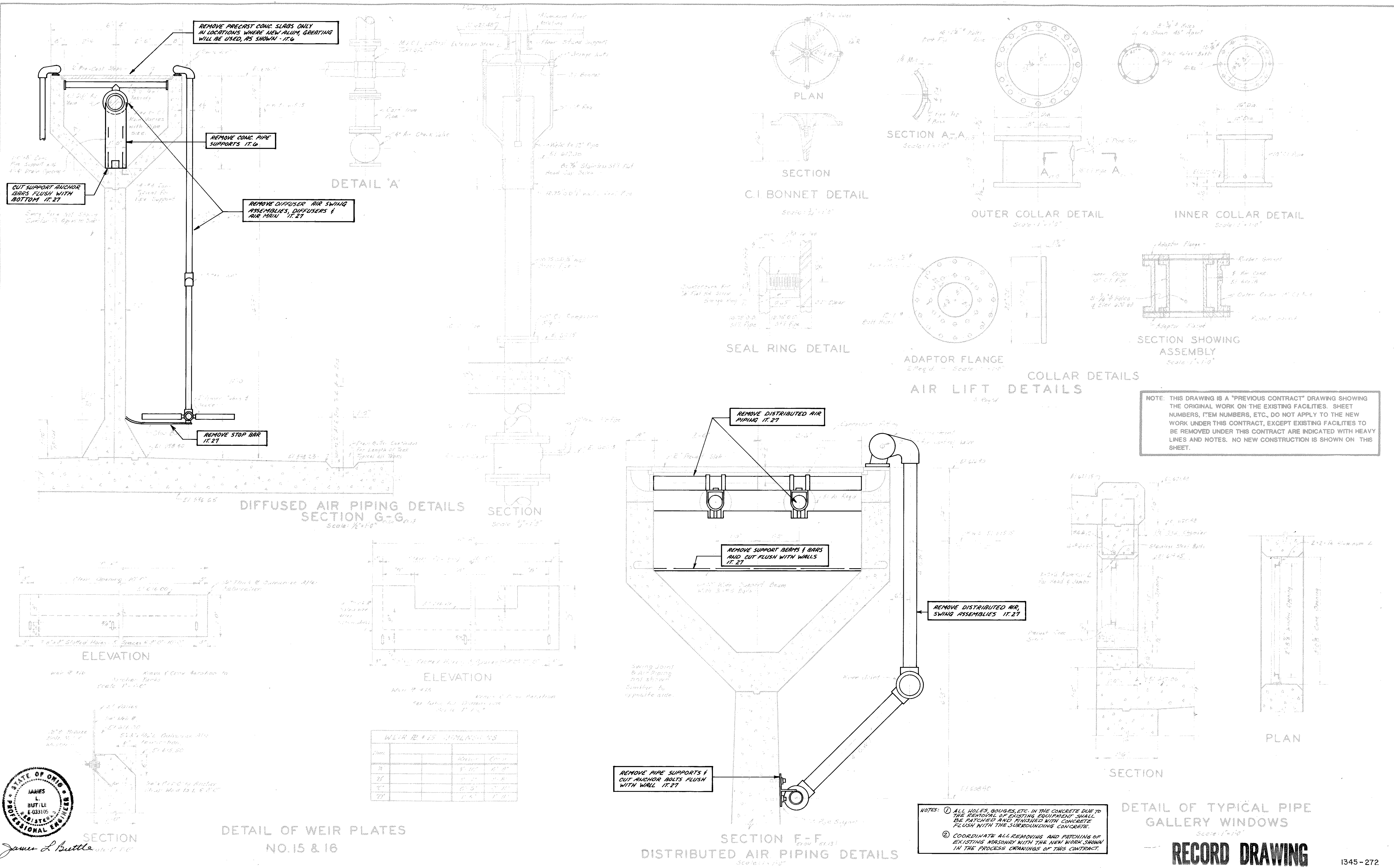
DESIGNED BY JTB DRAWN BY MR.
APPROVED BY R.W. Keor
SUBMITTED BY A.D. Simpson
DATE 10-14-83

APPROVED BY George D. Simpson
DATE 11-26-85

CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

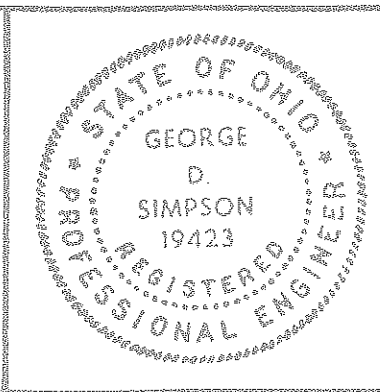
SECONDARY TREATMENT EXPANSION
CONTRACT 5
EXISTING AERATION PIPE GALLERY
SECTIONS

SCALE AS SHOWN
FILE NO. 1430-5.025
SHEET NO. EX. 12/24



SECTION		
Plate No. 101		
James L. Buttle		
AS BUILT		3-8
NO.	DESCRIPTION	DATE
REVISIONS		

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY JTB DRAWN BY MR
APPROVED BY R.W. Korte
SUBMITTED BY A.D. Simpson
DATE 10-14-83

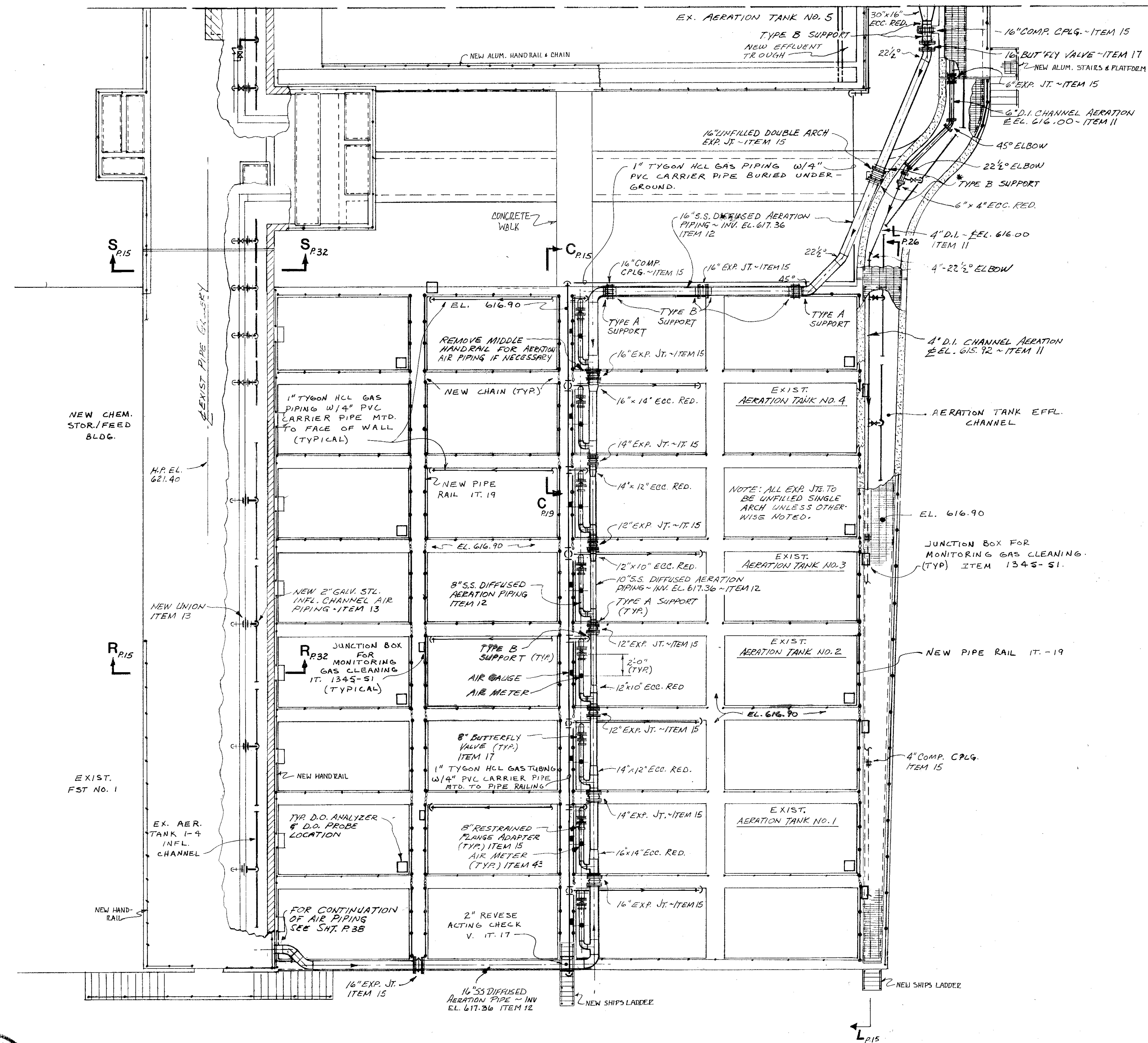
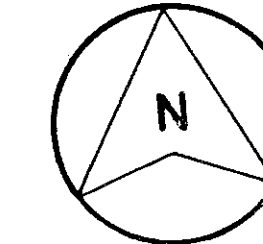
APPROVED BY Lonny J. Shivers
DATE 11-26-85

CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT -
IMPROVEMENTS

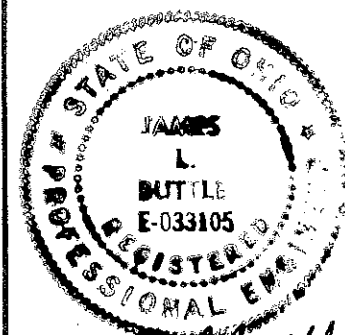
SECONDARY TREATMENT EXPANSION
CONTRACT 5
EXISTING AERATION PIPE GALLERY
DETAILS

SCALE AS SHOWN
FILE NO. 1430-5.026
SHEET NO. EX. 13/24

MATCH LINE - FOR CONTINUATION SEE SHT. P.16

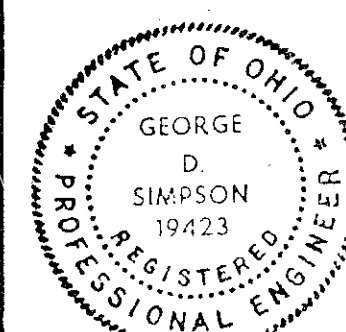
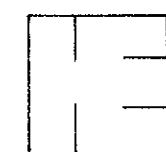


OPERATION
CENTER



NO.	DESCRIPTION	DATE

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY JLB DRAWN BY JYB
APPROVED BY RWL KROTZ
SUBMITTED BY G.D. Simpson
DATE 10-14-83

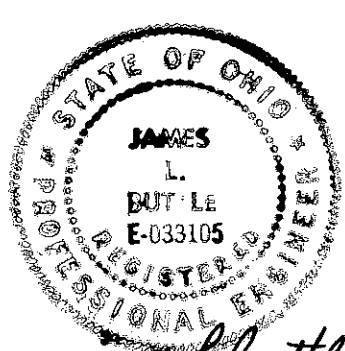
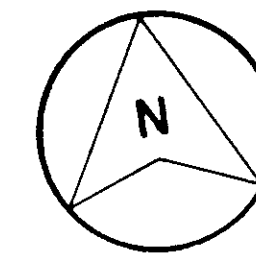
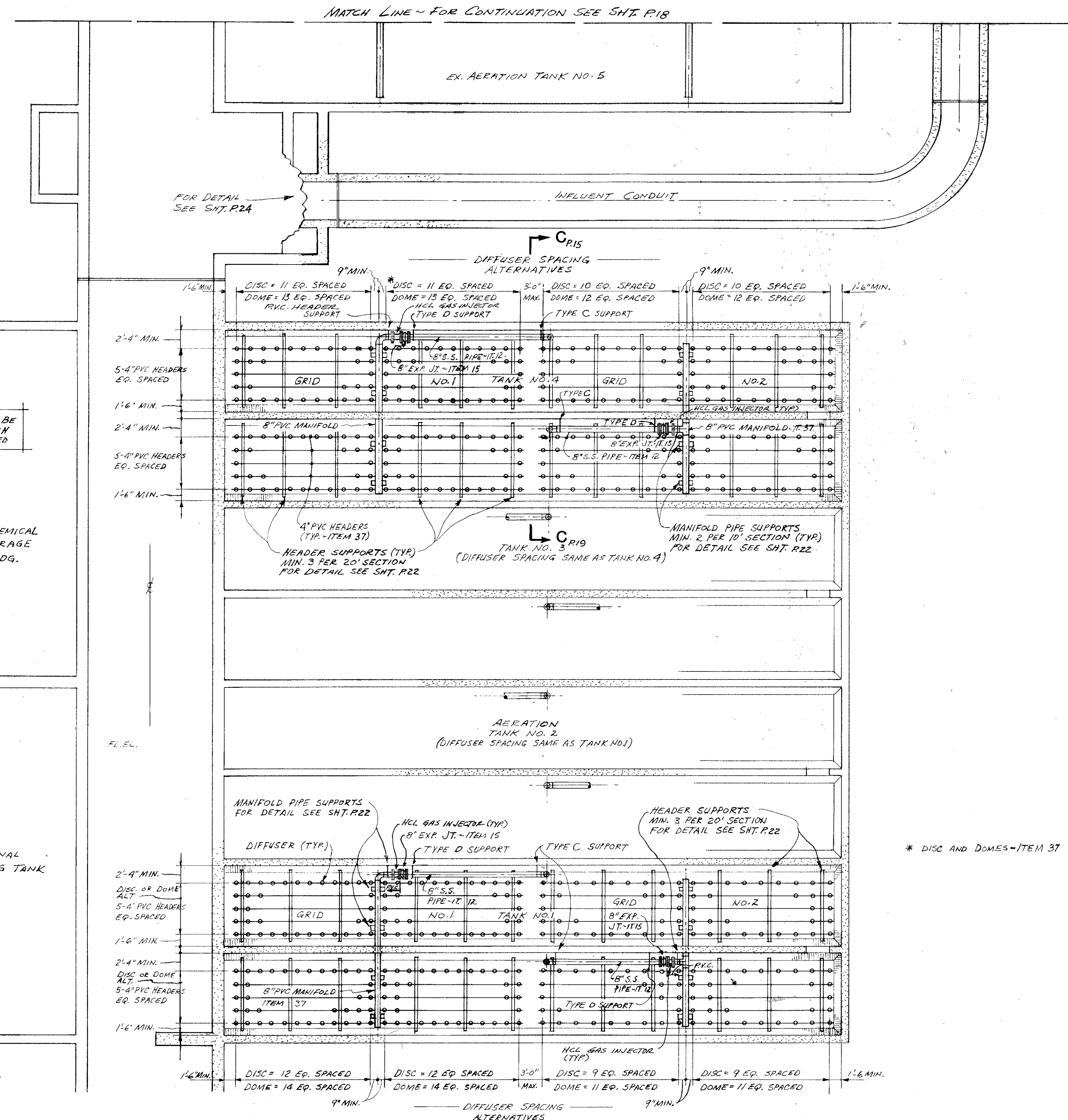
APPROVED BY
James L. Buttle
CITY ENGINEER
DATE 11-26-85

CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
AERATION TANKS NO. 1 THRU 4
TOP PLAN - AERATION AIR PIPING

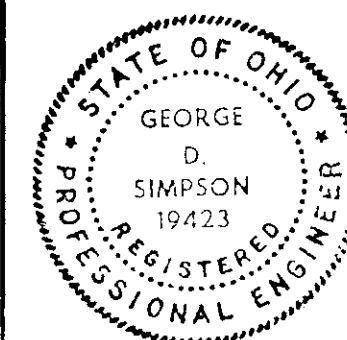
RECORD DRAWING

SCALE
1/8" = 1'-0"
FILE NO.
1430-5.131
SHEET NO.
P.15 / 68



NO.	DESCRIPTION	DATE
1	REVISIONS	

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY JLB DRAWN BY RWH JV
APPROVED BY RWH KROZ
SUBMITTED BY P.D. Simpson
DATE 10-14-83

APPROVED BY
CITY ENGINEER
DATE 11-21-85

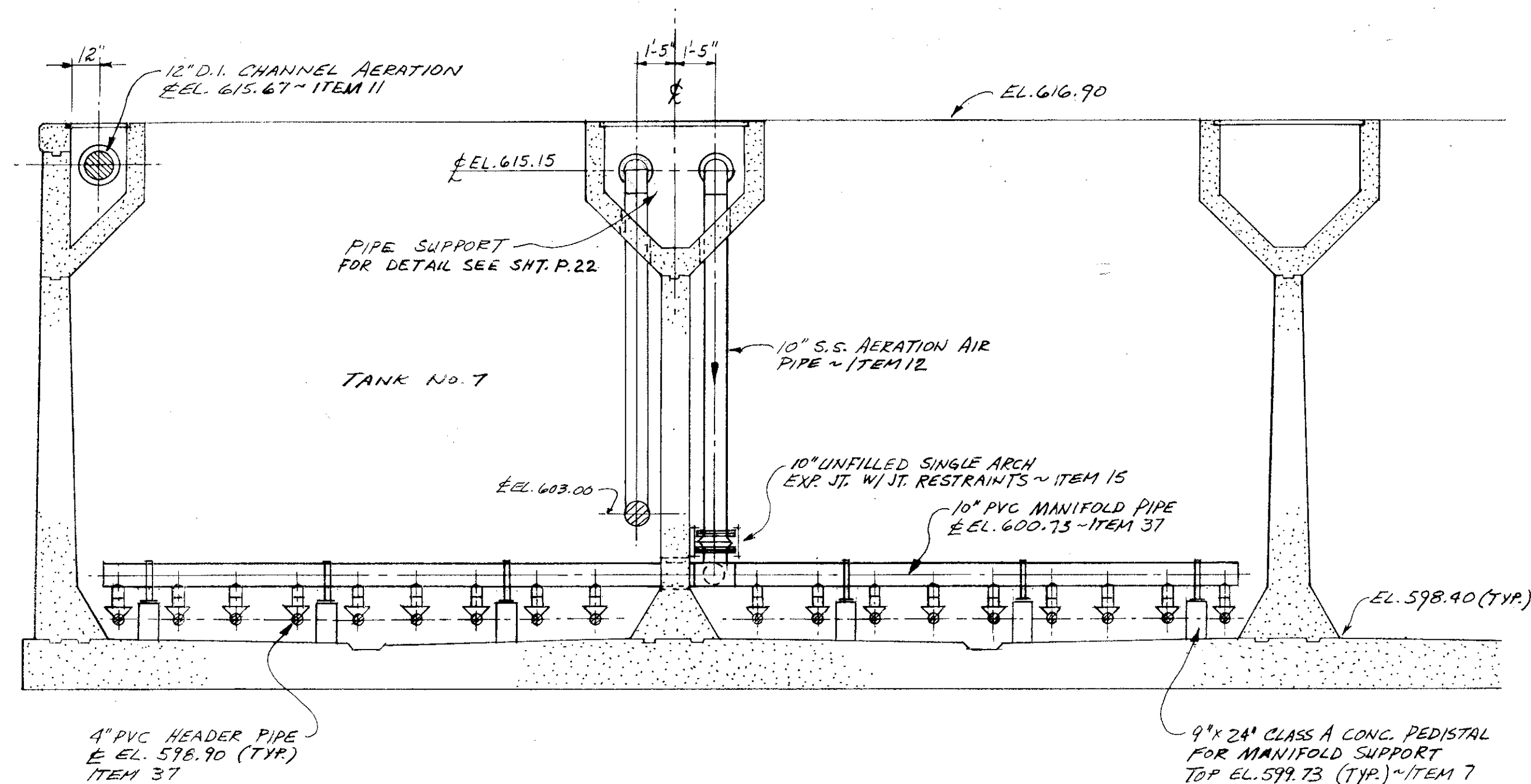
CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
AERATION TANKS NO. 1 THRU 4
SECTIONAL PLAN - AERATION DIFFUSERS

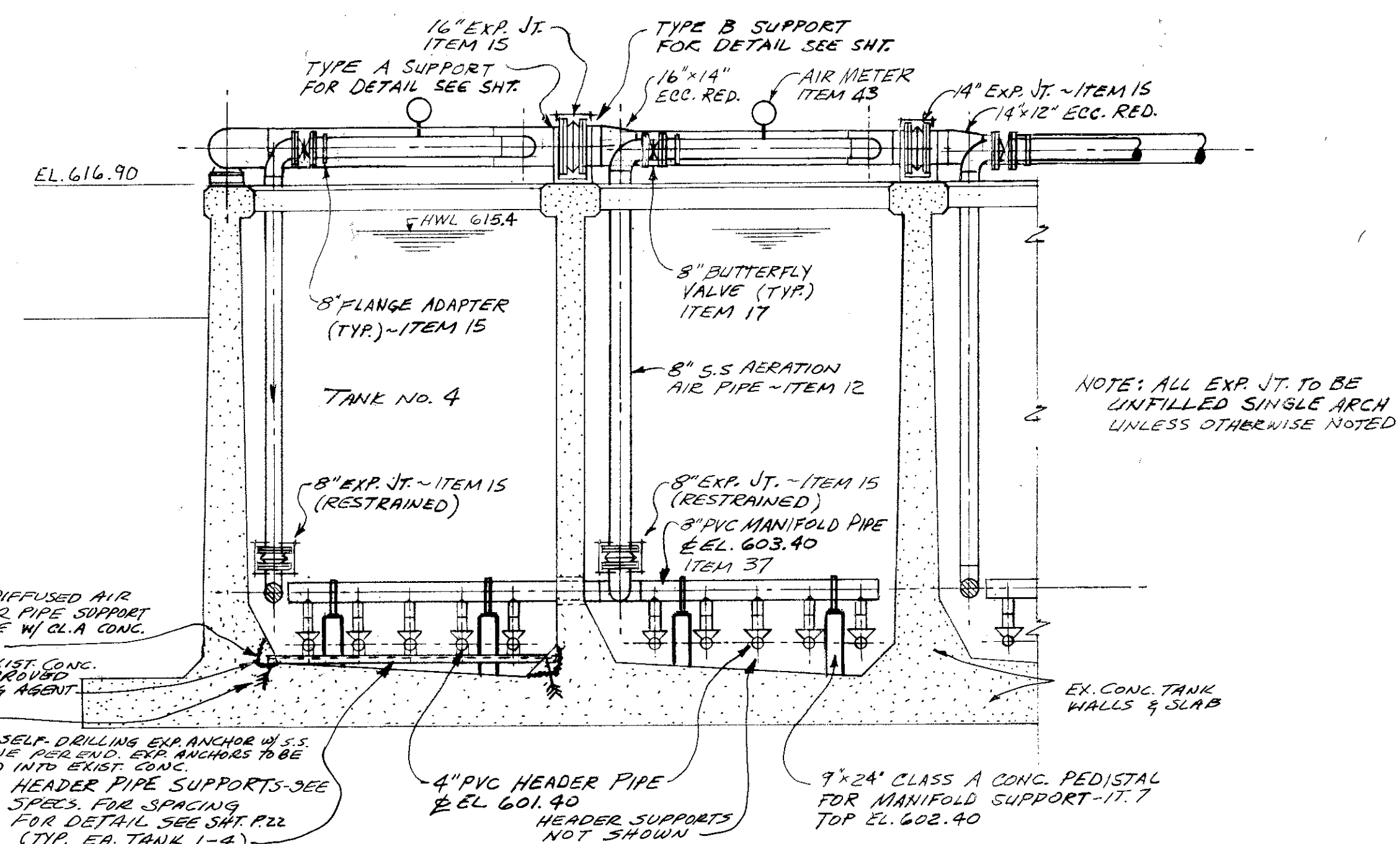
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FILE NO.	1430-5.133
SHEET NO.	P.17/68

RECORD DRAWING

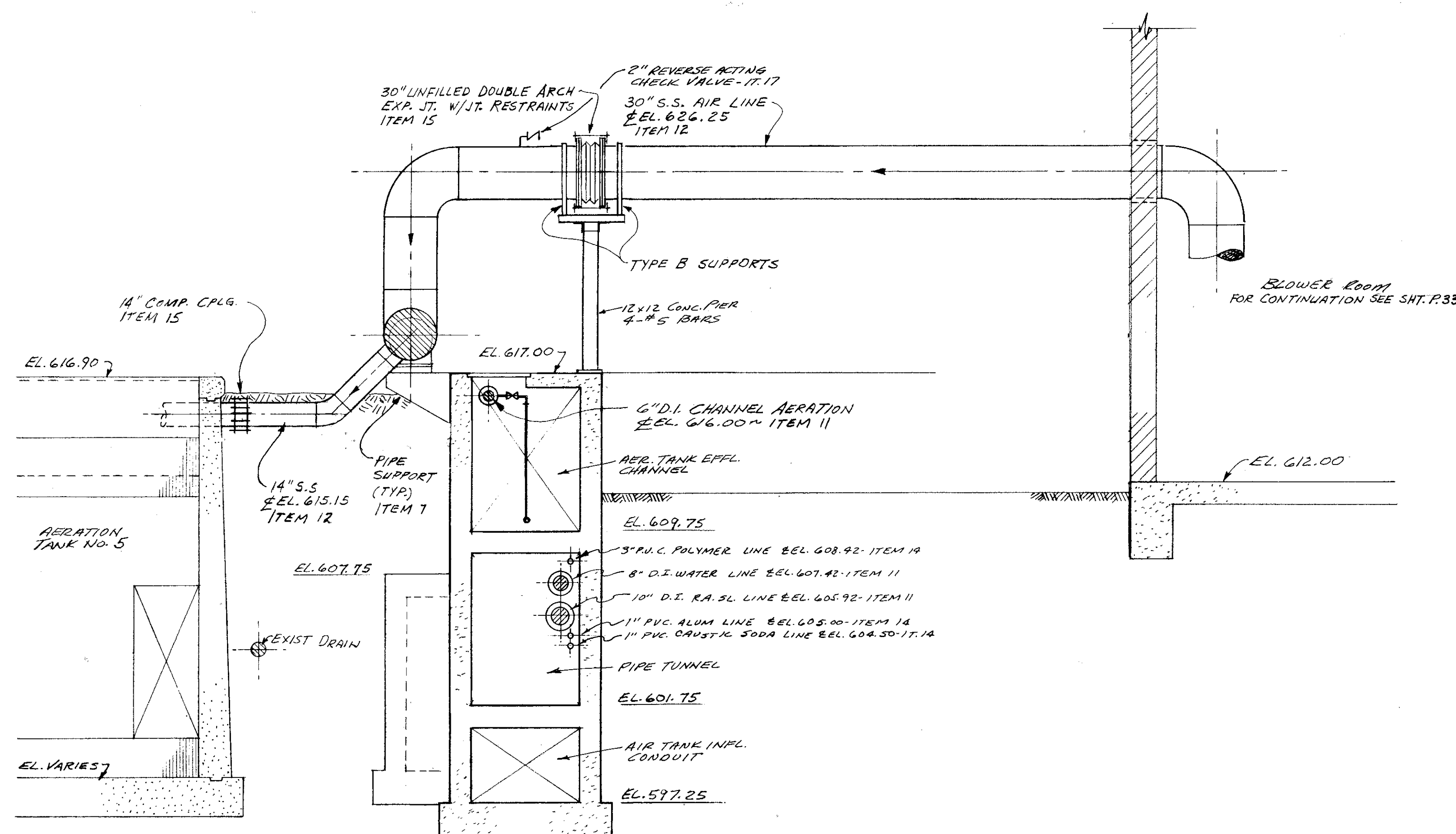
1345-379



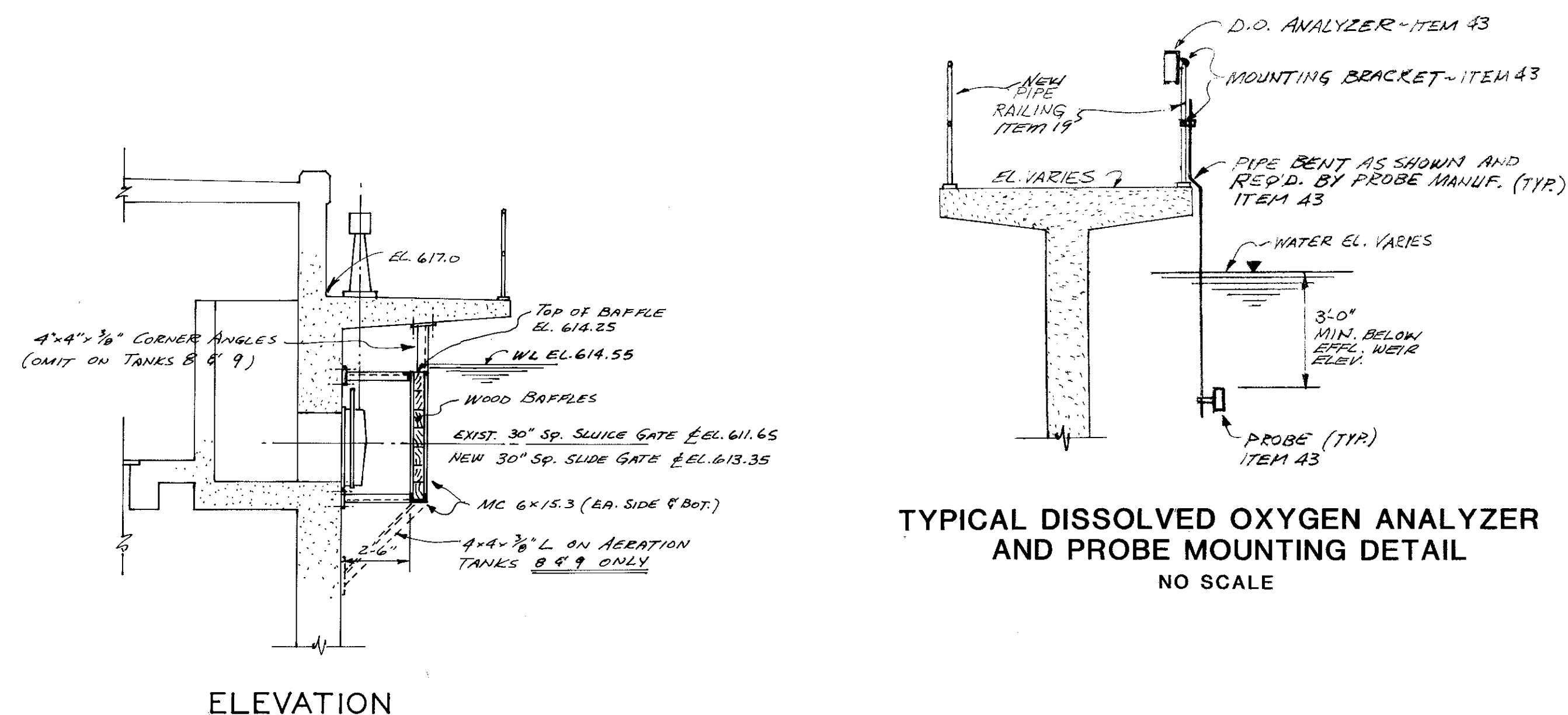
SECTION A-A
R16 R19



SECTION C-C
R15 R19

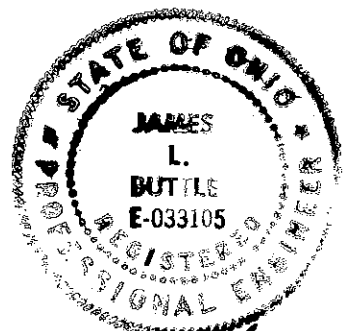


SECTION B-B
R16 R19



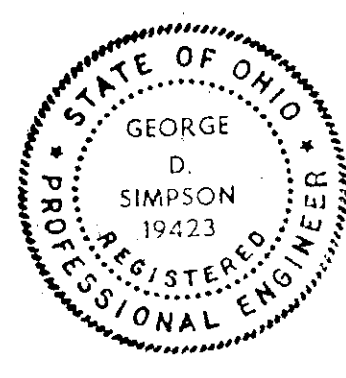
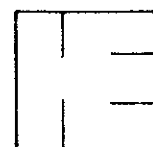
GATE BAFFLE DETAIL
(AERATION TANKS 5 THRU 7)
(AERATION TANKS 8 AND 9 SIMILAR)

TYPICAL DISSOLVED OXYGEN ANALYZER
AND PROBE MOUNTING DETAIL
NO SCALE



	AS BUILT	3-89

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY JLB DRAWN BY WJG, BRH
APPROVED BY R.W. KROZ
SUBMITTED BY L.D. Simpson
HAVENS AND EMERSON INC.
DATE 10-14-83

APPROVED BY
Ronny Johnson
CITY ENGINEER
DATE 11-26-85

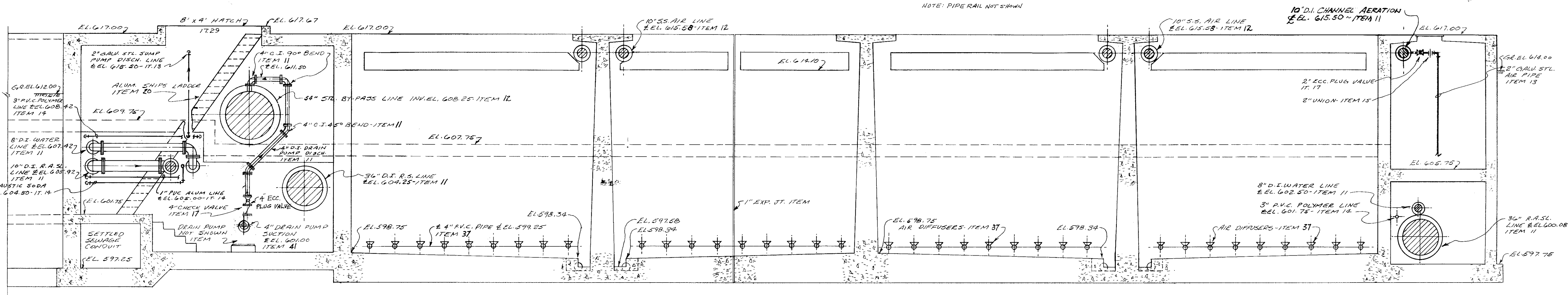
CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
AERATION TANKS
SECTIONS AND DETAILS

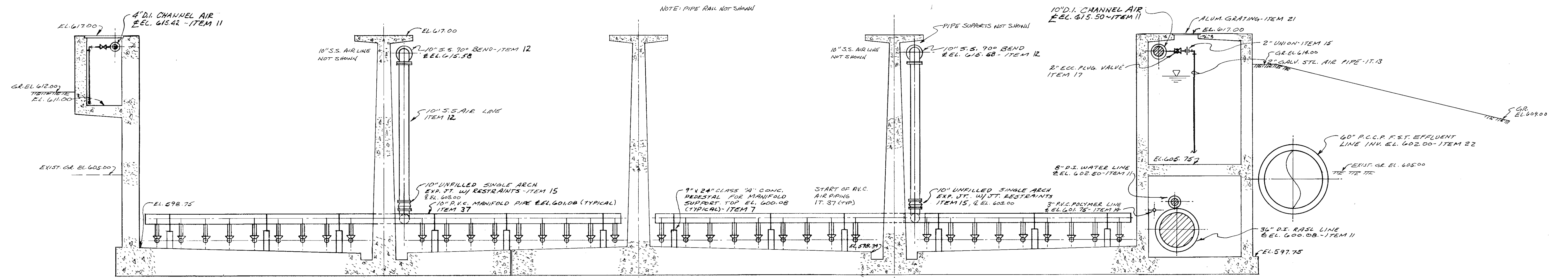
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SCALE	1/4" = 1'-0"
FILE NO.	1430-5.135
SHEET NO.	P. 19/68

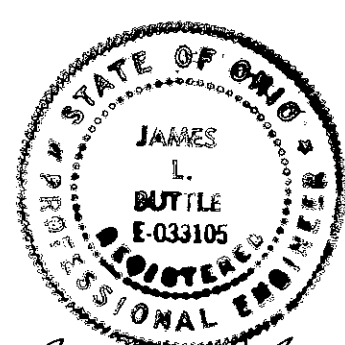
1345-381



SECTION J - J_{P21}

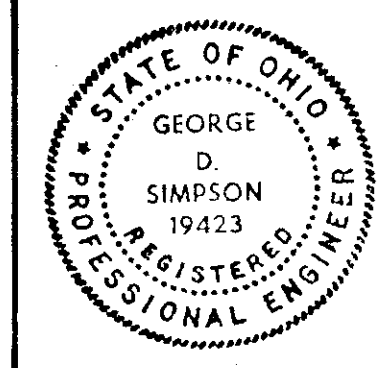


SECTION K - K_{P21}



NO.	DESCRIPTION	DATE

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY LJB DRAWN BY JKR
APPROVED BY R.W. KROZ
SUBMITTED BY L.D. Simpson
DATE 11-14-85

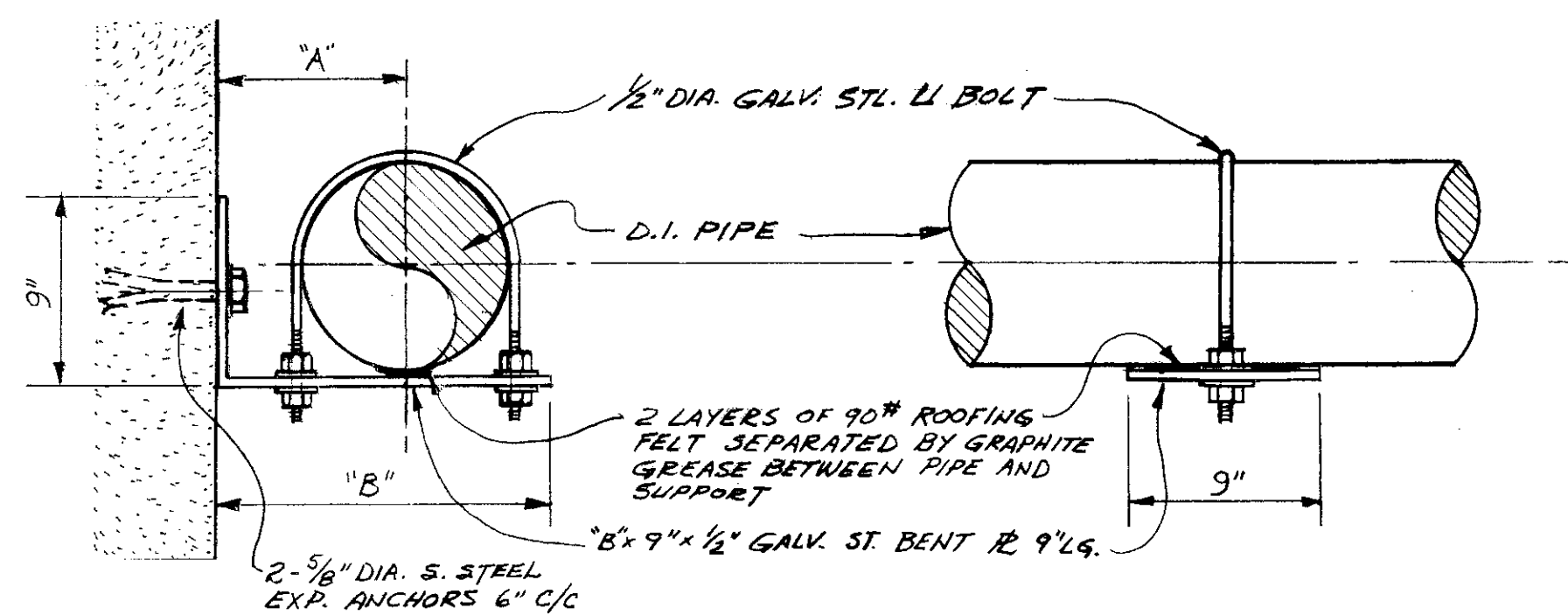
APPROVED BY Lenora J. Simpson
CITY ENGINEER
DATE 11-26-85

CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
AERATION TANKS
SECTIONS

SCALE
1/4" = 1'-0"
FILE NO.
1430-5.137
SHEET NO.
P. 21 / 68

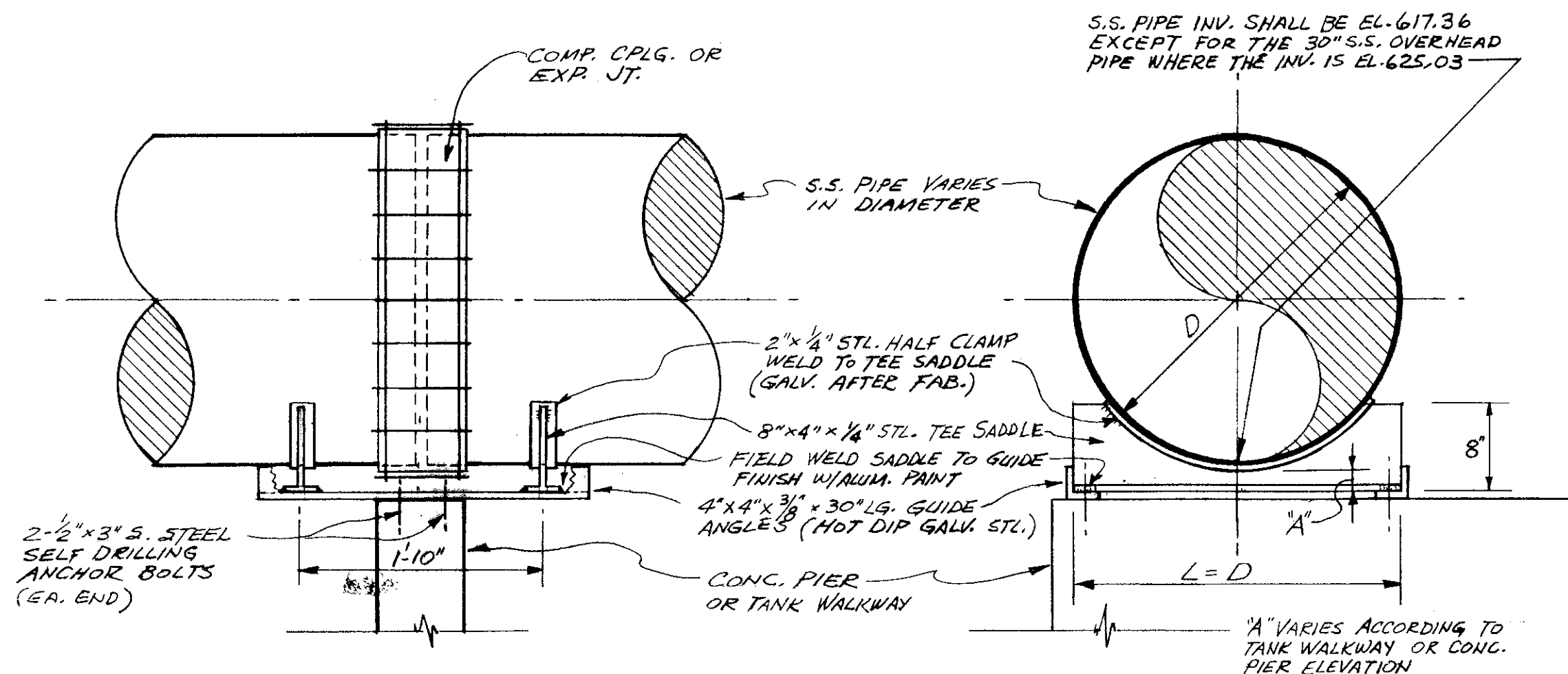
RECORD DRAWING 1345-383



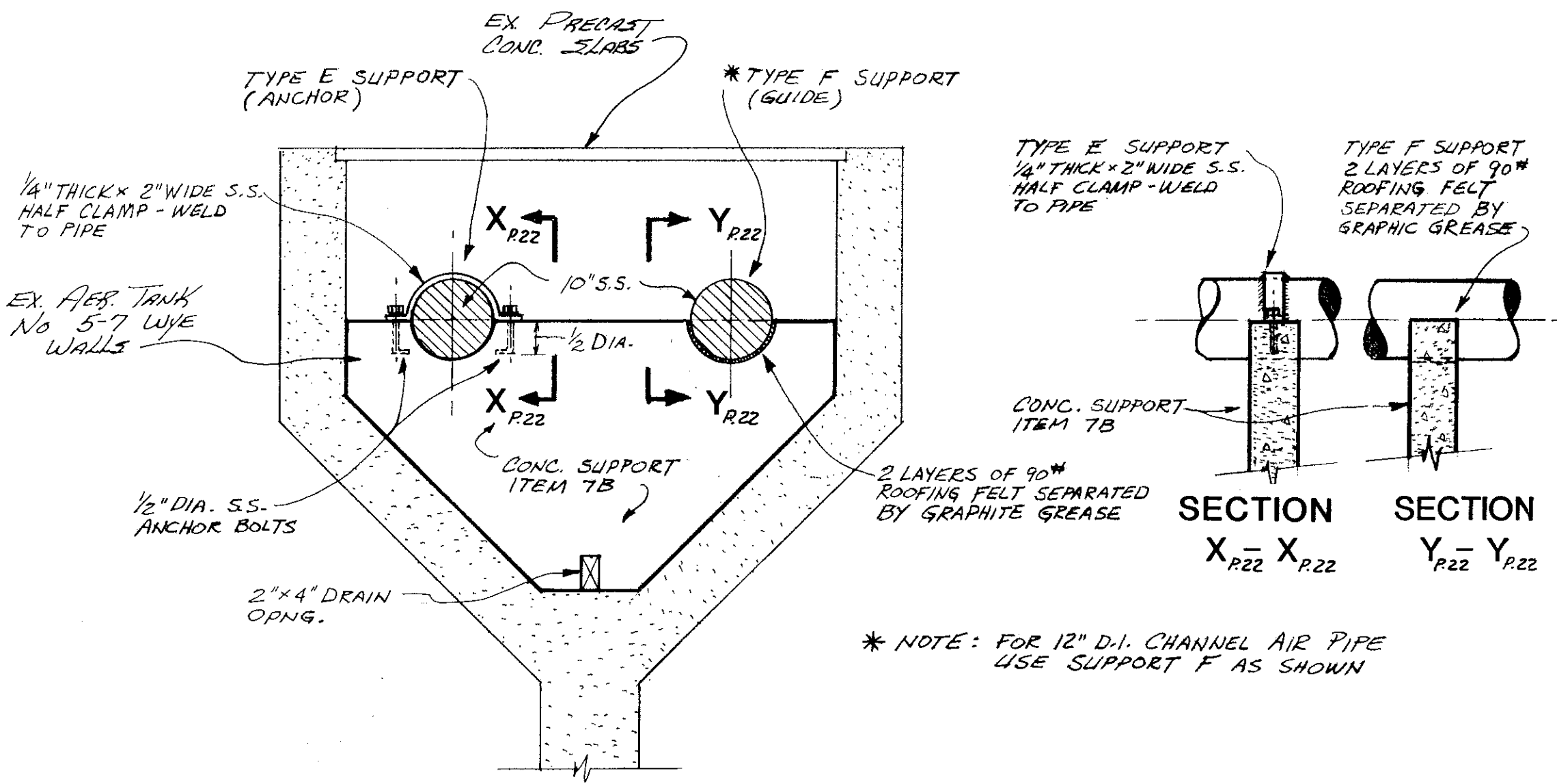
CHANNEL AIR SUPPORT DETAIL

CHANNEL AIR SUPPORT SCHEDULE			
LOCATION	PIPE SIZE	"A"	"B"
1 ST STAGE FLOCC. CHANNEL	6"	8"	13"
" " " "	8"	9"	15"
" " " "	10"	10"	17"
2 ND STAGE FLOCC. CHANNEL	4"	11"	15"
" " " "	6"	11"	16"
" " " "	8"	11"	17"
" " " "	10"	11"	18"
TANK 8 & 9 INFLUENT CHANNEL	4"	6"	10"
" " " "	6"	7"	12"
NEW MIXED LIQUOR CHANNEL	4"	6"	10"
" " " "	6"	9"	14"
" " " "	10"		19"

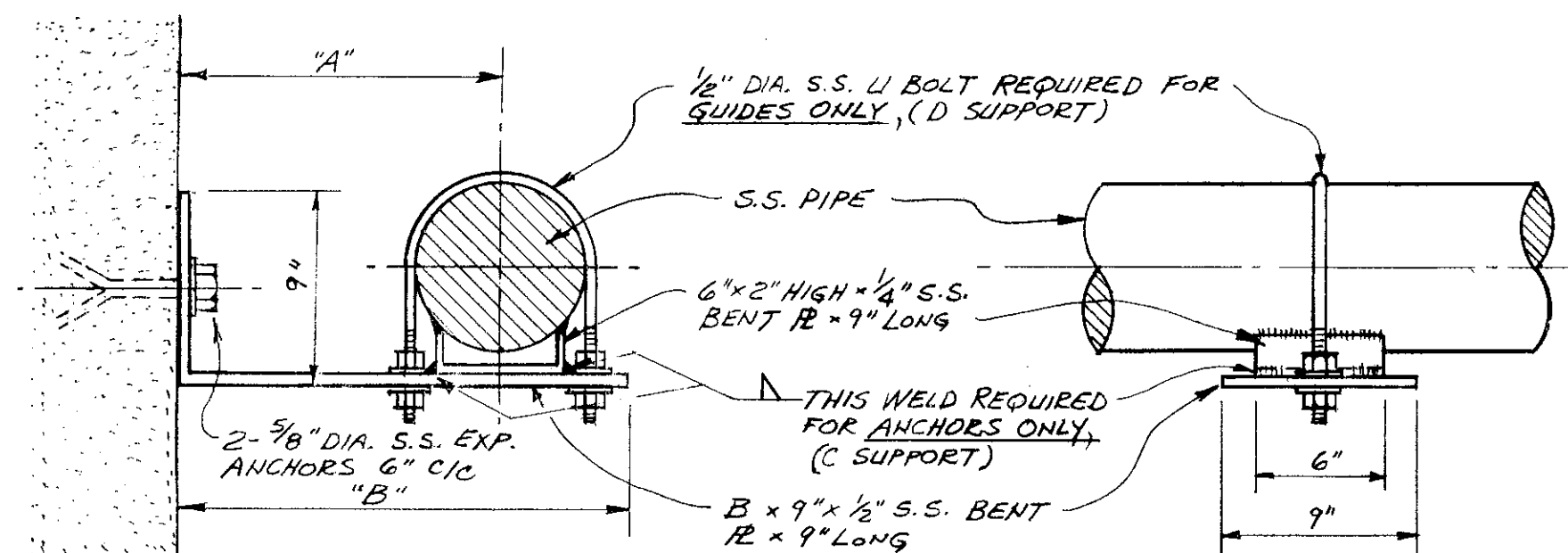
NOTE: ALL BENDS IN PIPING AND COMP. CLPG. SHALL BE SUPPORTED ON BOTH SIDES



TYPE A ANCHOR & TYPE B GUIDE PIPE SUPPORTS

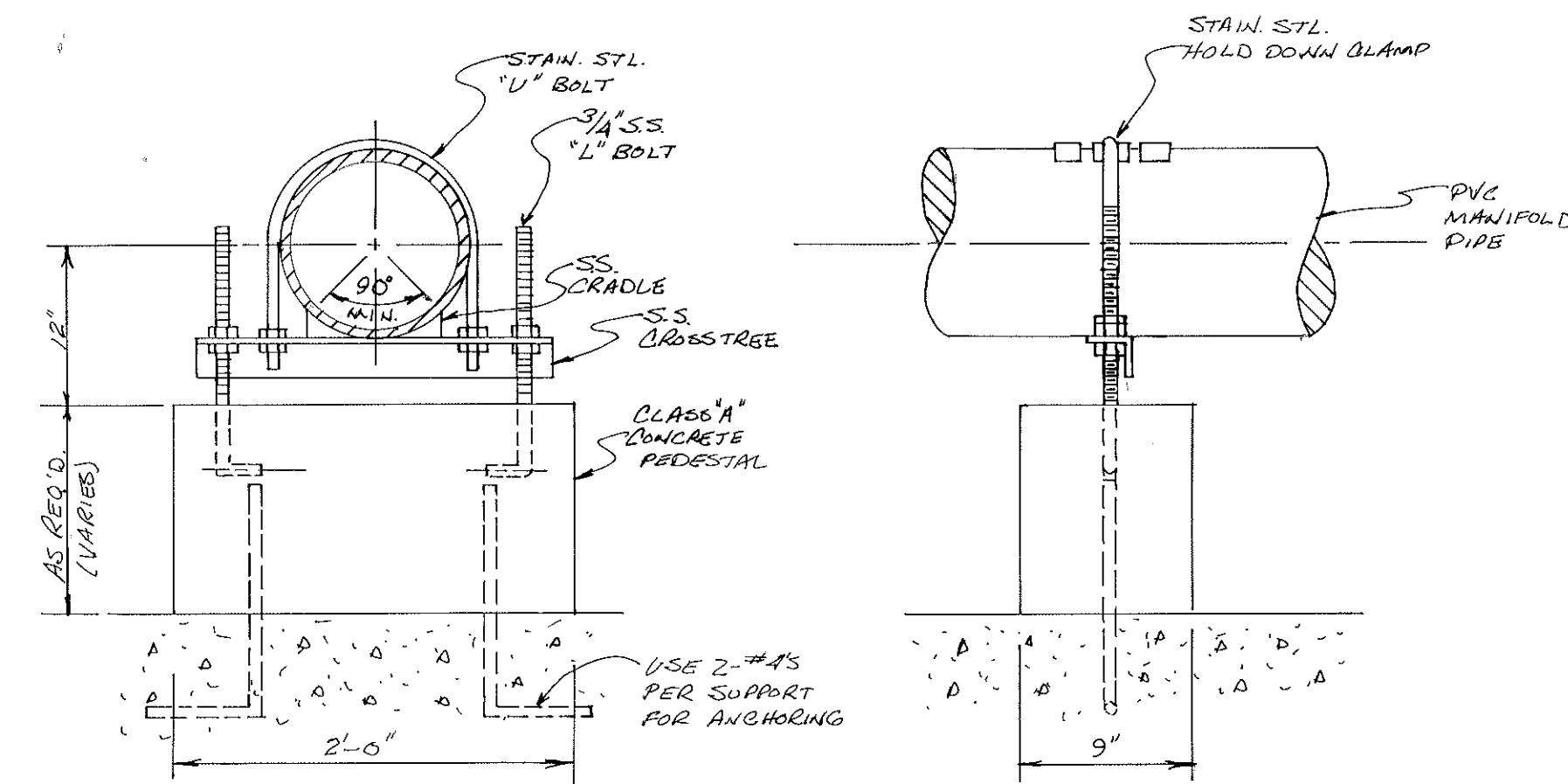


TYPE E ANCHOR & TYPE F GUIDE PIPE SUPPORTS

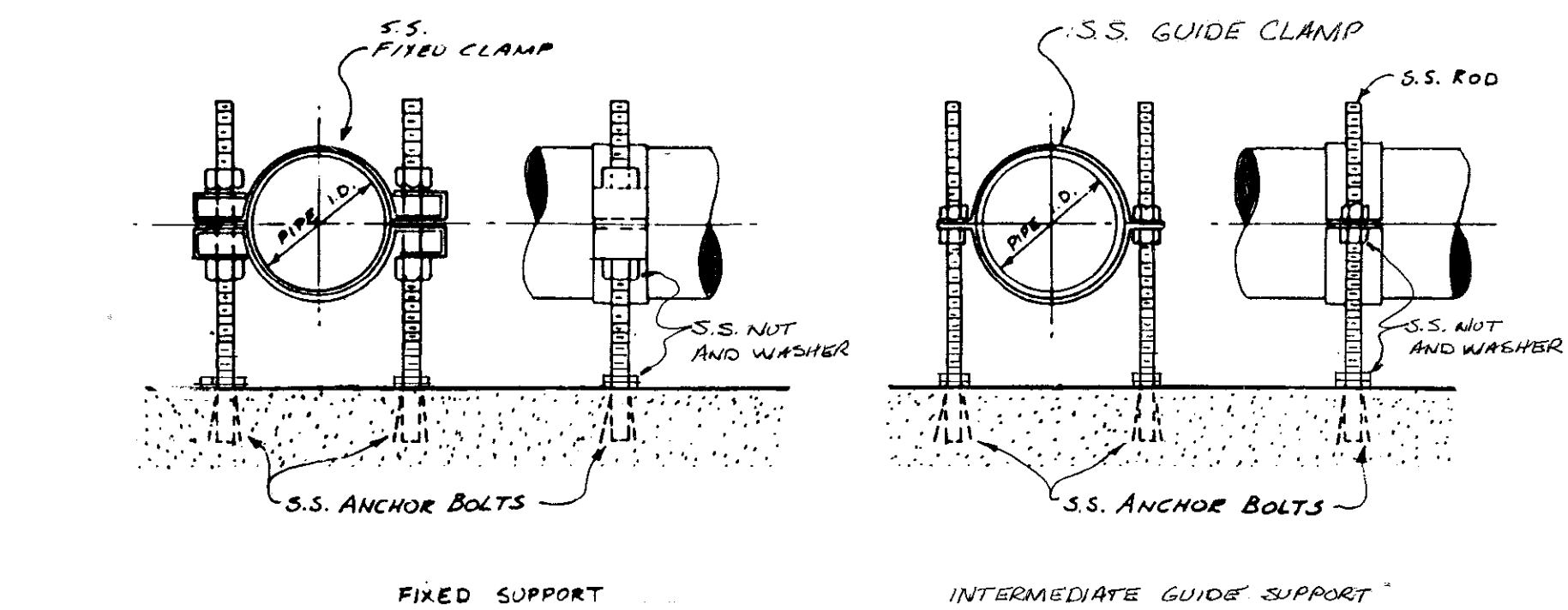


TYPE C ANCHOR & TYPE D GUIDE PIPE SUPPORTS

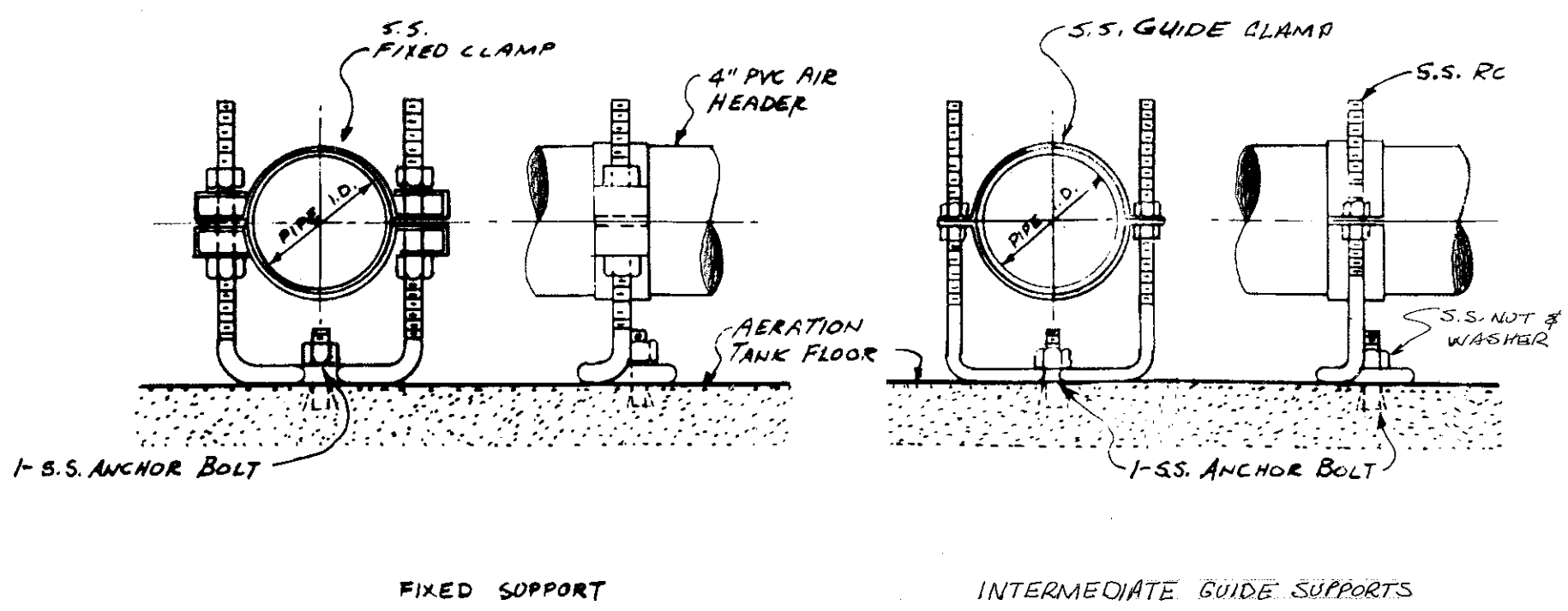
TYPE C & D SUPPORT SCHEDULE			
DESCRIPTION	PIPE SIZE	A	B
AERATION TR. 1-4 (VERTICAL WALLS)	8"	12"	18"
AERATION TR. 1-4 (BATTERED WALLS)	8"	15"	21"
AERATION TANK NO. 8 & 9	10"	15"	22"



AIR MANIFOLD SUPPORT

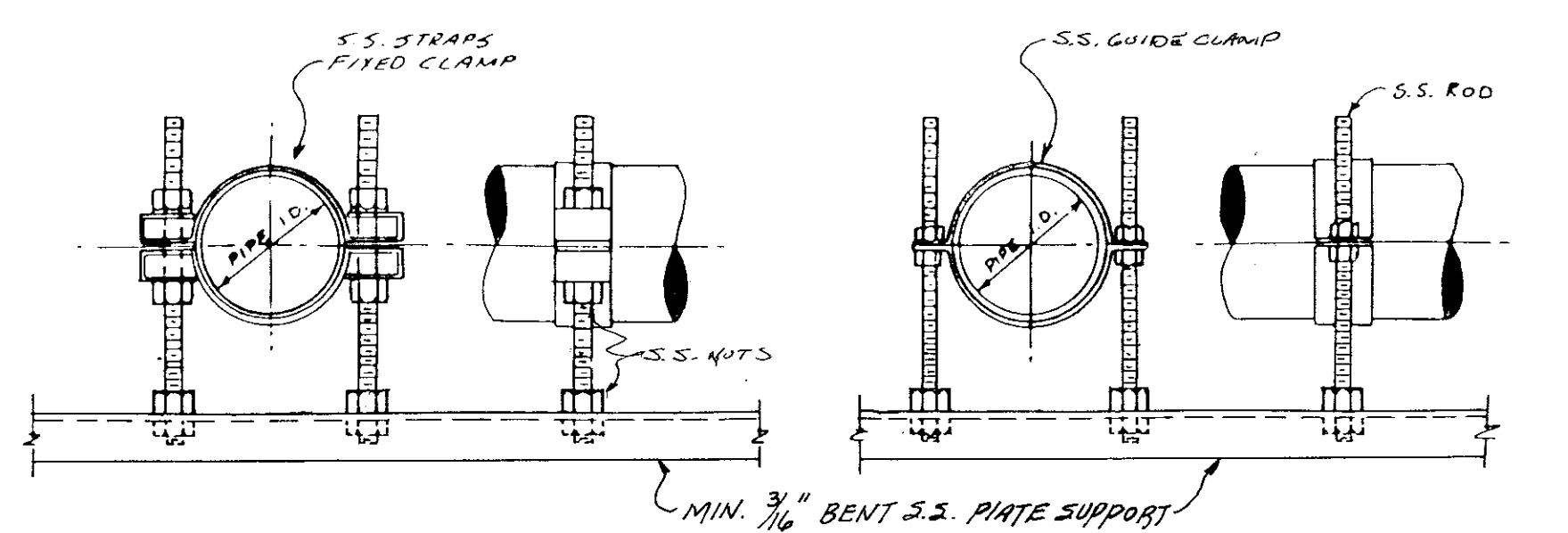


ALTERNATE 1

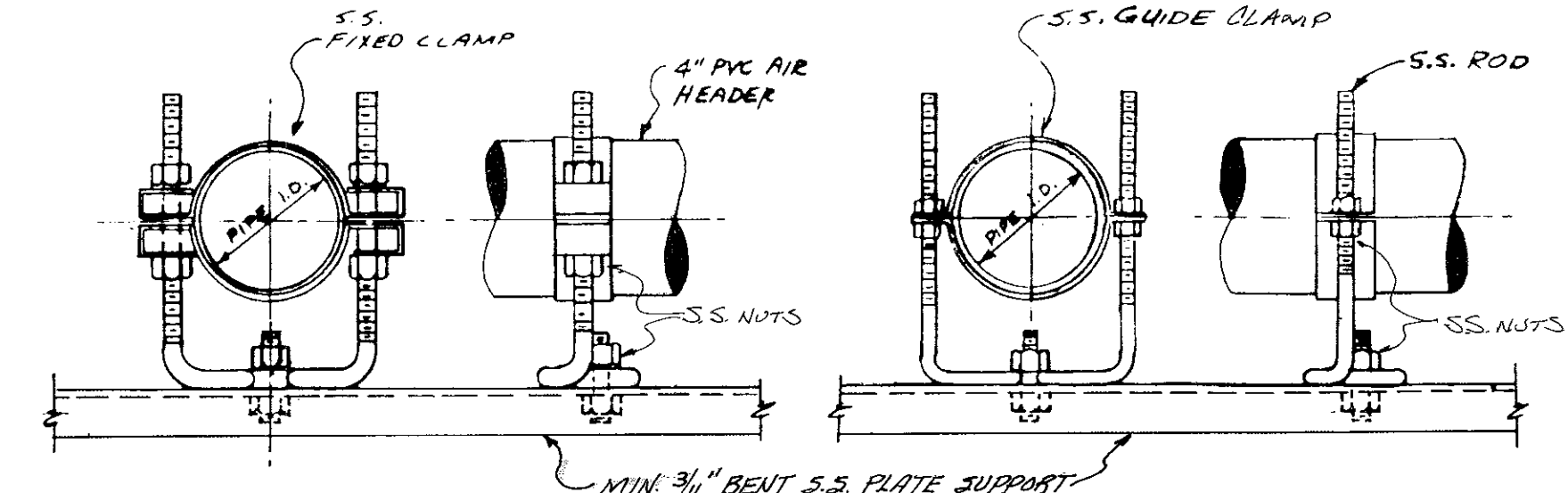


ALTERNATE 2

AERATION TANKS NO. 5 THRU 9
TYPICAL AIR DISTRIBUTION HEADER SUPPORTS

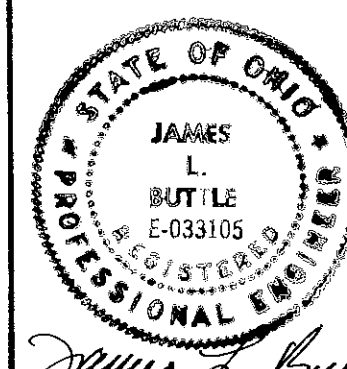


ALTERNATE 1



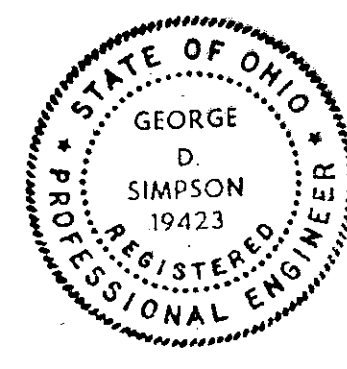
ALTERNATE 2

AERATION TANKS NO. 1 THRU 4
TYPICAL AIR DISTRIBUTION HEADER SUPPORTS



NO.	DESCRIPTION	DATE
1	AS BUILT	3-89
REVISIONS		

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY JLB DRAWN BY RRH/RS
APPROVED BY R.W. KROZ
SUBMITTED BY G.D. Simpson
DATE 10-14-83

APPROVED BY Henry J. Slings
DATE 11-26-85

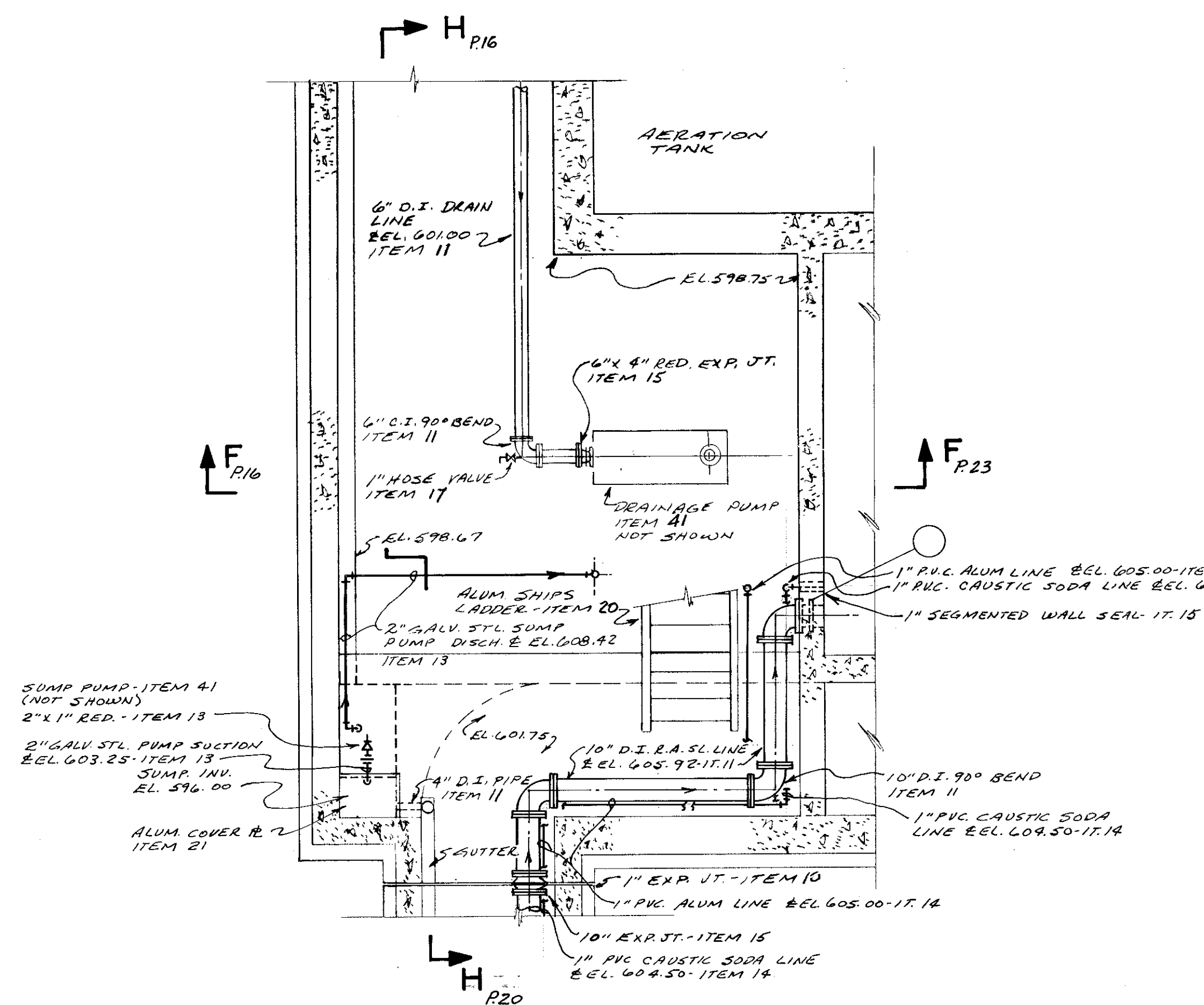
CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
AERATION TANKS
PIPE SUPPORT DETAILS

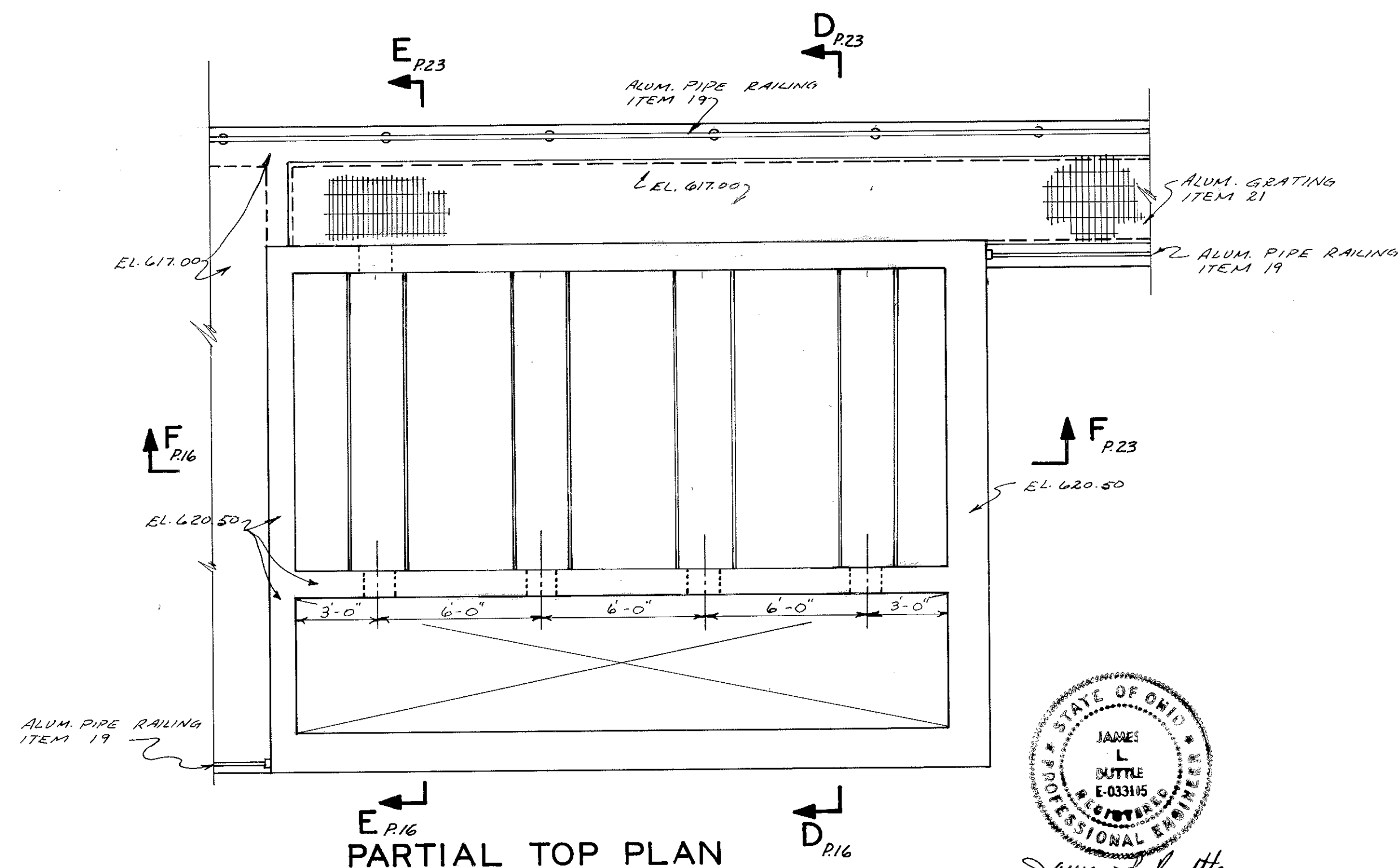
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FILE NO.	1430-5.138
SHEET NO.	P. 22 / 68

RECORD DRAWING

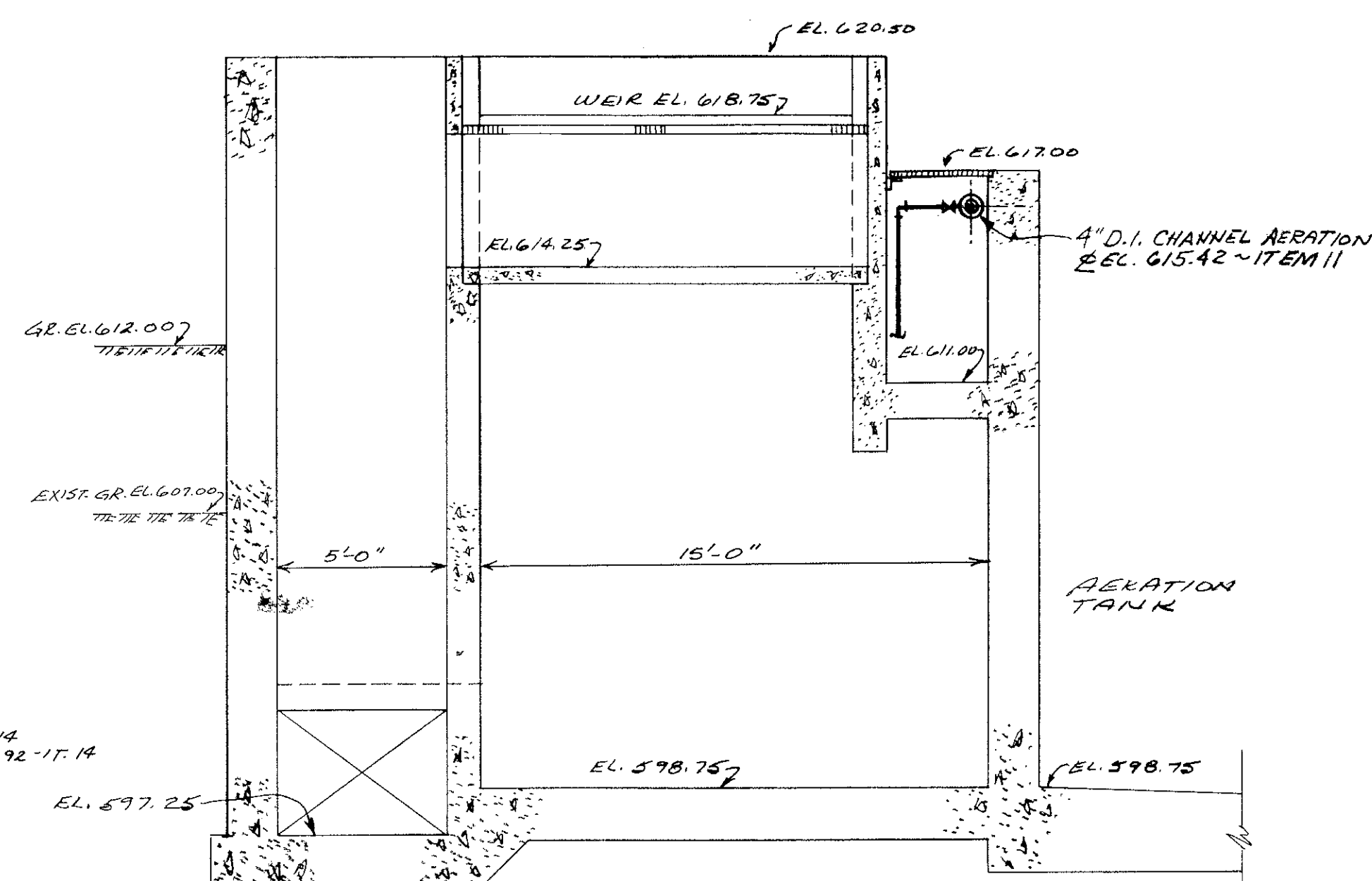
1345-384



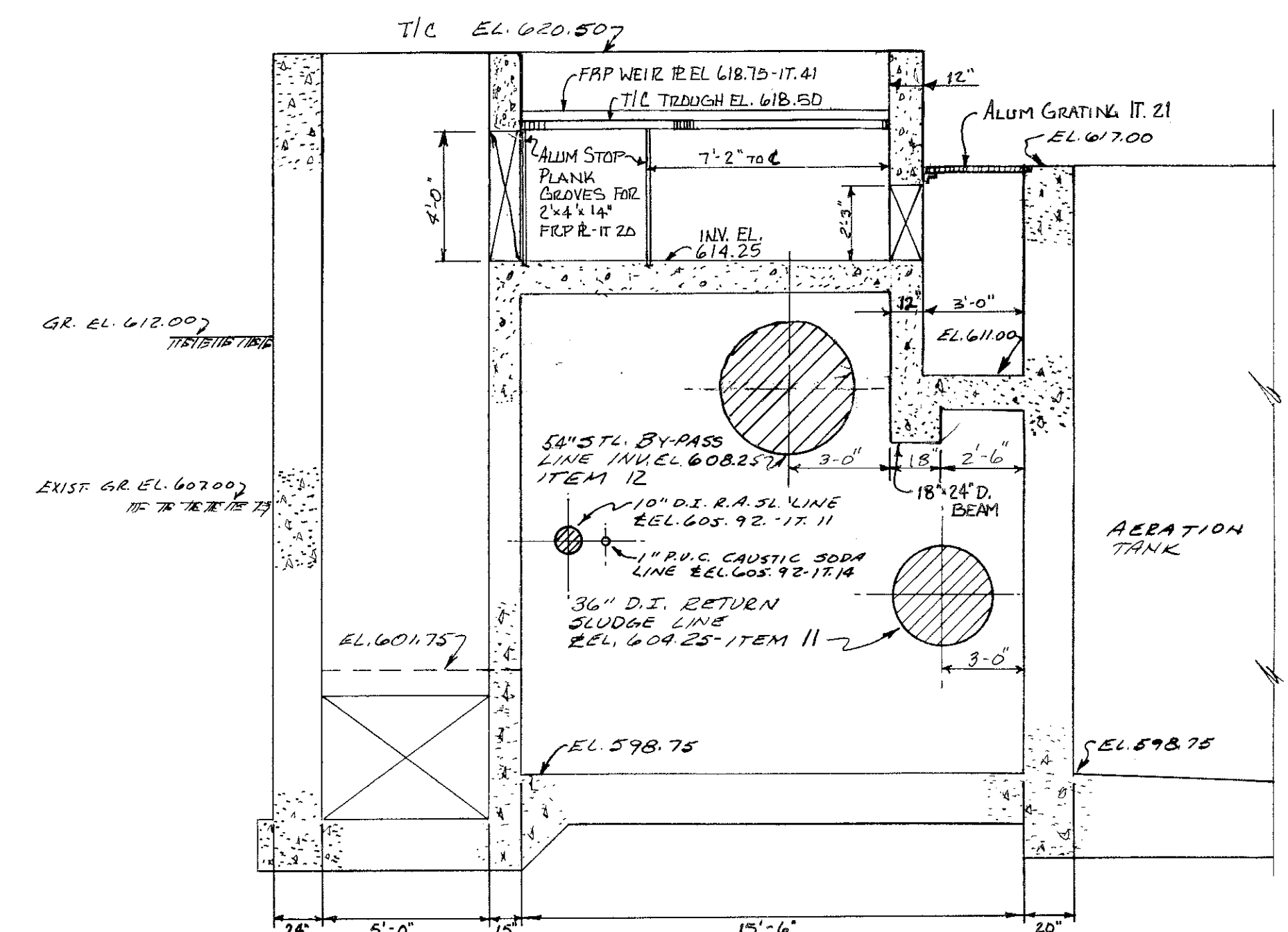
PARTIAL PLAN AT EL. 598.75



PARTIAL TOP PLAN

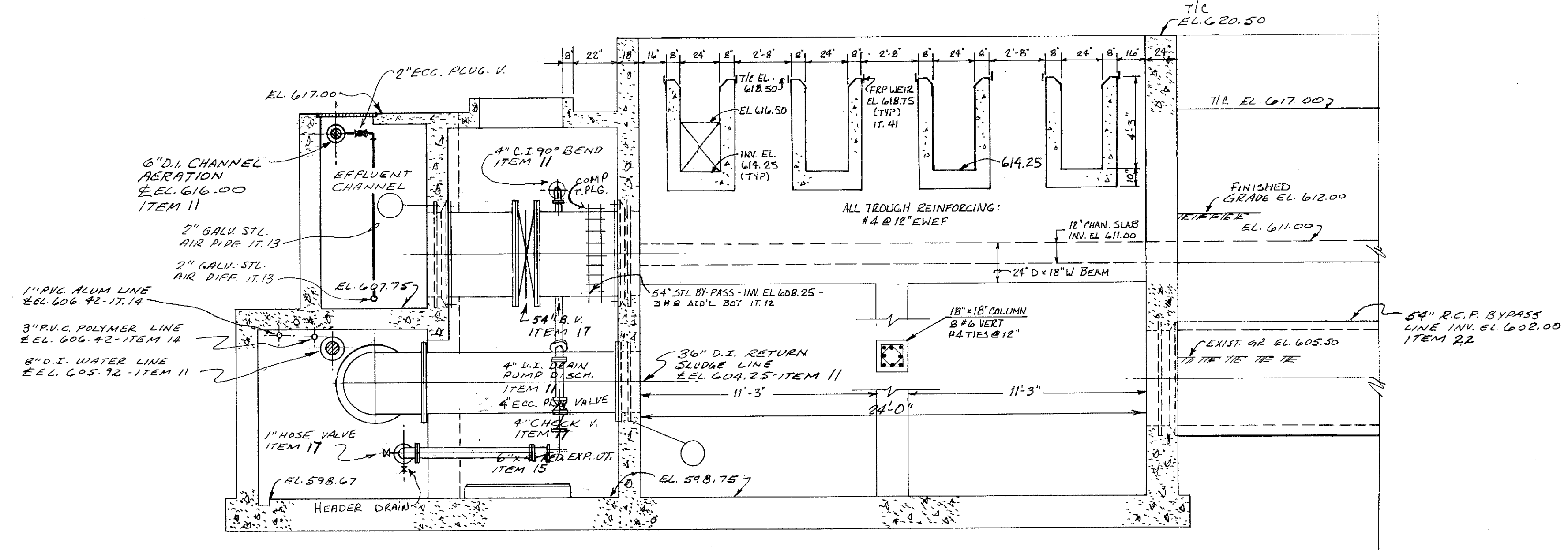


SECTION D - D
P16 P23



SECTION E - E
P16 P23

NOTE: SEE SH. P.33 OF CONTRACT & AREA FOR WEIR DETAILS CTRY.



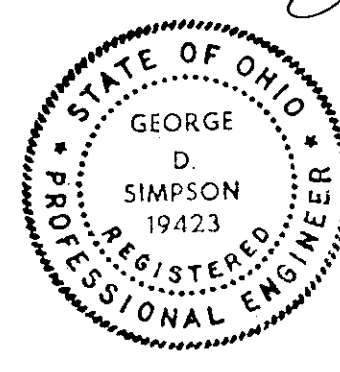
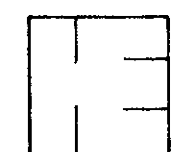
SECTION F - F
P16 P23

RECORD DRAWING

1345-385

NO.	DESCRIPTION	DATE
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HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY W.B. DRAWN BY W.D. ROB
APPROVED BY R.W. KROTZ
SUBMITTED BY G.D. Simpson
HAYENS AND EMERSON INC.
DATE 10-14-83

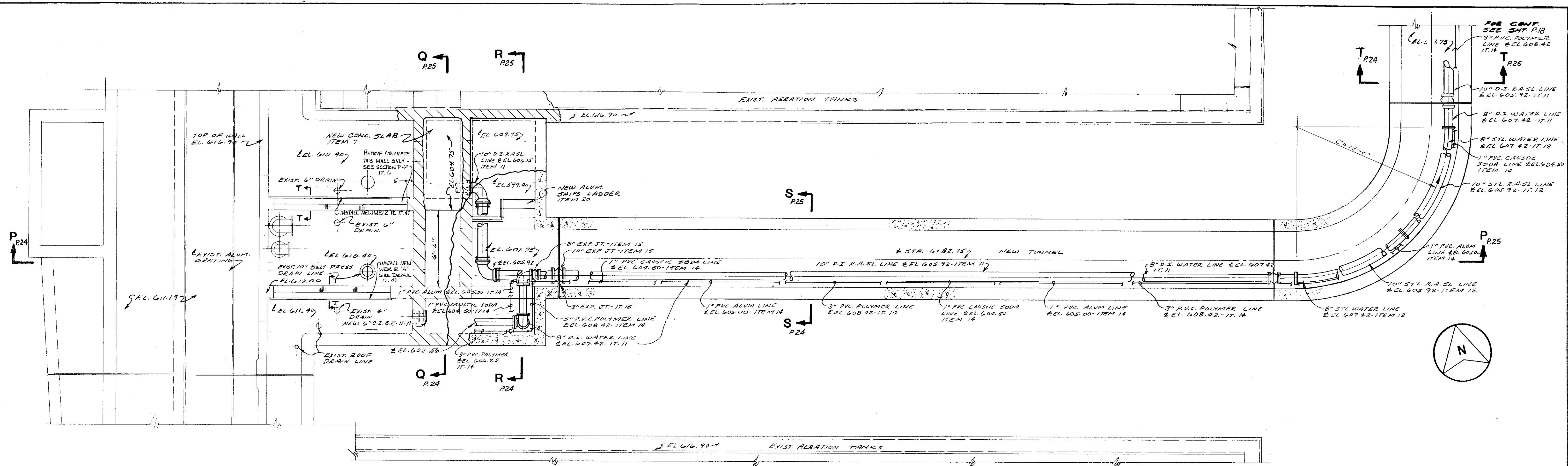
APPROVED BY

James J. Smith
CITY ENGINEER
DATE 11-26-85

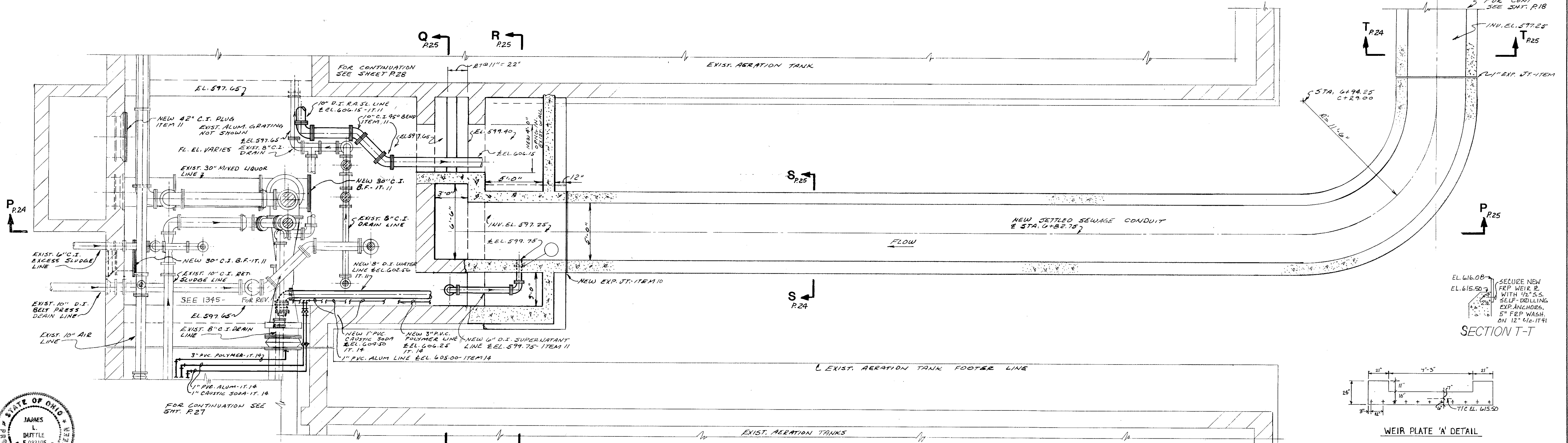
CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
AERATION TANKS
FLOW SPLITTER BOX NO.1
PLANS AND SECTIONS

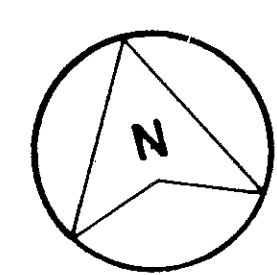
SCALE
1/4" = 1'-0"
FILE NO.
1430-5.139
SHEET NO.
P.23/68



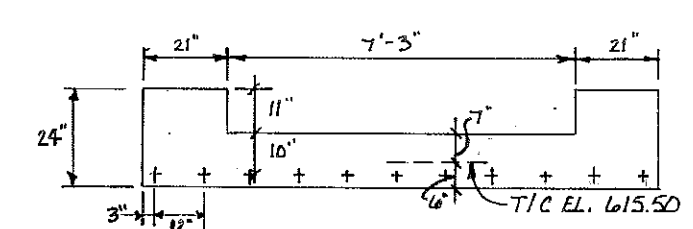
PLAN AT EL. 609.79



PLAN AT EL. 597.25

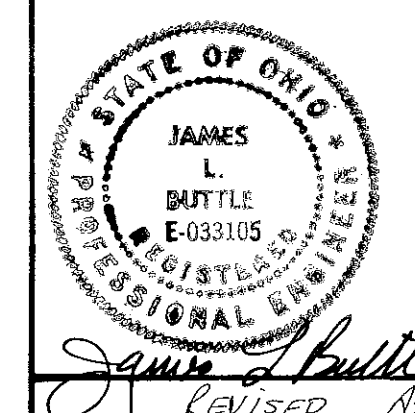


SECTION T-T



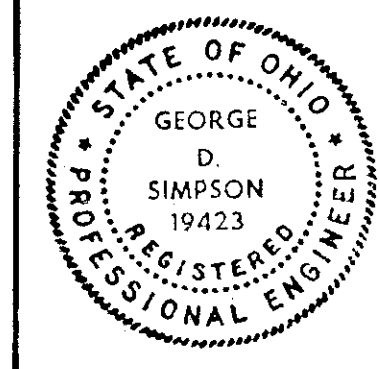
WEIR PLATE 'A' DETAIL

RECORD DRAWING



REVISIONS		
NO.	DESCRIPTION	DATE

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



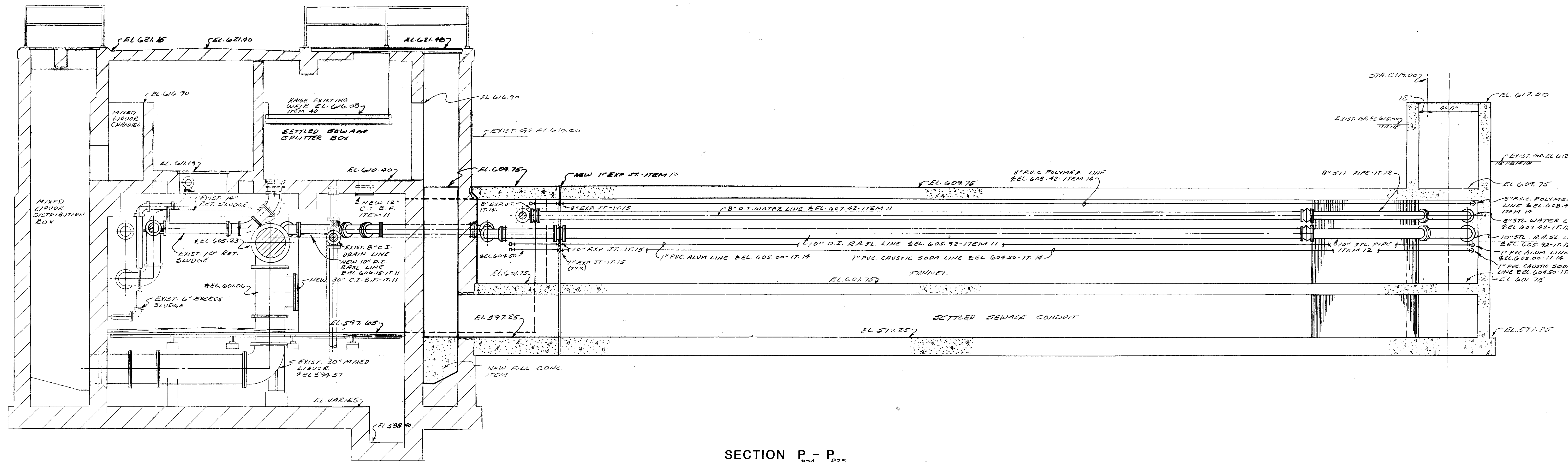
DESIGNED BY SWB DRAWN BY SWB, RCB
 APPROVED BY R.W. KROTZ
 SUBMITTED BY SD Simpson
 DATE 10-14-85

APPROVED BY James L. Duffile
 CITY ENGINEER

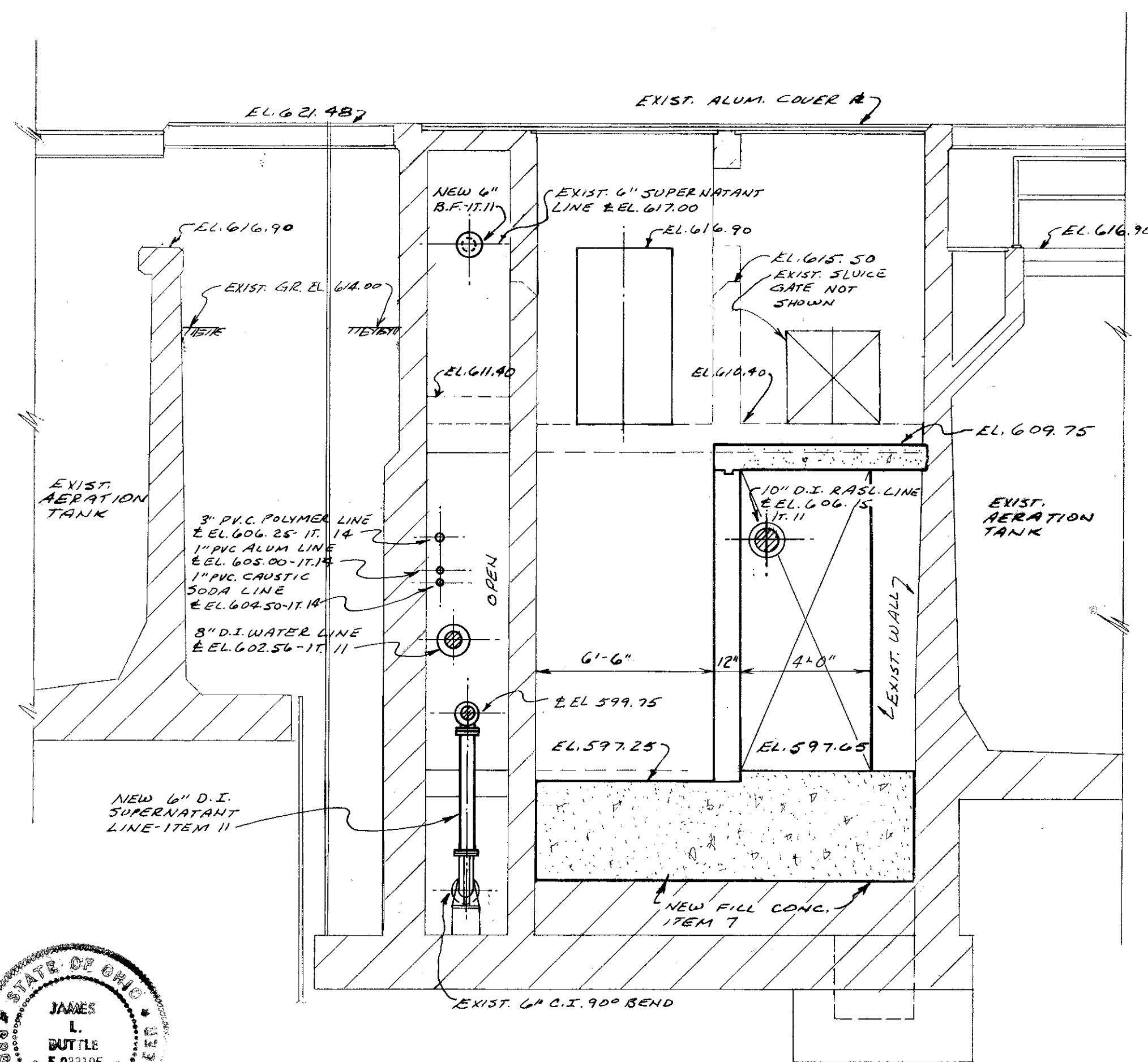
CITY OF ELYRIA, OHIO
 DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
 CONTRACT 5
**EXISTING AERATION TANKS NO. 1 THRU 7
 NEW INFLUENT CONDUIT & TUNNEL PLANS**

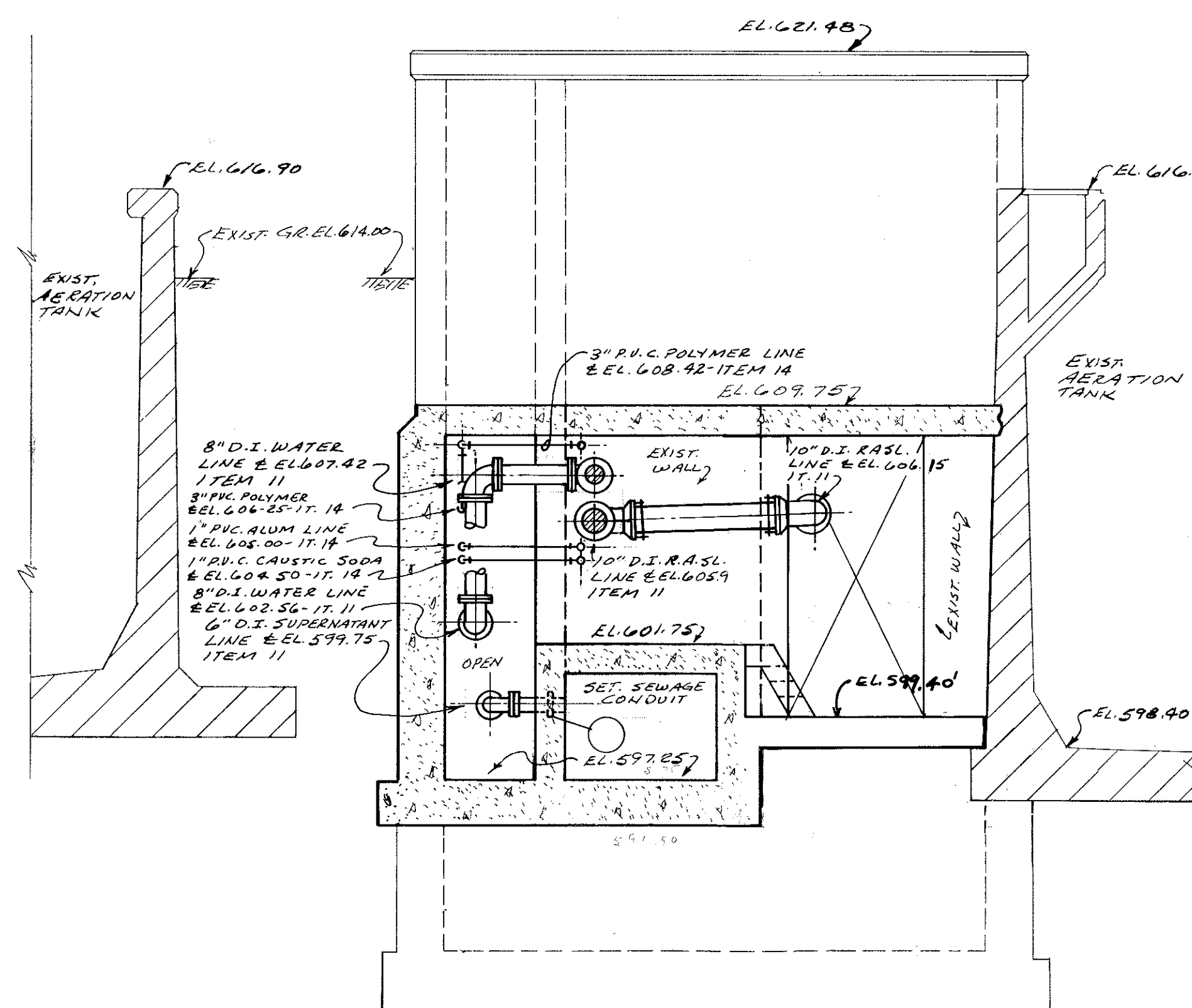
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 SHEET NO. P.24/68



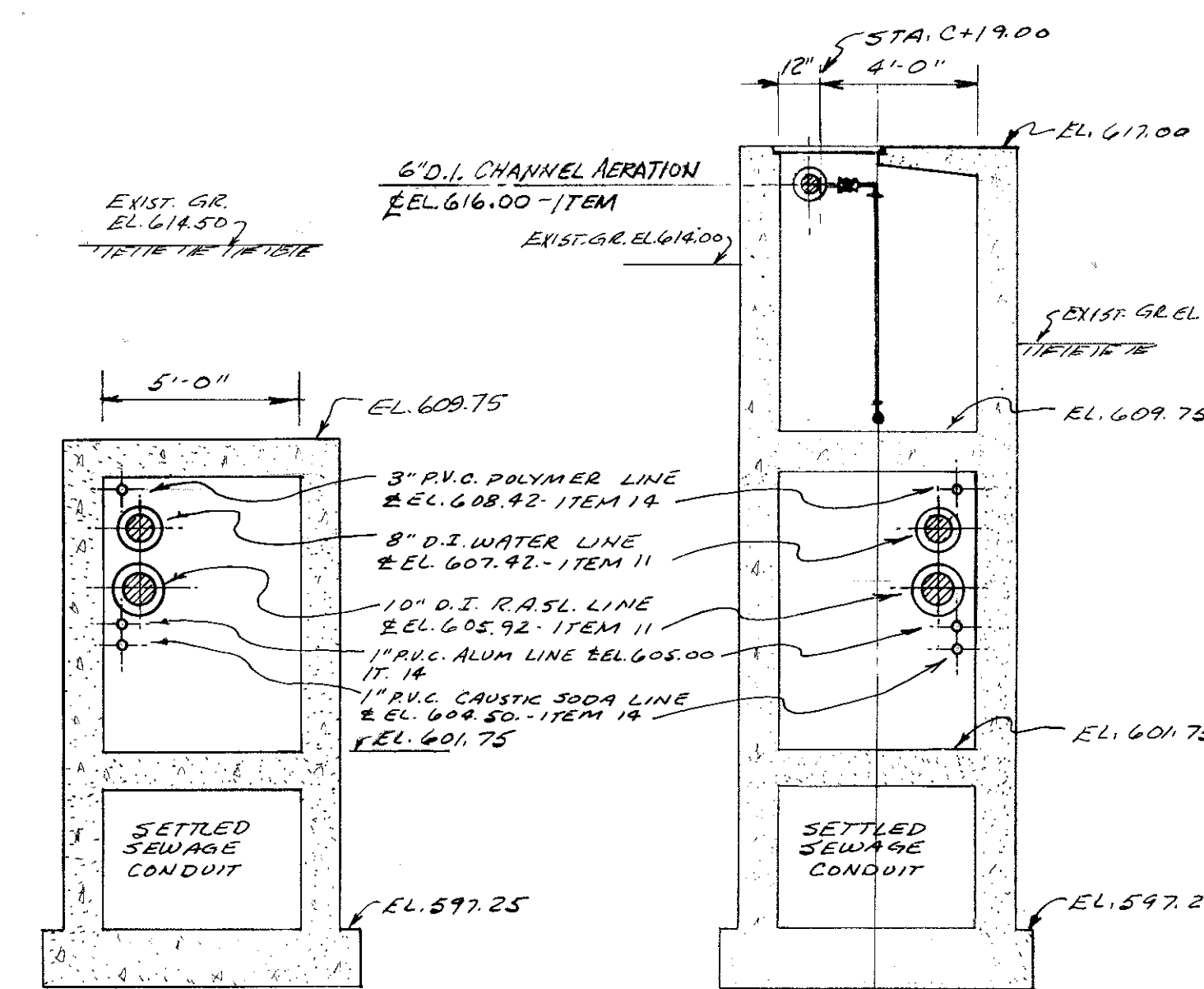
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P24 P25



SECTION Q - Q
P24 P25

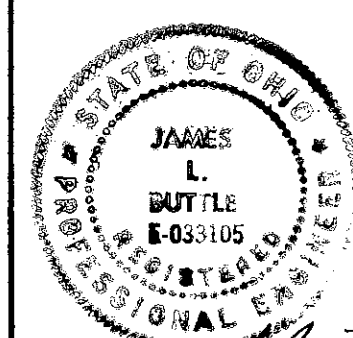


SECTION R - R
P24 P25



SECTION S - S
P24 P25

SECTION T - T
P24 P25



NO.	DESCRIPTION	DATE
1	REVISIONS	

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY SLB DRAWN BY SLB
APPROVED BY R.W. KROTZ
SUBMITTED BY S.D. Simpson
DATE 12-14-83

APPROVED BY Lonny Simpson
DATE 11-26-85

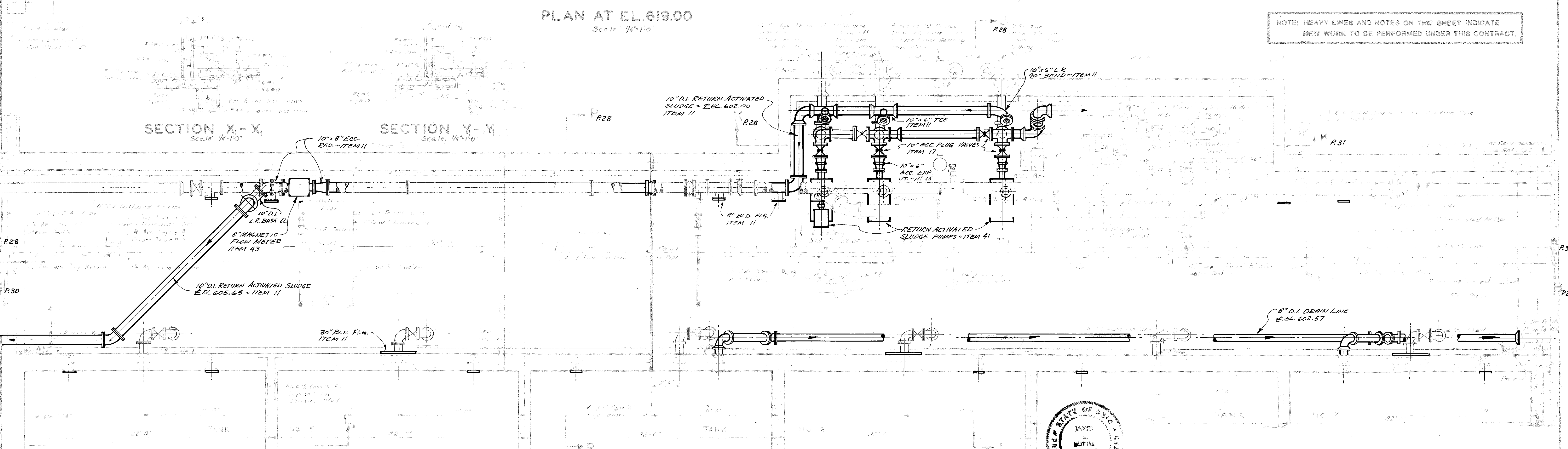
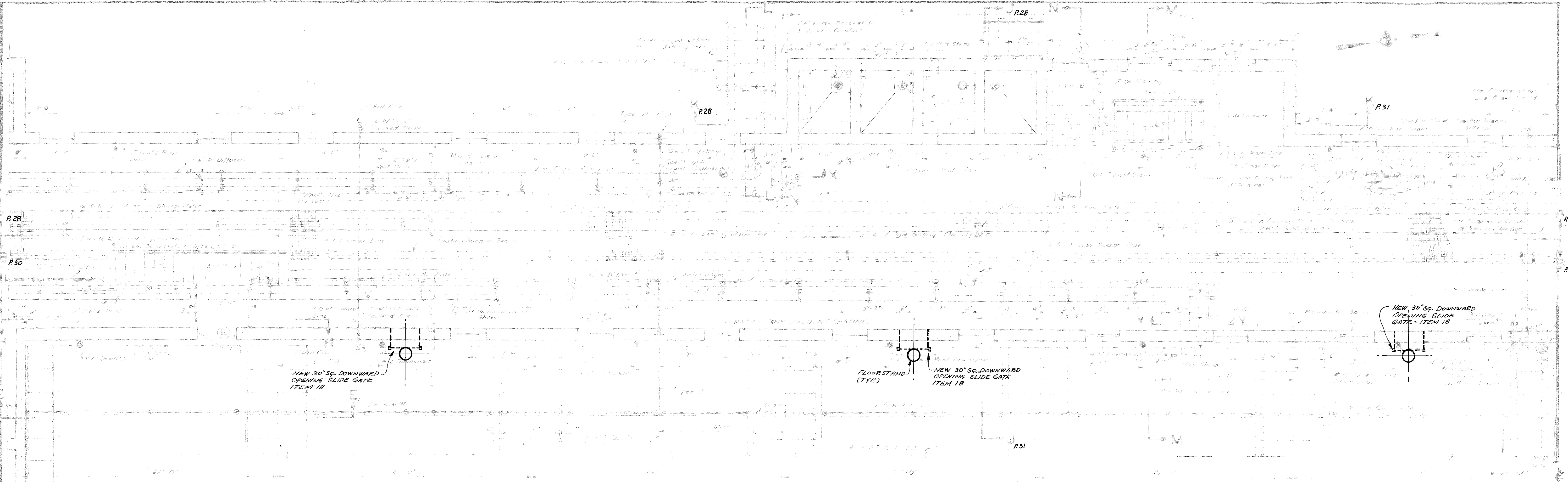
CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
EXISTING AERATION TANKS NO. 1 THRU 7
NEW INFLUENT CONDUIT & TUNNEL
SECTIONS

SCALE
1/4" = 1'-0"
FILE NO.
1430-5.141
SHEET NO.
P25/68

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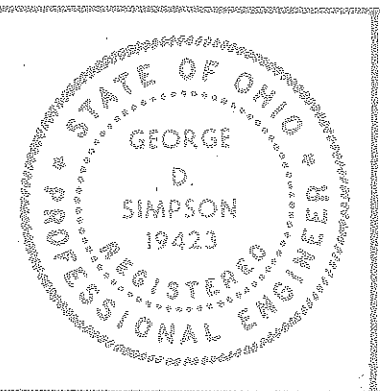
1345-387



REVISED	As Built	3-89
NO.	DESCRIPTION	DATE
REVISIONS		

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS

HE



DESIGNED BY JLB DRAWN BY JWD/RB

APPROVED BY R.W. KROTZ

SUBMITTED BY J.D. Simpson

DATE 10-14-83

APPROVED BY [Signature]

DATE 11-26-85

CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE

WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

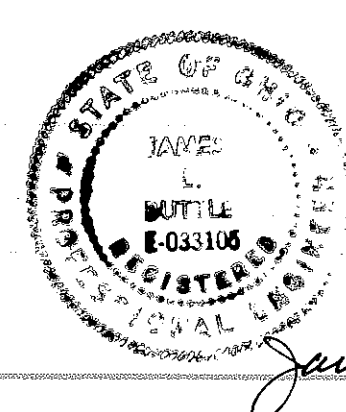
SECONDARY TREATMENT EXPANSION
CONTRACT 5

REVISIONS TO
EXISTING AERATION PIPE GALLERY
PLANS - NORTH HALF

SCALE
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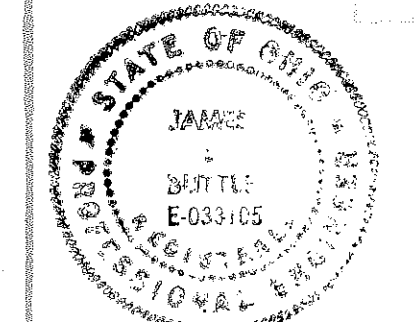
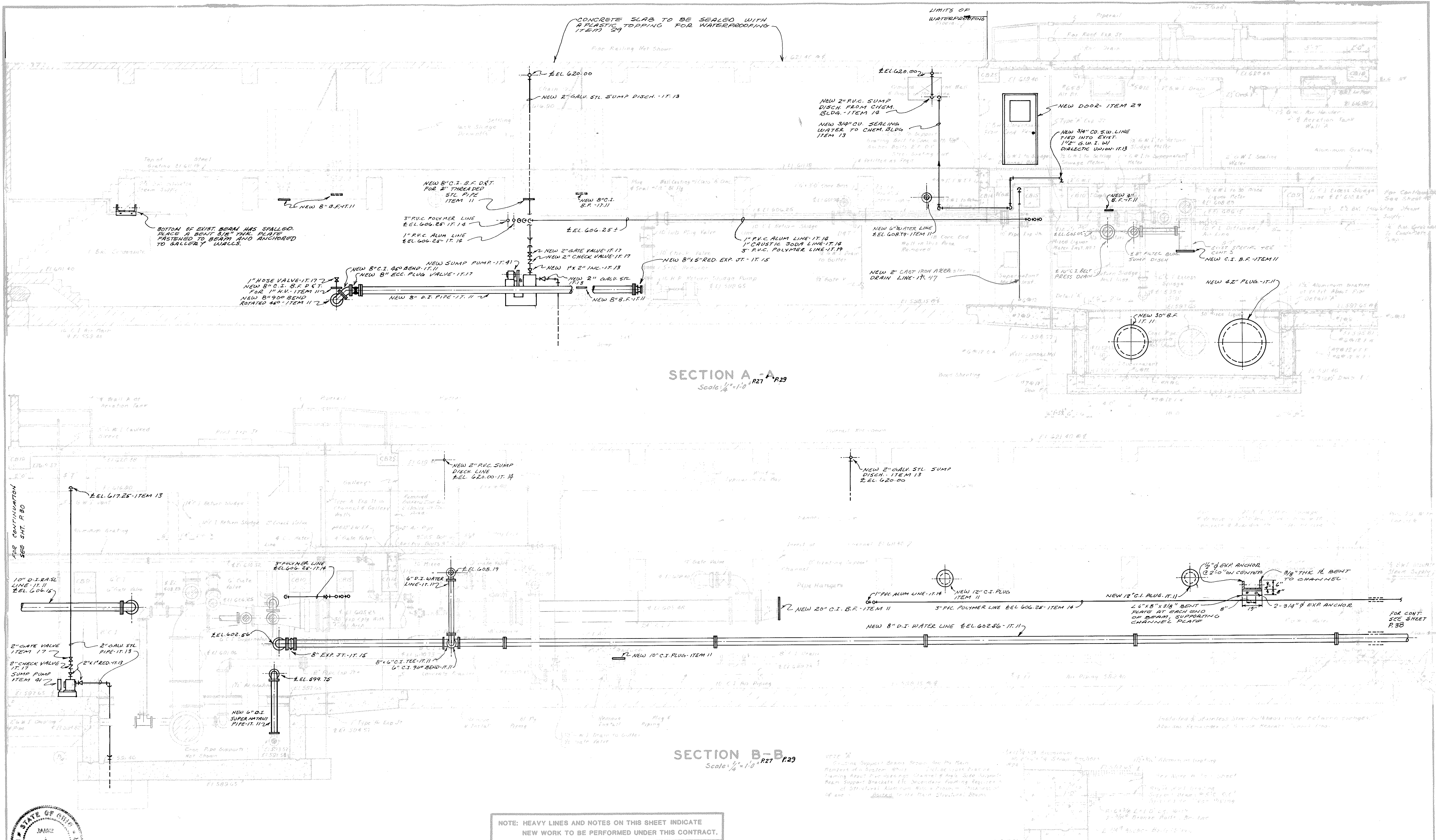
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SHEET NO.
P28/68



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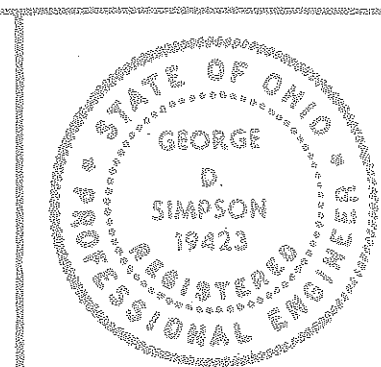
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REVISIONS

NO.	DESCRIPTION	DATE
3	NATIONAL - AS-BUILT	4-89
2	WILLIAMS & CO. - AS-BUILT	3-7-89
1	TINTON CORP. - AS-BUILT	1-31-89

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY JLB DRAWN BY JWD/RB
APPROVED BY R.W. KROZ
SUBMITTED BY J.D. Simpson
DATE 10-14-83

APPROVED BY Lonny J. Buttle
DATE 11-26-85

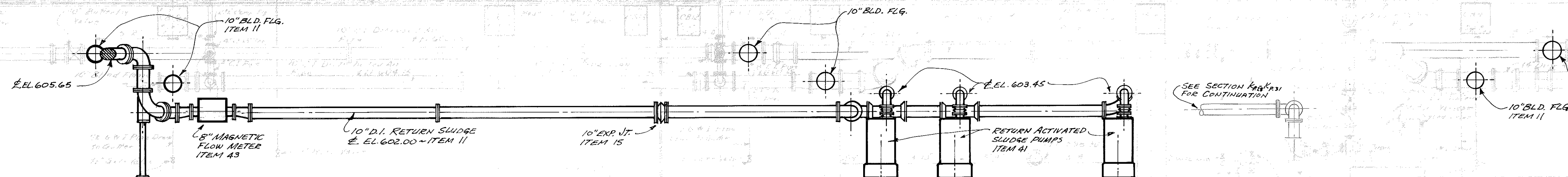
CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
REVISIONS TO
EXISTING AERATION PIPE GALLERY
SECTIONS - SOUTH HALF

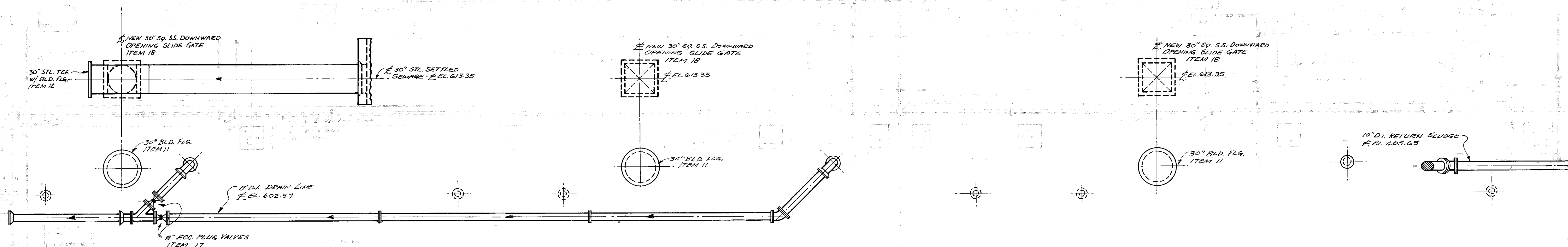
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SHEET NO. **R.29/68**

DETAIL 'A'
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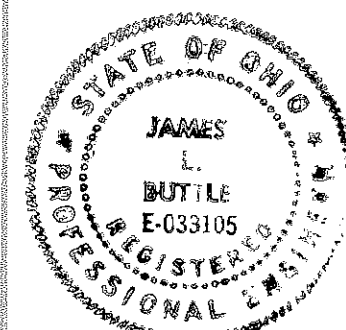


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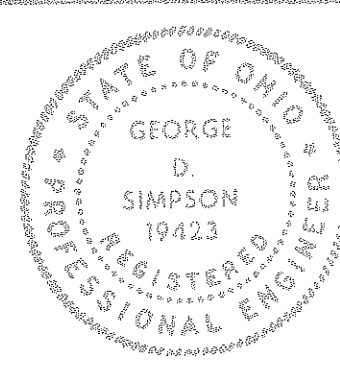
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NOTE: HEAVY LINES AND NOTES ON THIS SHEET INDICATE
NEW WORK TO BE PERFORMED UNDER THIS CONTRACT.



REVISED	AS BUILT	3-87
NO.	DESCRIPTION	DATE
REVISIONS		

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY JLB DRAWN BY JWQ/R28
APPROVED BY R.W. Krotz
SUBMITTED BY P.O. Simpson
DATE 10-14-83

APPROVED BY Lonny D. Shipp
DATE 11-26-85

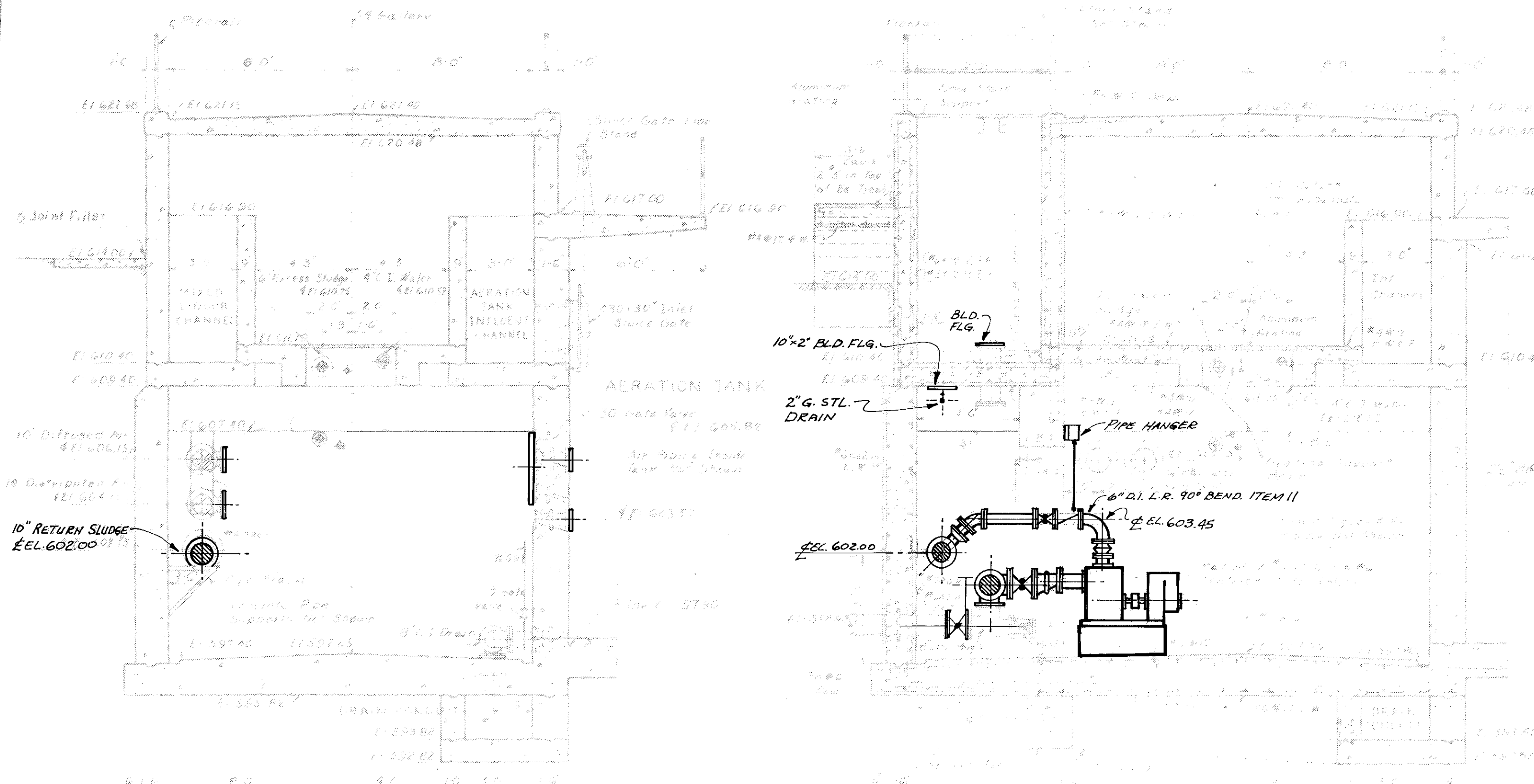
CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5

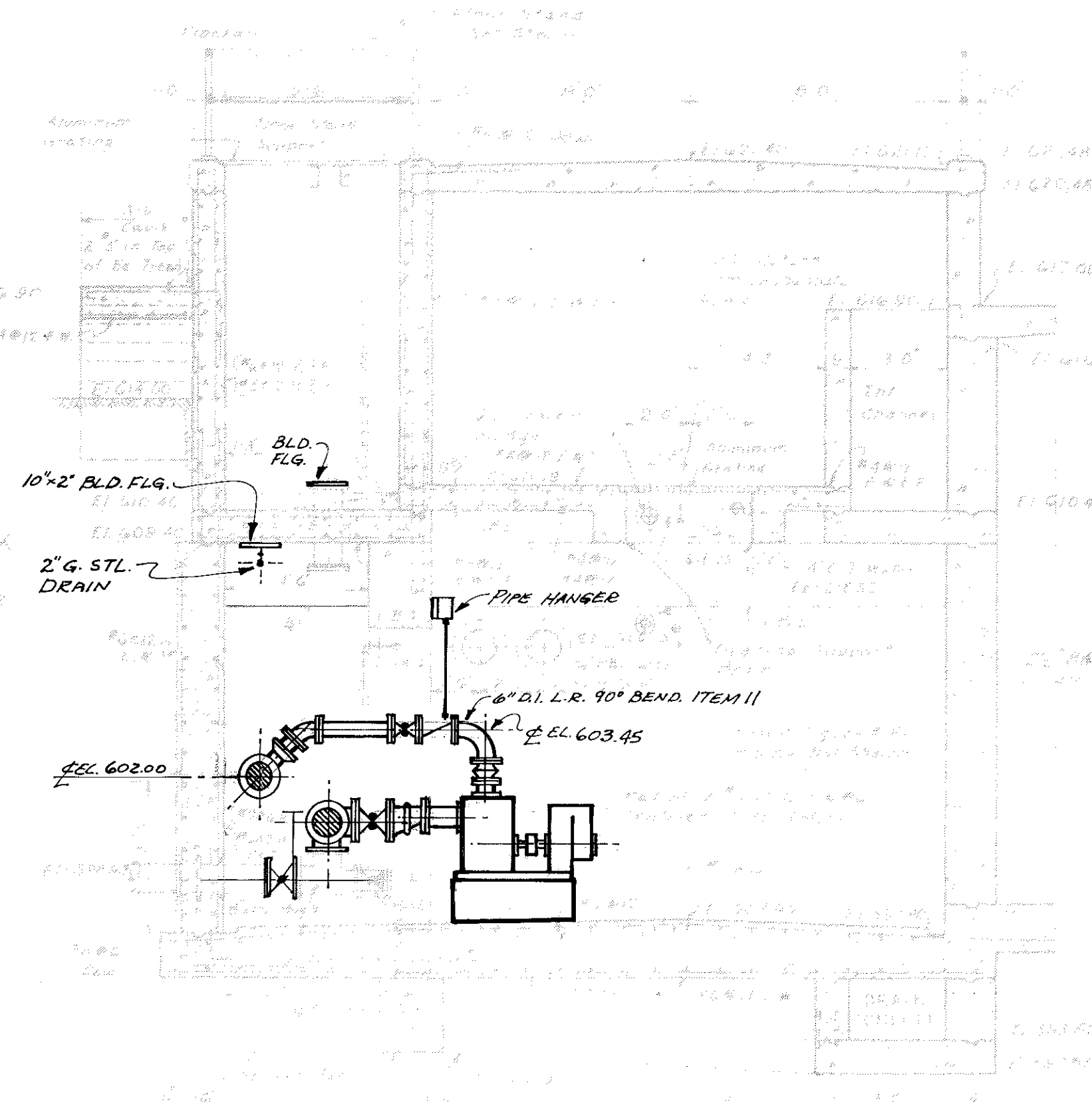
REVISIONS TO
EXISTING AERATION PIPE GALLERY
SECTIONS - NORTH HALF

RECORD DRAWING 1345-392

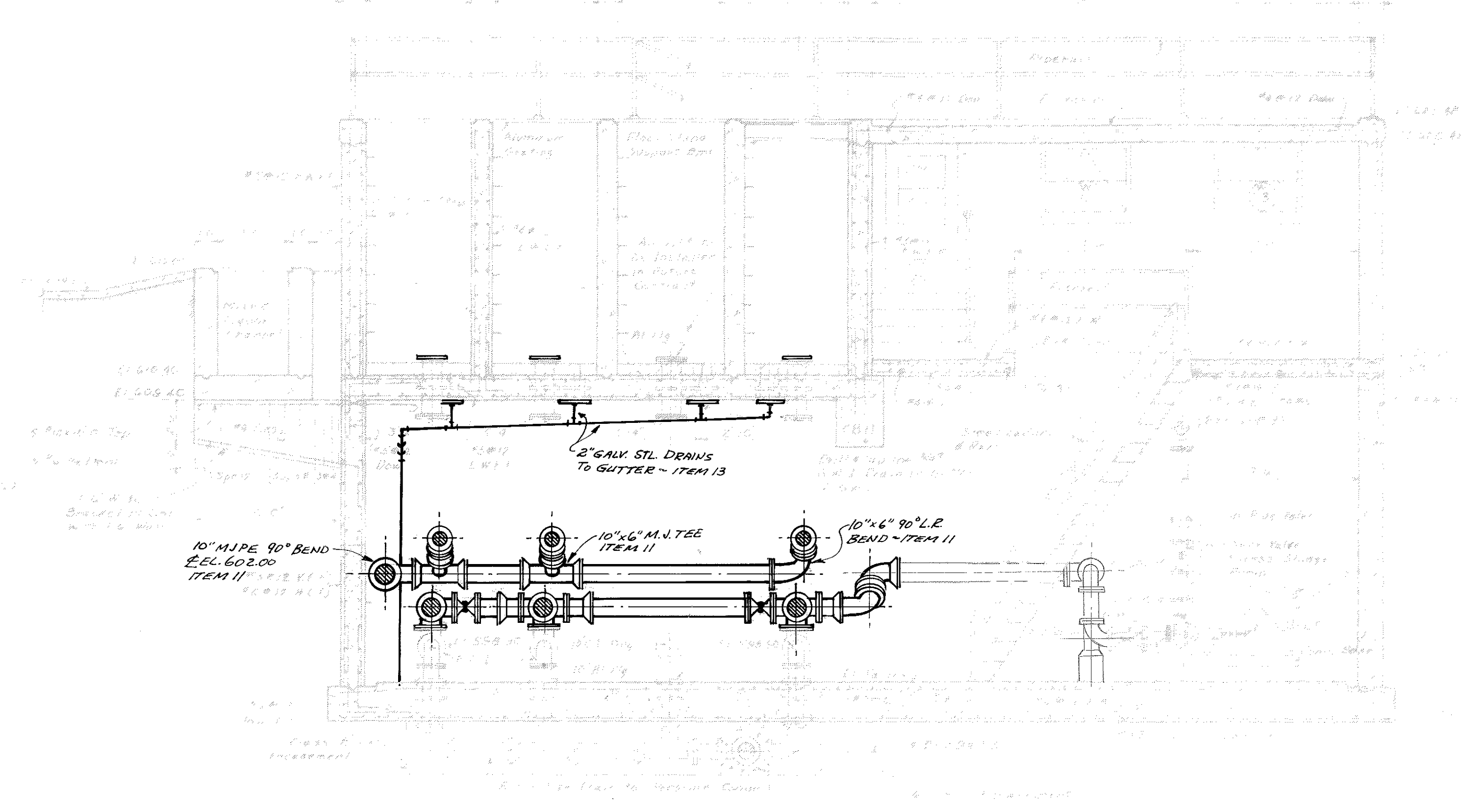
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FILE NO.
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SHEET NO.
P30/68



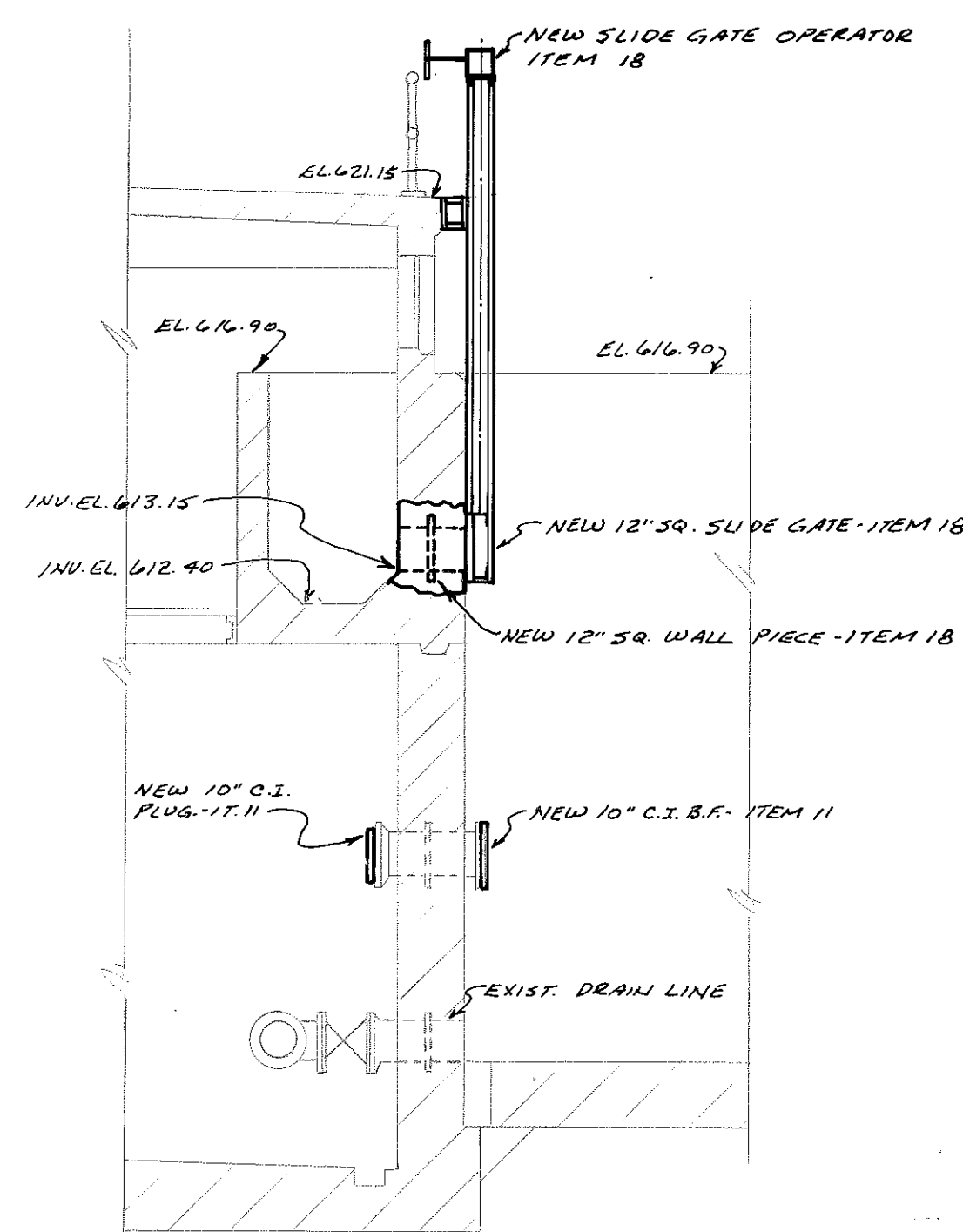
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Scale: 1/4" = 1'-0"
P28 P31



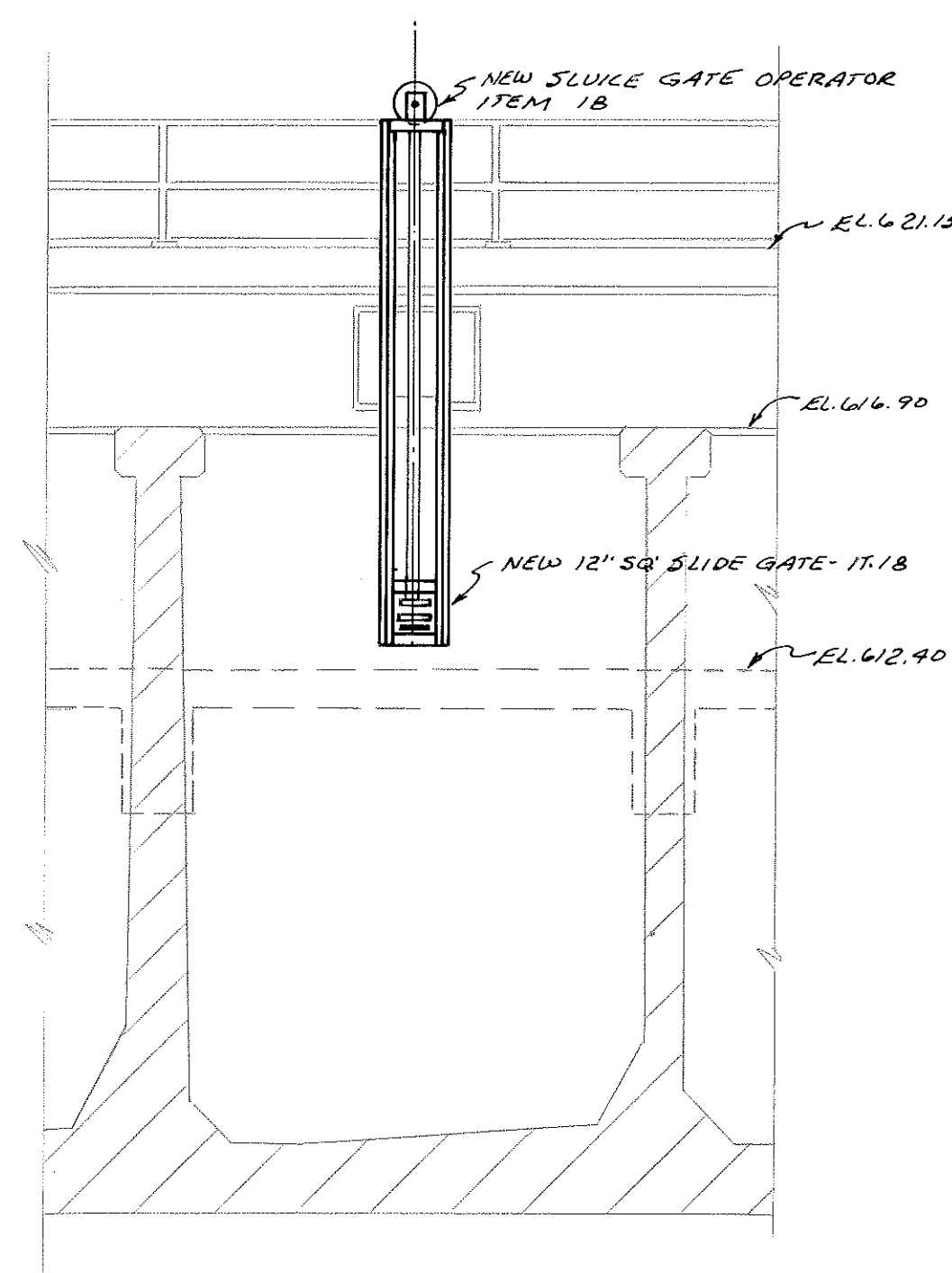
SECTION J-J
Scale: 1/4" = 1'-0"
P28 P31



SECTION K-K
Scale: 1/4" = 1'-0"
P28 P31

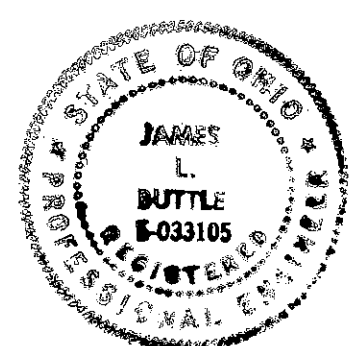


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P21 P31



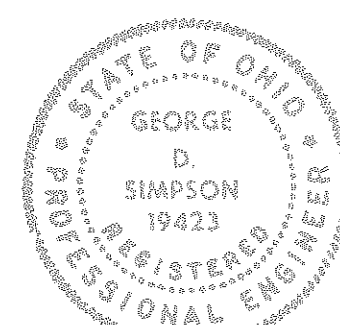
SECTION Y-Y
P21 P31

NOTE: HEAVY LINES AND NOTES ON THIS SHEET INDICATE
NEW WORK TO BE PERFORMED UNDER THIS CONTRACT.



James L. Buttle
Revised AS BUILT 3-89

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY JLB DRAWN BY JLB, RCB
APPROVED BY R.W. Krotz
SUBMITTED BY B.D. Simpson
DATE 10-14-83

APPROVED BY
Lenny Sherry
CITY ENGINEER

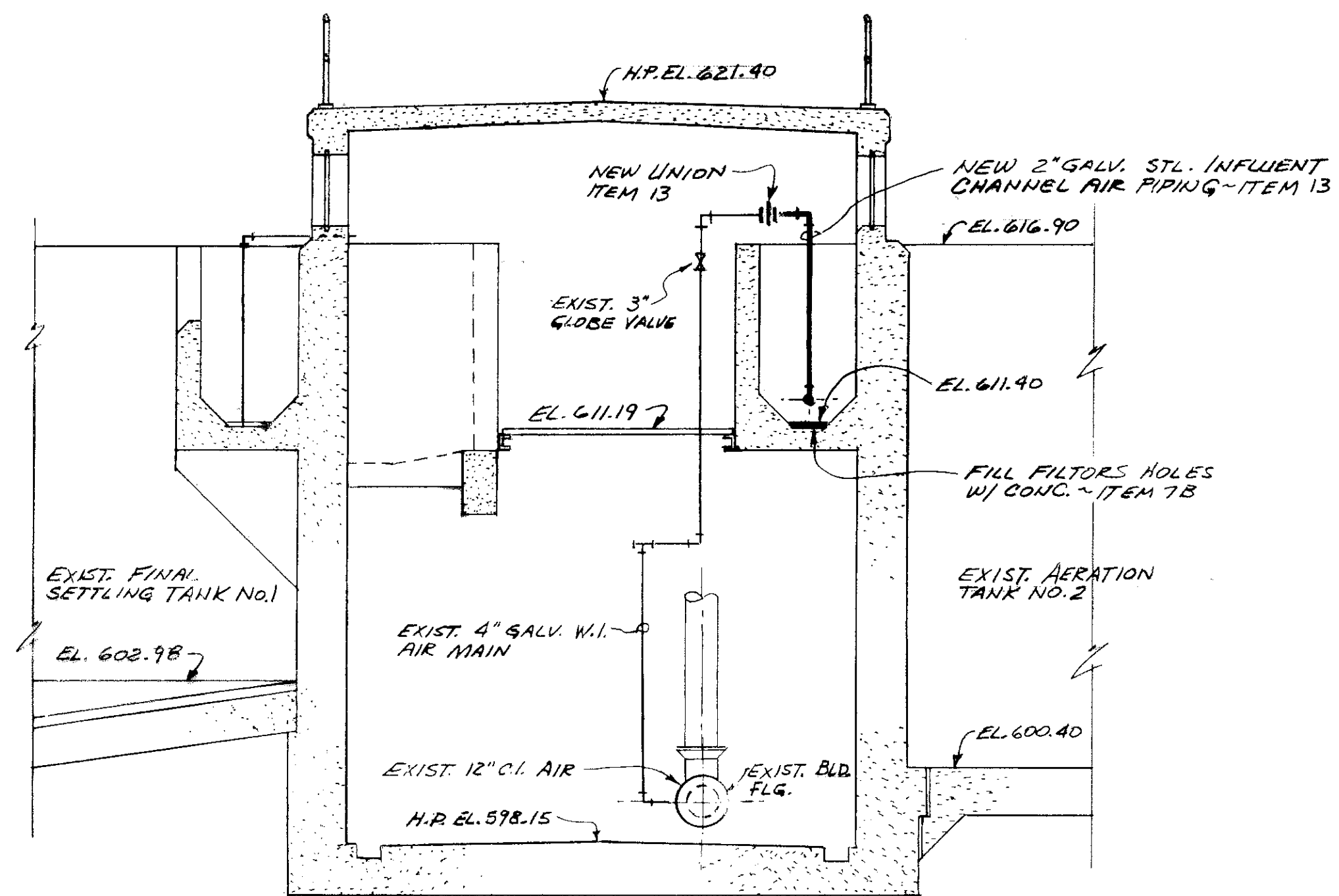
CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5

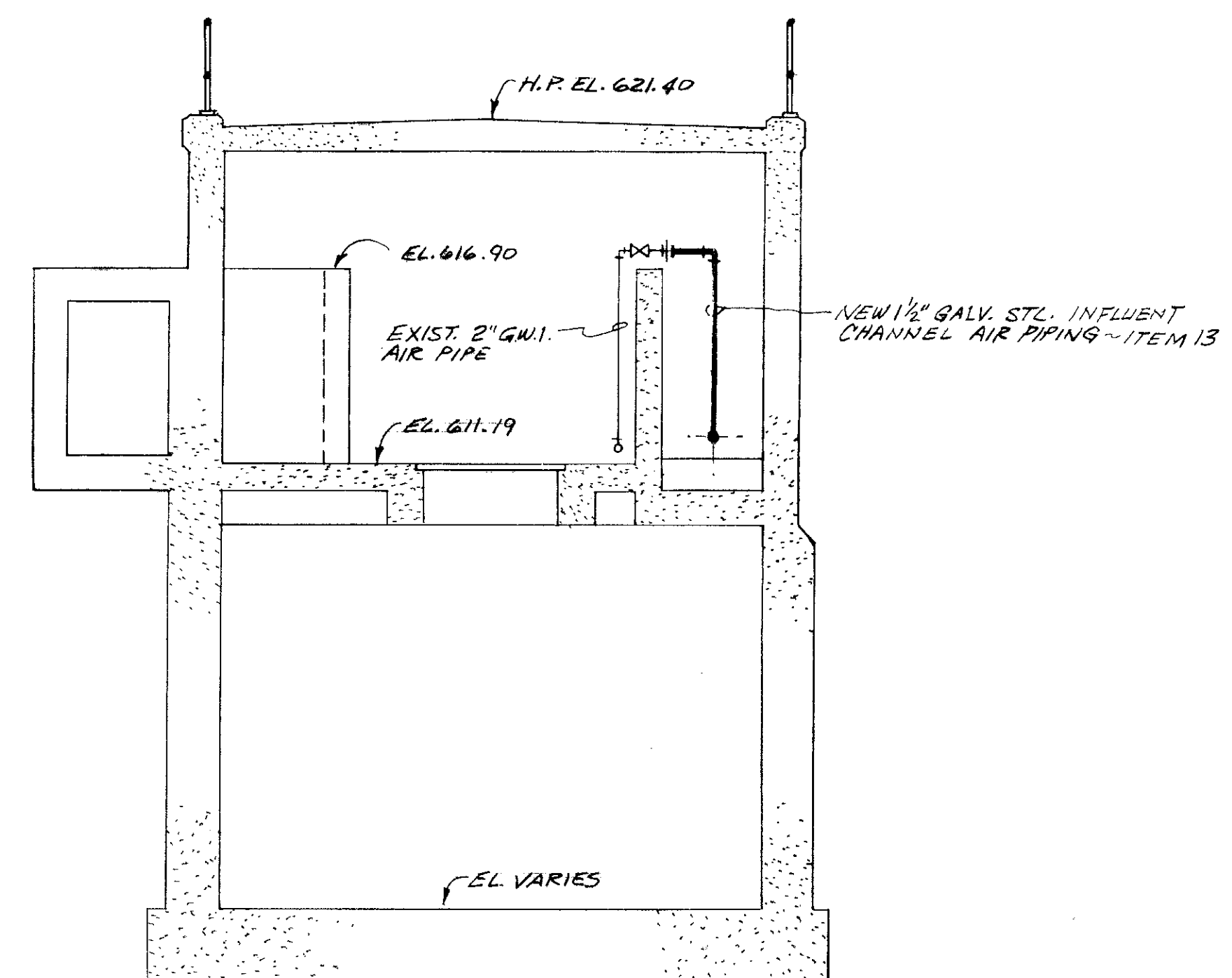
REVISIONS TO
EXISTING AERATION PIPE GALLERY
SECTIONS

RECORD DRAWING

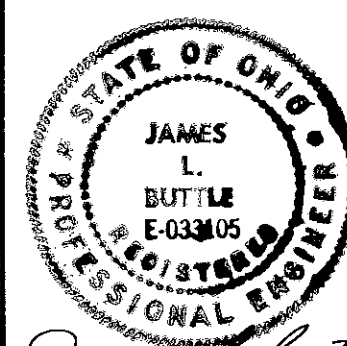
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SCALE
AS SHOWN
FILE NO.
1430-5.147
SHEET NO.
P.31 / 68



SECTION R₁₅ - R₃₂

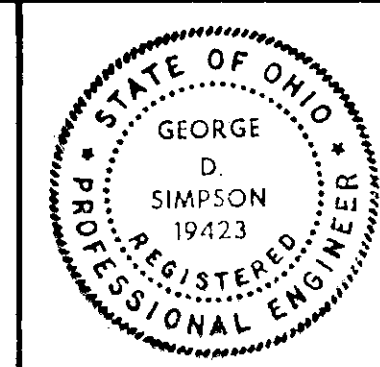
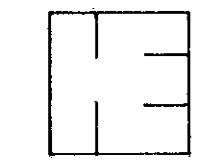


SECTION S₁₅ - S₃₂



Revised As Built 3-89		
NO.	DESCRIPTION	DATE
REVISIONS		

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY WLB DRAWN BY WLB, JV
 APPROVED BY R.W. Krotz
 SUBMITTED BY L.D. Simpson
 HAVENS AND EMERSON INC.
 DATE 10-14-83

APPROVED BY
Louise M. Lewis
 CITY ENGINEER
 DATE 11-26-83

CITY OF ELYRIA, OHIO
 DEPARTMENT OF PUBLIC SERVICE
 WATER POLLUTION CONTROL PLANT
 IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
 CONTRACT 5
 REVISIONS TO EXISTING AERATION
 PIPE GALLERY - SECTIONS

SCALE 1/4" = 1'-0"
FILE NO. 1430- 5.148
SHEET NO. P.32/68

RECORD DRAWING

1345-394

INSTRUMENT IDENTIFICATION LEGEND

CX	COMPARATOR	OE	DISSOLVED OXYGEN SENSOR
DI	DENSITY INDICATOR	OI	DISSOLVED OXYGEN INDICATOR
DET	DENSITY INDICATING TRANSMITTER	OT	DISSOLVED OXYGEN TRANSMITTER
DT	DENSITY TRANSMITTER	PE	PRESSURE SENSOR
FE	FLOW SENSOR	PHA	HIGH PRESSURE ALARM
FMS	HIGH FLOW SWITCH	PHIC	PH INDICATING CONTROLLER
FI	FLOW INDICATOR	PHRC	PH RECORDING CONTROLLER
FIC	FLOW INDICATING CONTROLLER	PI	PRESSURE GAUGE
FIRC	FLOW INDICATING RATIO CONTROLLER	PHE	PH SENSOR
FIRO	FLOW INDICATING RECORDING TOTALIZER	PHI	PH INDICATOR
FIQ	FLOW INDICATING TOTALIZER	PHT	PH TRANSMITTER
FIT	FLOW INDICATING TRANSMIT	PIC	PRESSURE INDICATING CONTROLLER
FLA	LOW FLOW ALARM	PDI	DIFFERENTIAL PRESSURE INDICATOR
FLS	LOW FLOW SWITCH	PLA	LOW PRESSURE ALARM
FQ	FLOW TOTALIZER	PS	PRESSURE SWITCH
FRC	FLOW RATIO CONTROLLER	PDS	DIFFERENTIAL PRESSURE SWITCH
FRRC	FLOW RECORDING RATIO CONTROLLER	PDSH	HIGH DIFFERENTIAL PRESSURE SWITCH
FRQ	FLOW RECORDER TOTALIZER	PDA	DIFFERENTIAL PRESSURE ALARM
FT	FLOW TRANSMITTER	PSH	HIGH PRESSURE SWITCH
FY	FLOW COMPUTATION	PDE	DIFFERENTIAL PRESSURE SENSOR
HSB	VALVE STOP/INTERMEDIATE P.B.	PDT	DIFFERENTIAL PRESSURE TRANSMITTER
HCS	SPEED CONTROLLER	PSL	LOW PRESSURE SWITCH
HSCO	CLOSES/DEC. MOMENTARY P.B.	PT	PRESSURE TRANSMITTER
HSCN	OPEN/INC. MOMENTARY P.B.	SI	SPEED INDICATOR
HSM	MODE (H-O-A) SELECTOR	SICR	SPEED INDICATING RATIO CONTROLLER
HSMX	MODE (H-O-A) SELECTOR WITH LOCKOUT	TE	TEMPERATURE SENSOR
HSN	START/OPEN P.B. OR SWITCH	THA	HIGH TEMPERATURE ALARM
HSNH	HIGH SPEED START/OPEN P.B. OR SWITCH	TI	TEMPERATURE INDICATOR
HSNL	LOW SPEED START/OPEN P.B. OR SWITCH	TIC	TEMPERATURE INDICATOR CONTROLLER
HSPR	PRESSURE RESET SWITCH	TT	TEMPERATURE TRANSMITTER
HSTR	TEMPERATURE RESET SWITCH	VS	VIBRATION SWITCH
HSYR	TORQUE OVERLOAD RESET SWITCH	VSA	VIBRATION SWITCH ALARM
HS	SELECTOR SWITCH	XAPH	HIGH OIL PRESSURE ALARM
HSS	SELECTOR SWITCH (LOCAL/REMOTE)	XAPL	LOW OIL PRESSURE ALARM
HST	MANUAL SELECTOR SWITCH (TANK)	XIL	OIL LEVEL INDICATOR
HSO	STOP/CLOSE P.B. OR SWITCH	XIP	OIL PRESSURE INDICATOR
HSOX	STOP/CLOSE P.B. OR SWITCH WITH LOCKOUT	XITI	OIL COOLER INLET TEMPERATURE INDICATOR
HCZ	STROKE POSITION CONTROL	XITO	OIL COOLER OUTLET TEMPERATURE INDICATOR
IAS	AMMETER SURGE ALARM	XATO	OIL COOLER OUTLET TEMPERATURE ALARM
II	INDICATING AMMETER	XLI	OIL LEVEL GAUGE
KC	TIMER	XSPH	HIGH OIL PRESSURE SWITCH
KCN	'ON' CONTROL TIMER	XSPL	LOW OIL PRESSURE SWITCH
KCO	'OFF' CONTROL TIMER	XSTO	OIL COOLER OUTLET TEMPERATURE SWITCH
KI	ELAPSED TIME METER	YHA	HIGH TORQUE ALARM
LC	LEVEL CONTROLLER	YS	TORQUE SWITCH (TO REMOTE INSTR.)
LE	LEVEL SENSOR	YSR	TORQUE RESET SWITCH
LHA	HIGH LEVEL ALARM	YSO	TORQUE SHUTDOWN SWITCH (NO ACCOMPANYING REMOTE INSTRUMENTATION)
LHS	HIGH LEVEL SWITCH	ZE	POSITION SENSOR
LI	LEVEL INDICATOR	ZI	POSITION INDICATOR (VALVE, GATE, ETC.)
LIC	LEVEL INDICATING CONTROLLER	ZLA	ALARM LIGHT
LLA	LOW LEVEL ALARM	ZLN	RUN/OPEN LIGHT
LLS	LOW LEVEL SWITCH	ZLNH	HIGH SPEED RUN LIGHT
LR	LEVEL RECORDER	ZLNL	LOW SPEED RUN LIGHT
LS	LEVEL SWITCH	ZLO	STOP/CLOSED LIGHT
LST	SLUDGE LEVEL TRANSMITTER	ZSR	RESET SWITCH
LT	LEVEL TRANSMITTER		

GENERAL NOTE:

THE SYMBOLS USED ON THE PROCESS & INSTRUMENTATION DRAWINGS TO DESIGNATE THE DIFFERENT VALVE TYPES, METER, H.P., ETC. MAY NOT DENOTE THE SAME AS CALLED FOR IN THE SPEC. OR SHOWN ON THE PROCESS DRAWINGS. THOSE VALVE TYPES, ETC. CALLED FOR IN THE SPEC. SUPERSEDE THOSE SHOWN ON THE PROCESS DRAWINGS. WHEREAS THOSE SHOWN ON THE PROCESS DRAWINGS SUPERSEDE THOSE ON THE P & ID. THE LOCATION HEREON OF VALVES, METERS, SAMPLERS, ETC. ARE SCHEMATIC ONLY. FOR THE CORRECT LOCATION SEE THE PROCESS DRAWINGS. LIKEWISE, FOR THE CORRECT LINE SIZES AND MATERIALS, SEE THE PROCESS DRAWINGS.

INSTRUMENTATION SYMBOLLOGY

Symbol	Designation
	VALVES AND COCKS
	Air and Vacuum
	Air Cock
	Air Cock with Nose Connection
	Air Release
	Ball
	Butterfly
	Check
	Cone
	Diaphragm
	Eccentric Plug
	Float
	Four Way
	Gate
	Hose
	Knife
	Lubricated Plug - Long Pattern
	Lubricated Plug - Short Pattern
	Metering Pump
	Needle
	Pinch
	Pressure Reducing
	Pressure Relief
	PVC Ball
	PVC Check
	Safety
	Slide
	Solenoid
	Telescoping
	Three Way
	Vacuum Relief
	Plug Drain Valve
	Shear Gate
	VALVE OPERATORS
	Diaphragm
	Electrical
	Hydraulic
	Pneumatic
	GAS AND LIQUID PUMPS
	Air Lift
	Blower or Fan
	Centrifugal Pump
	Compressor
	Duplex Pump
	Metering Pump
	Plunger Pump
	Propeller Pump
	Progressive Cavity Pump
	Torque Flow Pump
	Vacuum Pump
	GATES
	Stop Plank
	Slide
	Stuice
	Weir

PROCESS FLOW STREAM LEGEND

ACID	ACID	OF	OVERFLOW
AA	AERATION AIR	OZ	OZONE
AIR	AIR	PSW	PLANT SERVICE WATER
ALUM	ALUMINUM SULFATE	POL	POLYELECTROLYTE (POLYMER)
APOL	ANIONIC POLYMER	PF	PRESSURIZED FLOW
ASH	ASH SLURRY	PSK	PRIMARY SKIMMINGS
BO	BLOWOFF	PSL	PRIMARY SLUDGE
BSL	BOTTOM SLUDGE	RS	RAW SEWAGE
BY	BYPASS	RSL	RAW SLUDGE
C	CARBON	RW	RAW WATER
CB	CORE BLOW	RASL	RETURN ACTIVATED SLUDGE
CPOL	CATIONIC POLYMER	REC	RECIRCULATION
CH	CHEMICAL	RNSL	RETURN NITRIFIED SLUDGE
CLSW	CLORINATED SERVICE WATER	RD	ROOF DRAIN
CLG	CHLORINE GAS	SAN	SANITARY SEWER
CL	CHLORINE LIQUID	SC	SCUM (CONCENTRATED)
CLS	CHLORINE SOLUTION	SLW	SEALING WATER
CO	CLEANOUT	SE	SECONDARY EFFLUENT
CW	COLD WATER	SSK	SECONDARY SKIMMINGS
CA	COMPRESSED AIR	SS	SETTLED SEWAGE
CSL	CONDITIONED SLUDGE	SL	SLUDGE
DSL	DIGESTED SLUDGE	CK	SLUDGE CAKE
DGAS	DIGESTER GAS	SLR	SLUDGE RETURN
DSUP	DIGESTER SUPERNATANT	SLTR	SLUDGE TRANSFER
DS	DOWNSPOUT	STM	STEAM
D	DRAIN	STD	STORM DRAIN
EO	EMERGENCY OVERFLOW	ST	STORMWATER
FCL	FERRIC CHLORIDE	SUB	SUBNATANT
FT	FILTRATE	SUP	SUPERNATANT
FE	FINAL EFFLUENT	TPE	TRICKLING FILTER EFFLUENT
FSE	FIRST STAGE EFFLUENT	ISL	THICKENED SLUDGE
FD	FLOOR DRAIN	TPSL	THICKENED PRIMARY SLUDGE
FOIL	FUEL OIL	TSSL	THICKENED SECONDARY SLUDGE
FSSK	FIRST STAGE SKIMMINGS	TMSL	THICKENED MIXED SLUDGE
GAS	GAS (NATURAL)	V	VACUUM
G	GRIT	VC	VACUUM CLEANING
HW	HOT WATER	VT	VENT
HWR	HOT WATER RETURN	WASH	WASHWATER
HWS	HOT WATER SUPPLY	WASL	WASTE ACTIVATED SLUDGE
IA	INSTRUMENT AIR	WMSL	WASTE NITRIFIED SLUDGE
L	LIME	WW	WASTEWATER
LS	LIME SLURRY	W	WATER (POTABLE)
ML	MIXED LIQUOR	HSL	HEATED SLUDGE
NL	NITRIFIED LIQUOR	RCSL	RECIRCULATED SLUDGE
		DPOL	POLYELECTROLYTE (POLYMER) DEWATERING
		WMT	WET WEATHER STORAGE TANK

GENERAL INSTRUMENT SYMBOLS

	LOCALLY MOUNTED
	REMOVED MOUNTED FRONT OF PANEL CP-1
	REMOVED MOUNTED REAR OF PANEL CP-2

STANDARD EQUIPMENT DESIGNATORS

B	BLOWER
C	COLLECTOR
G	GATE
M	METER
P	PUMP
V	VALVE
X	OTHER



PIPING SYMBOLS

PIPING SYMBOLS

SCALE DRAWING REPRESENTATION

FLANGED JOINT
BAS JOINT
COMPRESSION JOINT
MECH. JOINT
LOCKED MECH. JOINT (WITH GROOVE)
DRESSER CPLG.
SCREWED JOINT
PIPE EXPANSION COUPLING
WELDED PIPE



VALVE SYMBOLS

VALVE OPERATING LEGEND

W	WRENCH OPERATED
WX	WRENCH OPERATED, WITH EXTENSION STEM
WG	WORM GEAR OPERATED
SG	SPUR GEAR OPERATED
FS	FLOOR STAND OPERATED
HW	HAND WHEEL OPERATED
CW	CHAIN WHEEL OPERATED
C	CYLINDER OPERATED
S	SOLENOID OPERATED
M	MOTOR OPERATED
A	AIR OPERATED
L	LEVER OPERATED

EXAMPLES

	HAND WHEEL OPERATED GATE VALVE
	WORM GEAR OPERATED SHORT PATTERN LUB. PLUG VALVE
	SPUR GEAR, FLOOR STAND OPERATED LONG PATTERN LUB. PLUG VALVE

EQUIPMENT AND VALVE IDENTIFICATION SYMBOLS

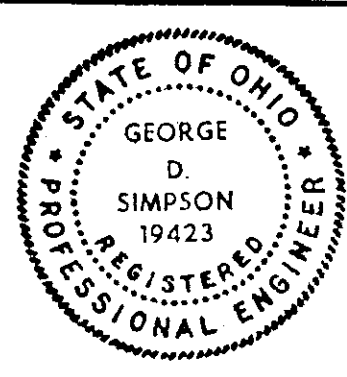
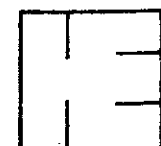
EXAMPLE:	AIR-M004-02
PROCESS FLOW STREAM	
EQUIPMENT TYPE	
SEQUENTIAL EQUIPMENT NO.	
PARALLEL UNIT FACILITY NO.	

e.g. THE FOURTH AERATION AIR METER IN THE PROCESS SEQUENCE SERVING THE 2nd TANK.

RECORD DRAWING

1345-420

AS	Built	3-87
NO.	DESCRIPTION	DATE
REVISIONS		

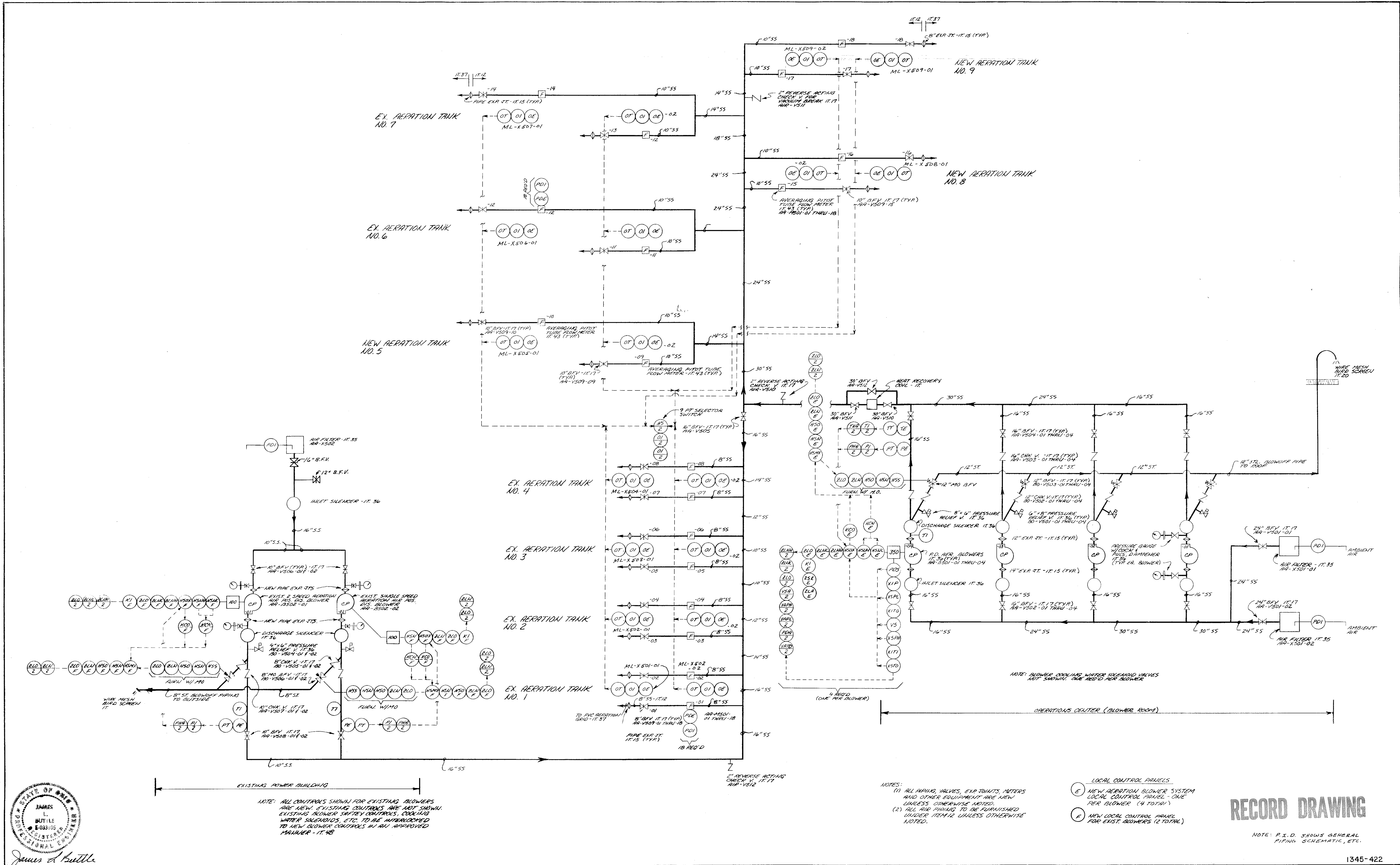
HAVENS AND EMERSON INC.
CONSULTING ENGINEERS

DESIGNED BY JLB DRAWN BY MR
APPROVED BY R.W. KROZ
SUBMITTED BY J.D. Simpson
DATE 10-14-83

APPROVED BY

James D. Riddle
CITY ENGINEER

DATE 11-26-85CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICEWATER POLLUTION CONTROL PLANT
IMPROVEMENTSSECONDARY TREATMENT EXPANSION
CONTRACT 5PROCESS AND INSTRUMENTATION
LEGENDS AND SYMBOLSSCALE
NONEFILE NO.
1430-5.175SHEET NO.
P.59/68



REVISIONS

NO.	DESCRIPTION	DATE
1	AS BUILT	3-87

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS

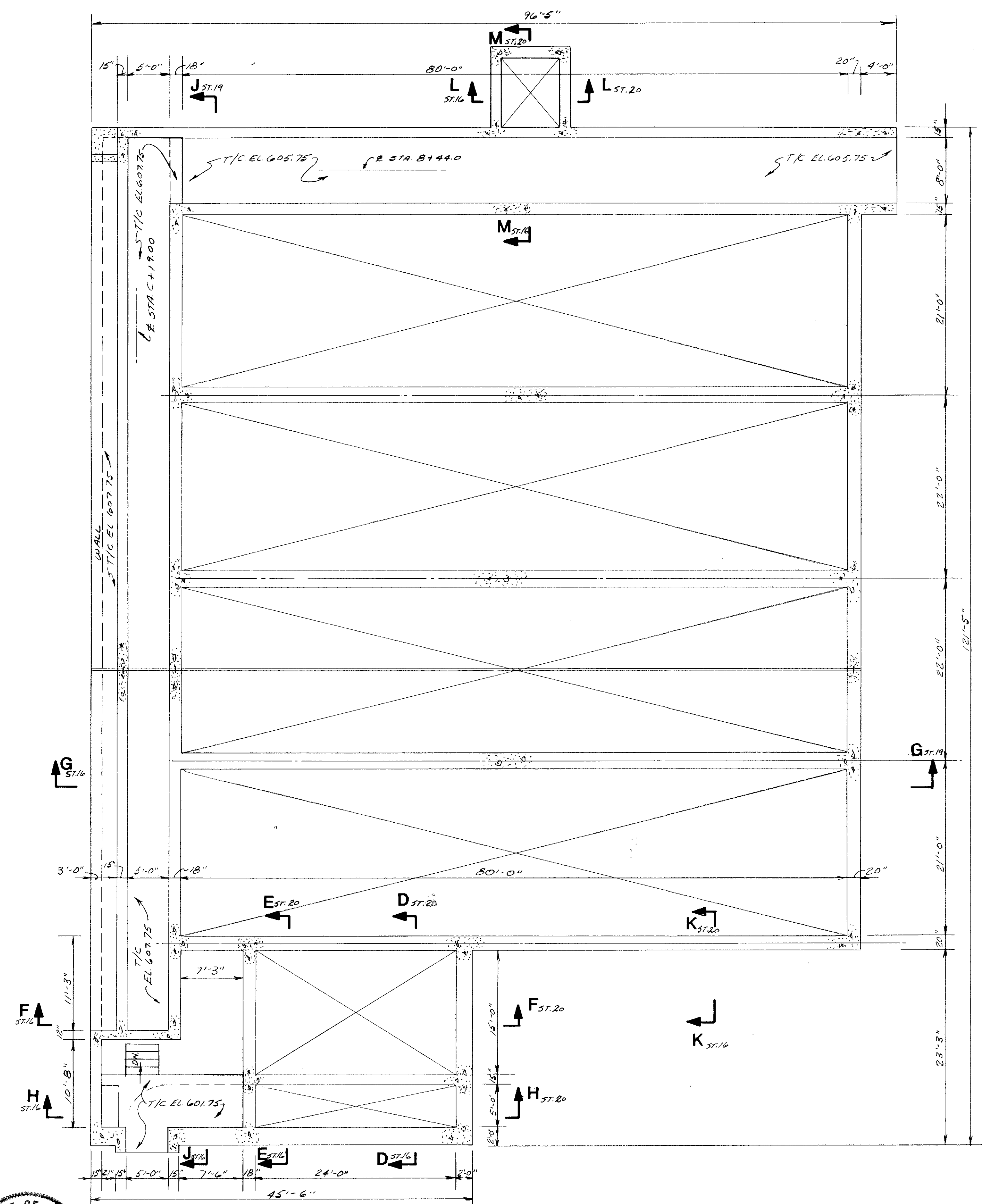
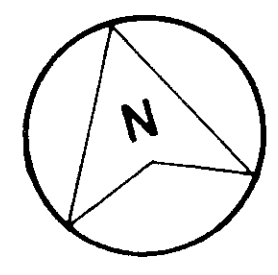
DESIGNED BY *R.A.* DRAWN BY *M.R.*
APPROVED BY *R.W. KROTZ*
SUBMITTED BY *D.B. Simpson*
DATE *10-14-83*

APPROVED BY *James A. Buttle*
DATE *11-26-85*

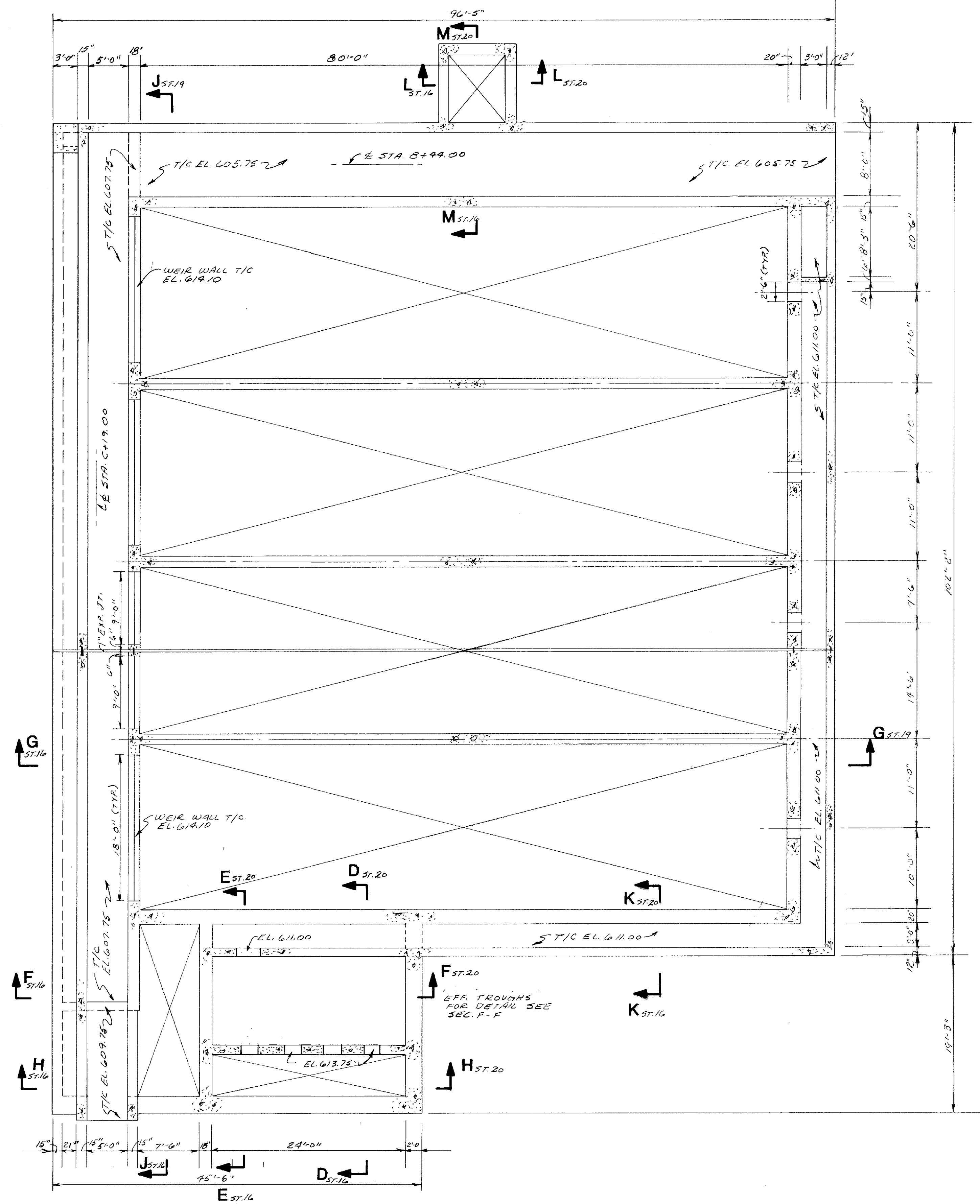
CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
DIFFUSED AERATION SYSTEM
PROCESS AND INSTRUMENTATION DIAGRAM

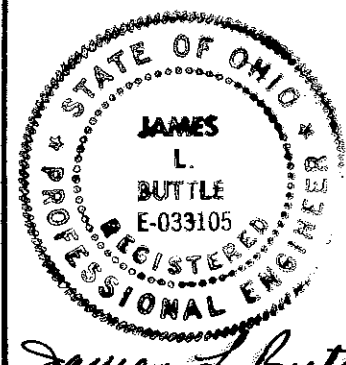
SCALE
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FILE NO.
1430-5.177
SHEET NO.
P. 61/68



PLAN AT EL. 607.75

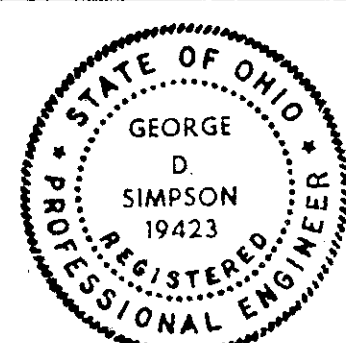
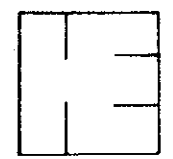


PLAN AT EL. 615.00



James A. Russo			
	Revised As Built		3-89
NO.	DESCRIPTION	DATE	
REVISIONS			

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY HNS DRAWN BY RCB
APPROVED BY E.W. Korte
SUBMITTED BY B.D. Simpson
DATE 10-14-83

APPROVED BY James L. Buttle
DATE 11-26-85

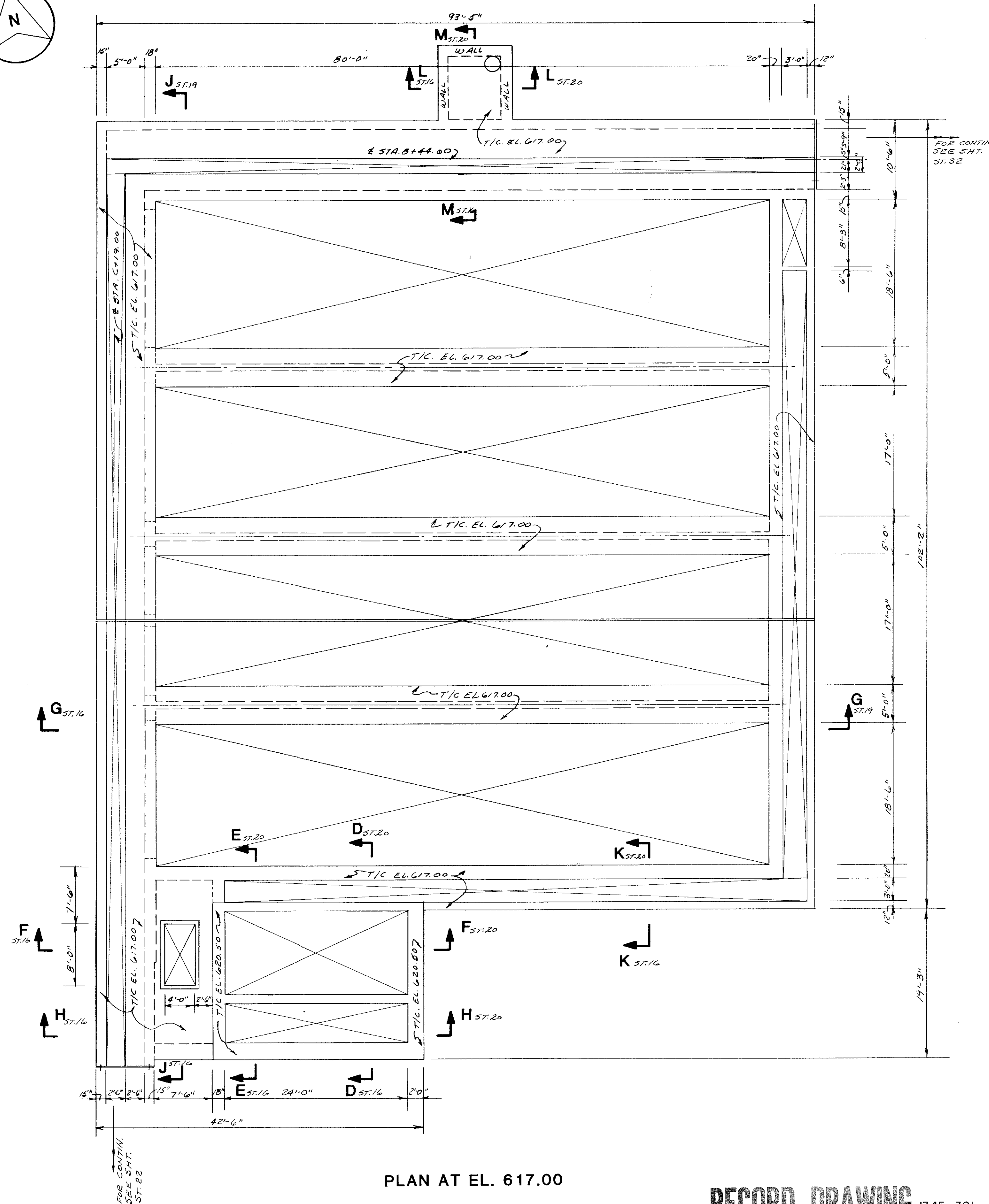
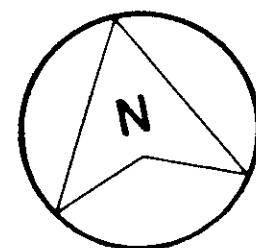
CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
STRUCTURAL
AERATION TANKS NO. 8 & 9
PLANS

RECORD DRAWING

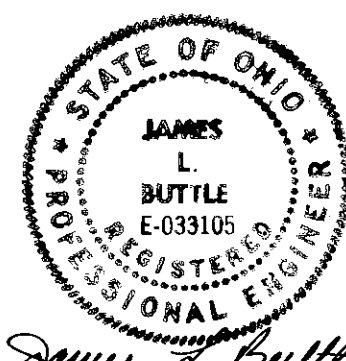
1345-300

SCALE
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FILE NO.
1430-5.054
SHEET NO.
ST.17/49



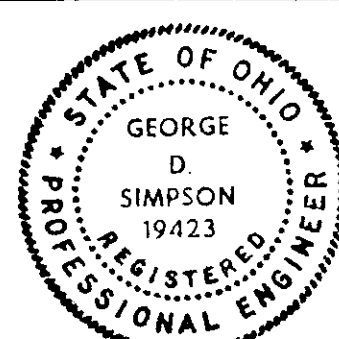
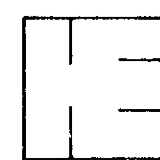
PLAN AT EL. 617.00

RECORD DRAWING 1345-301



NO.	DESCRIPTION	DATE
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HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



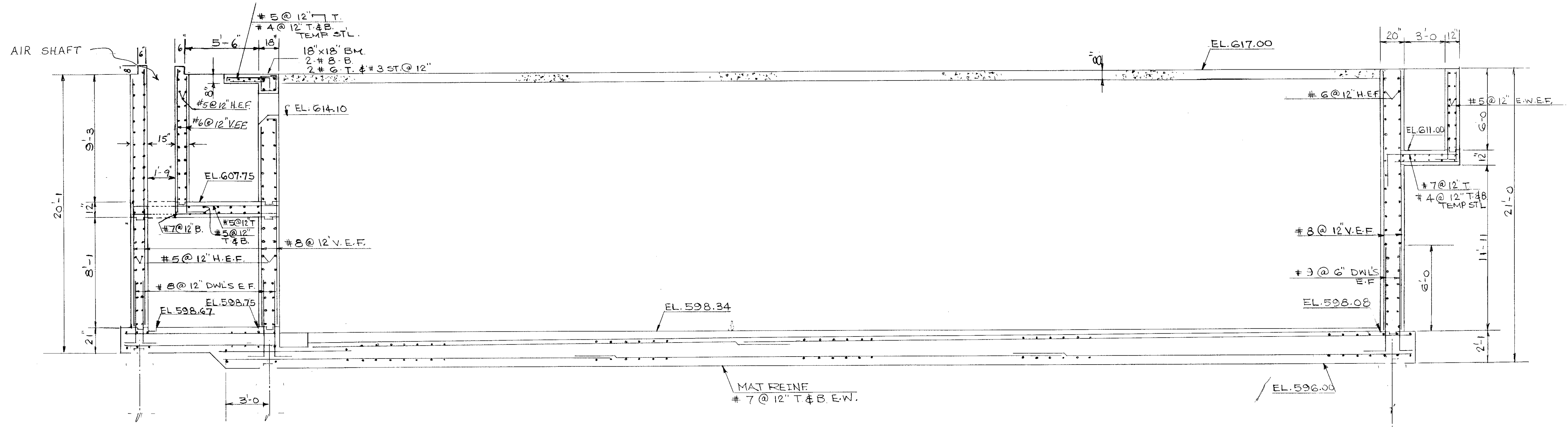
DESIGNED BY HNS DRAWN BY RCB
APPROVED BY R.W. Keote
SUBMITTED BY J.D. Simpson
HAVENS AND EMERSON INC.
DATE 10-14-83

APPROVED BY James L. Buttle
CITY ENGINEER
DATE 11-26-85

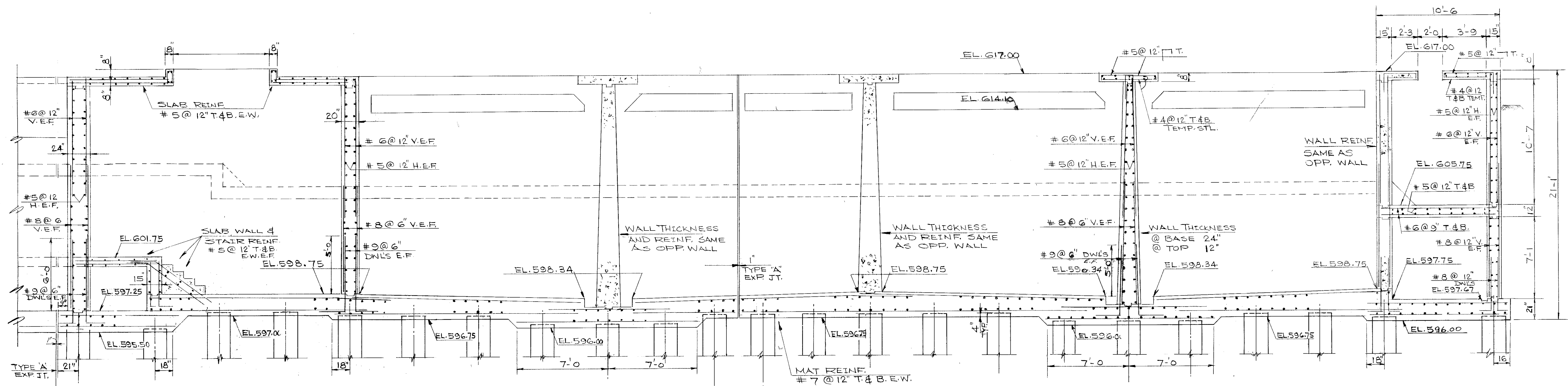
CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
STRUCTURAL
AERATION TANKS NO. 8 & 9
PLAN

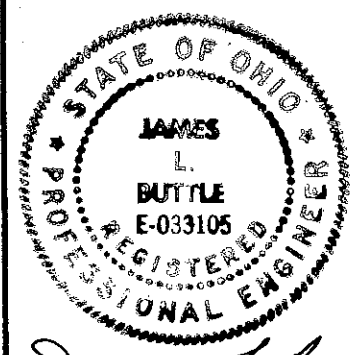
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FILE NO.
1430-5.055
SHEET NO.
ST. 18 / 49



SECTION G-G ST. 19



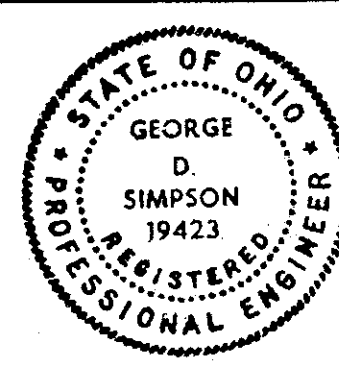
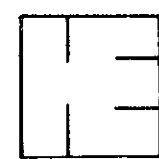
SECTION J-J ST. 19



James L. Buttle

NO.	DESCRIPTION	DATE
1	REVISED AS BUILT	3-87

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY HNS DRAWN BY RCB
APPROVED BY *R.W. Korte*
SUBMITTED BY *G.D. Simpson*
DATE 10-14-83

APPROVED BY *James L. Buttle*
DATE 11-26-85

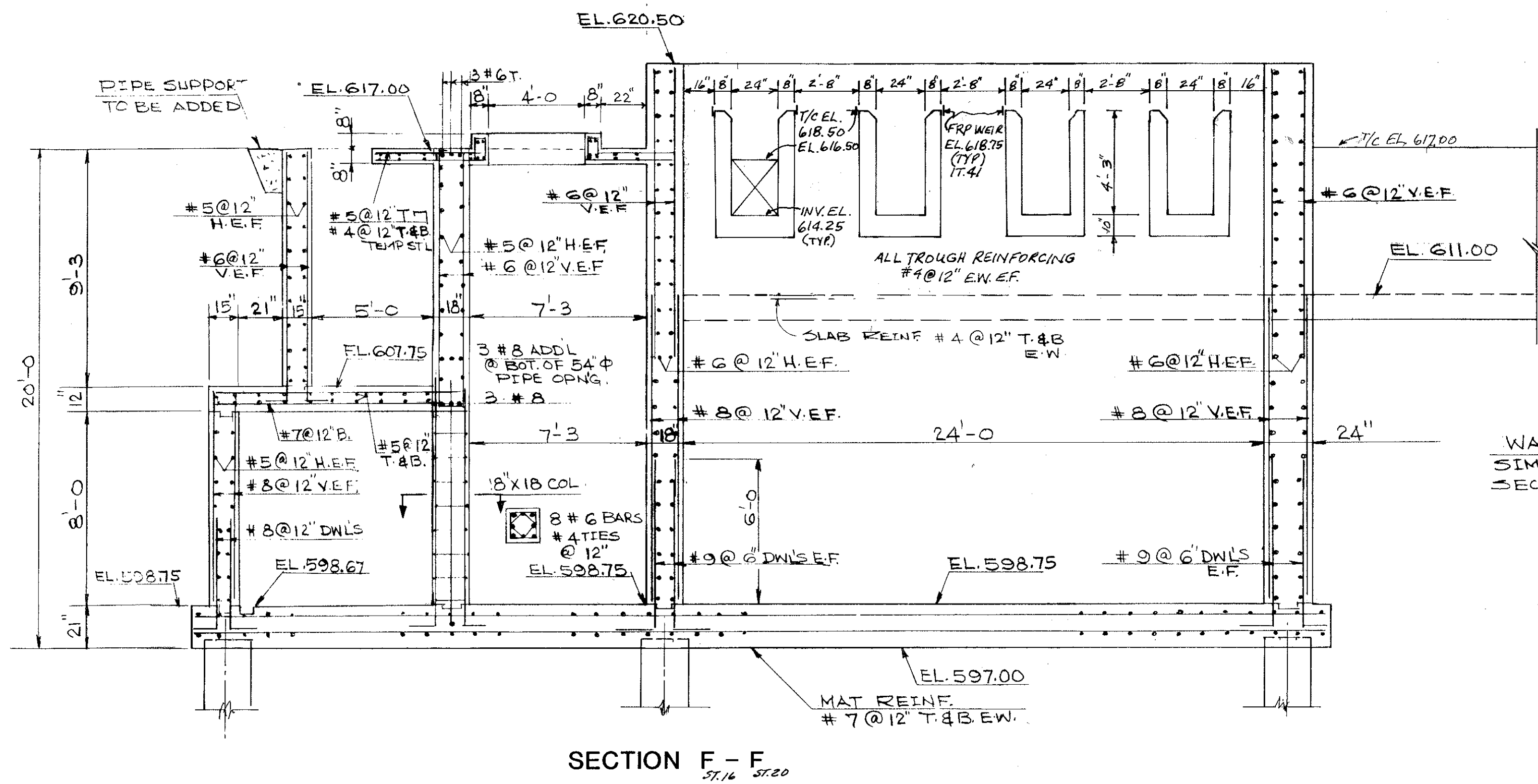
CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
STRUCTURAL
AERATION TANKS NO. 8 & 9
SECTIONS

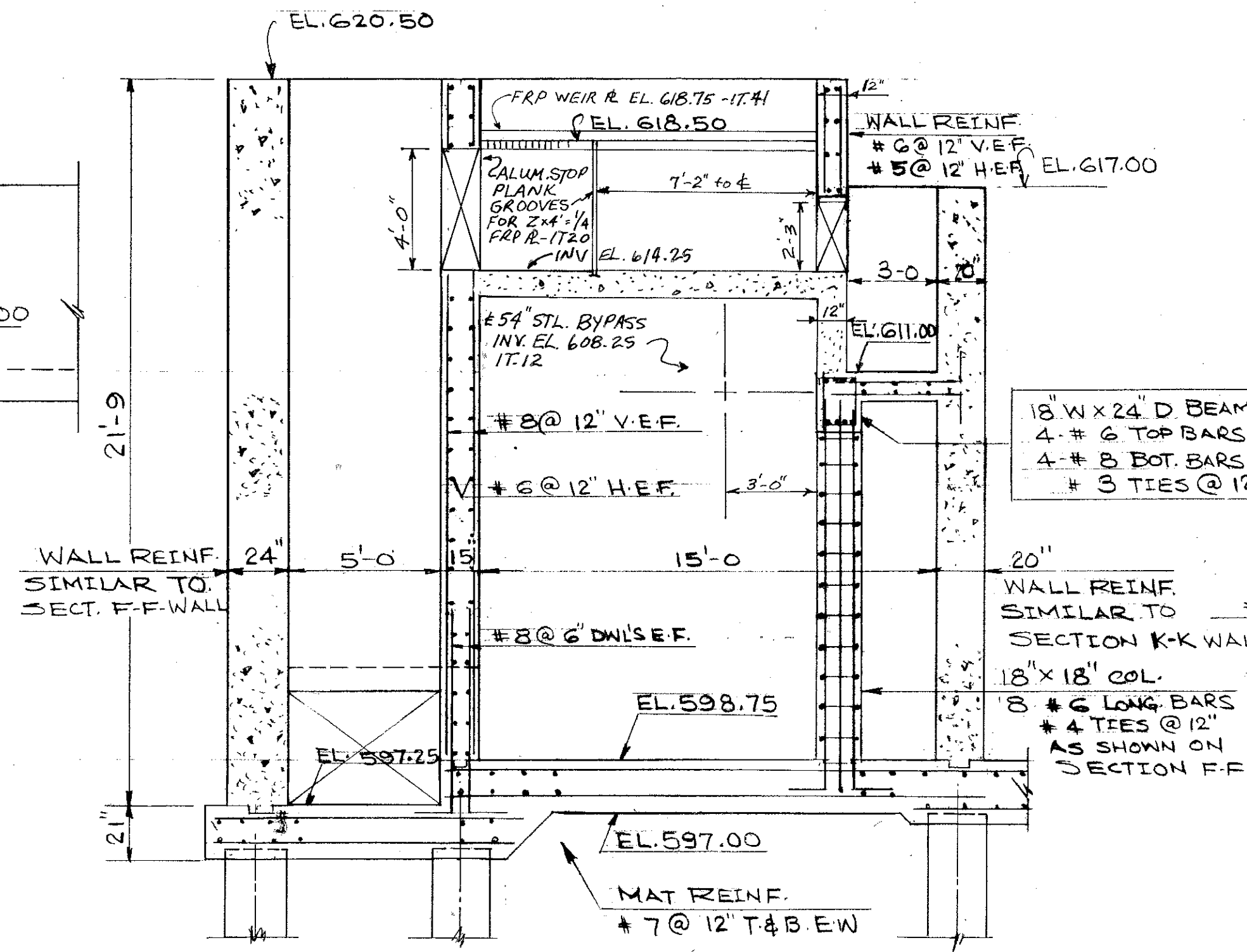
RECORD DRAWING

1345-302

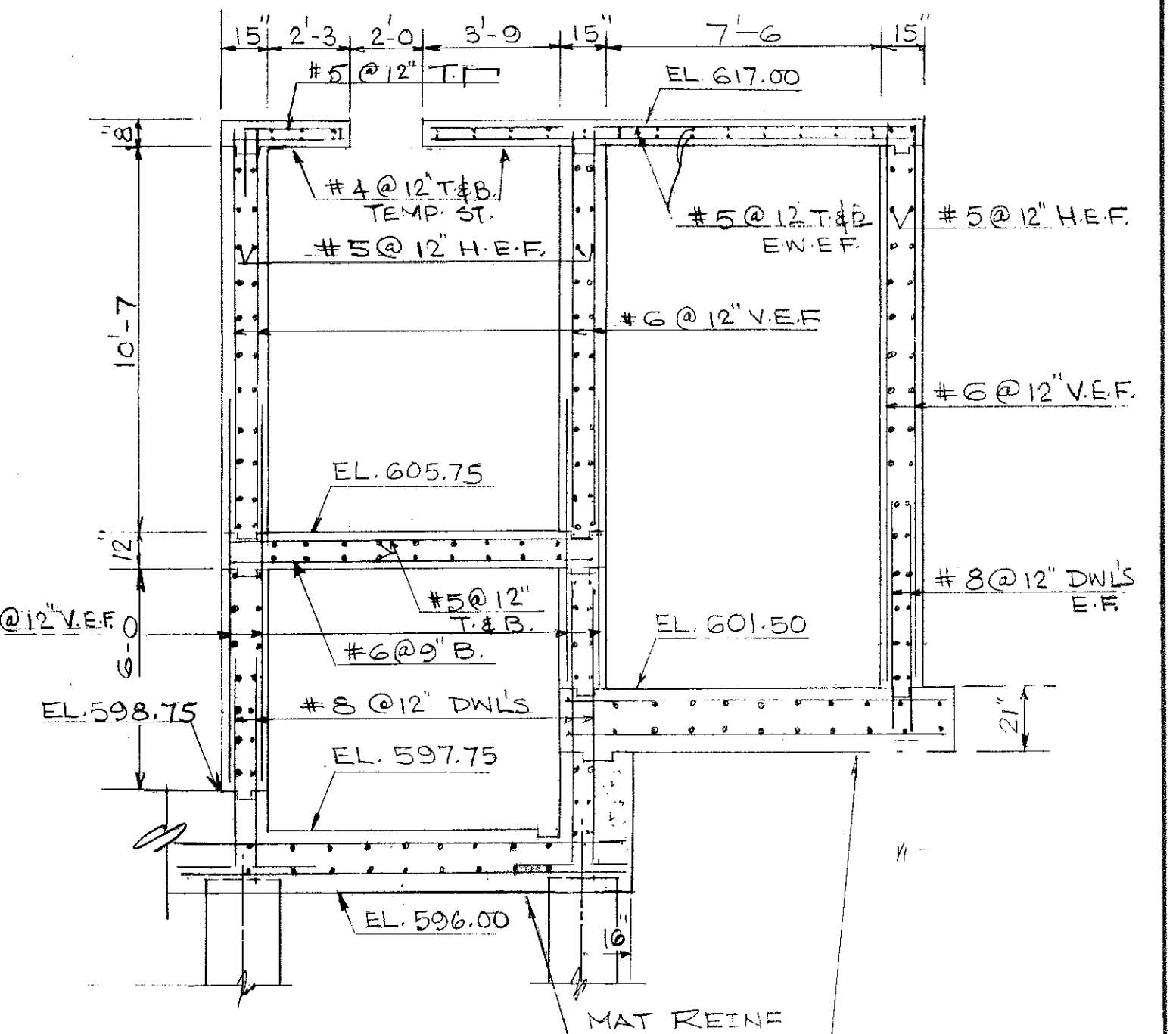
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FILE NO.
1430-5.056
SHEET NO.
ST. 19/49



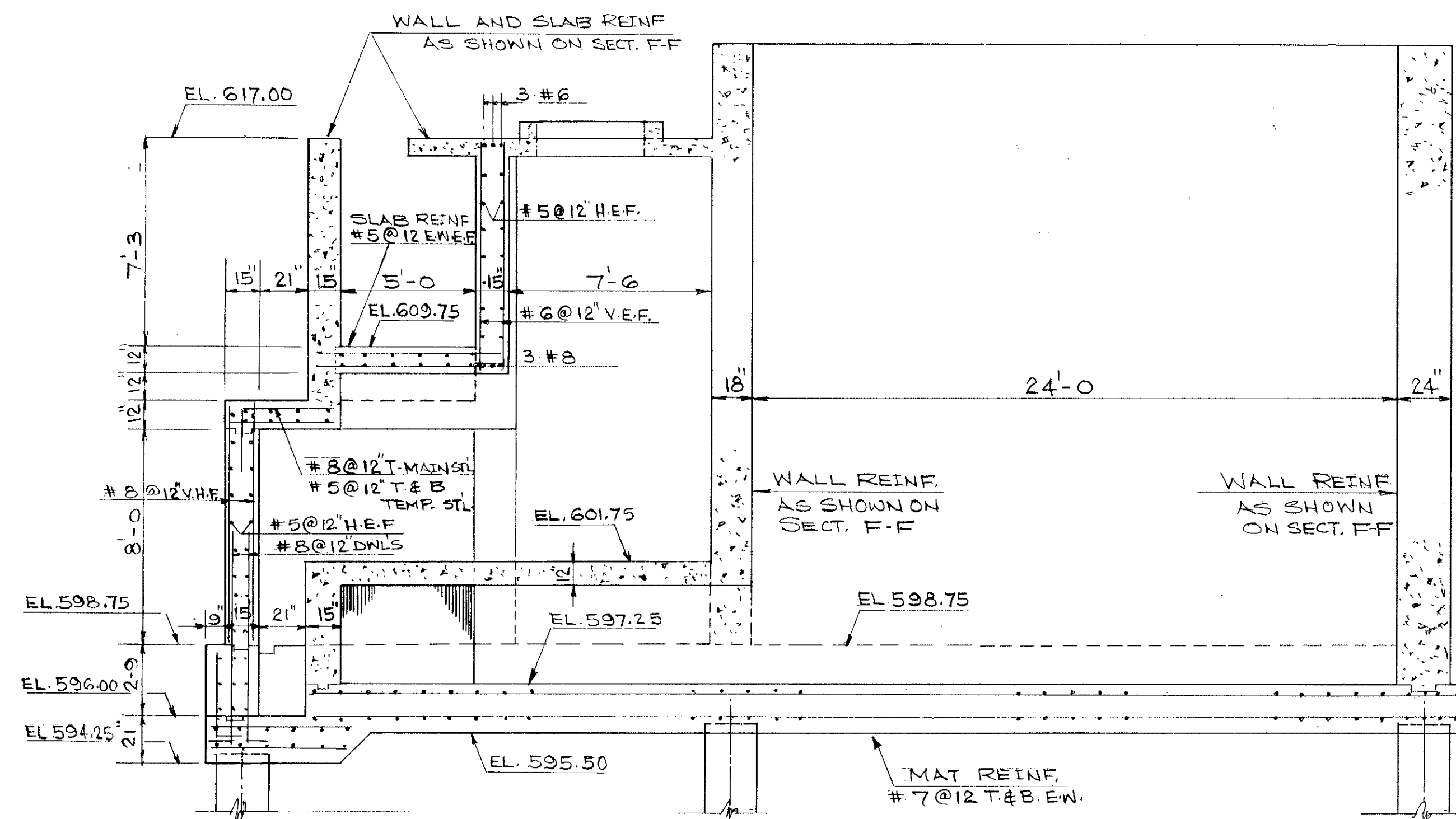
SECTION F - F
ST.16 ST.20



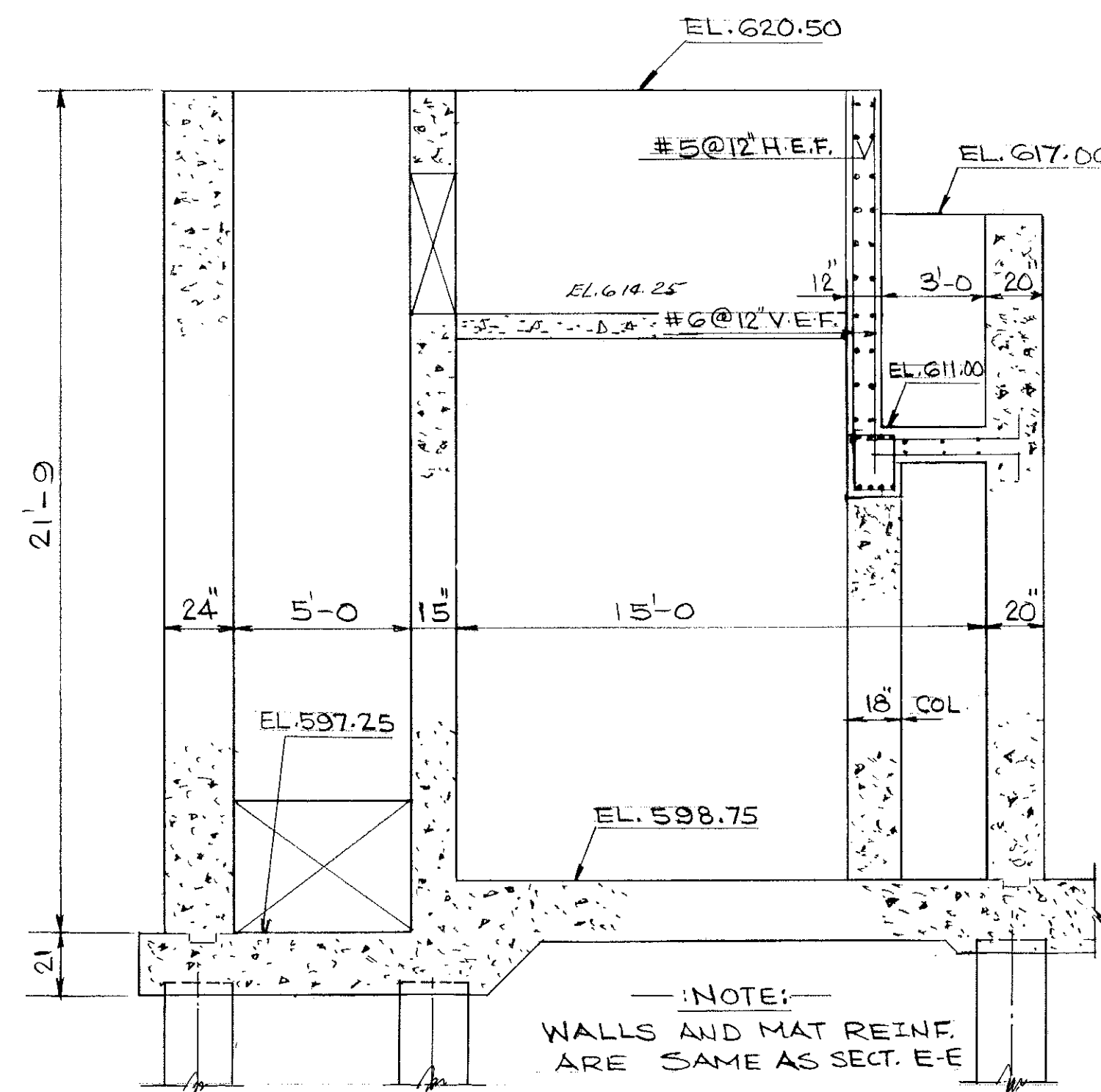
SECTION E - E
ST.16 ST.20



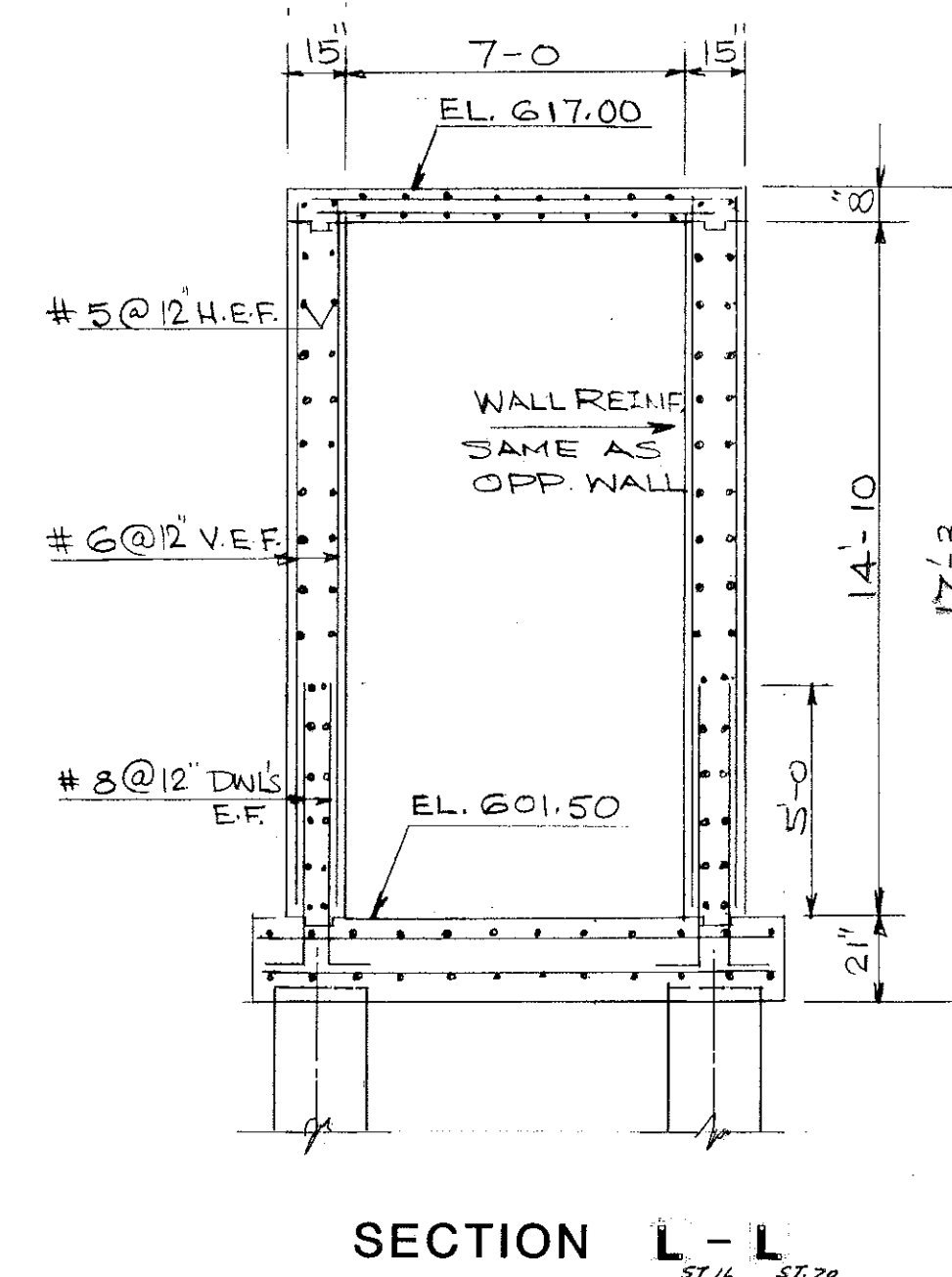
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ST.16 ST.20



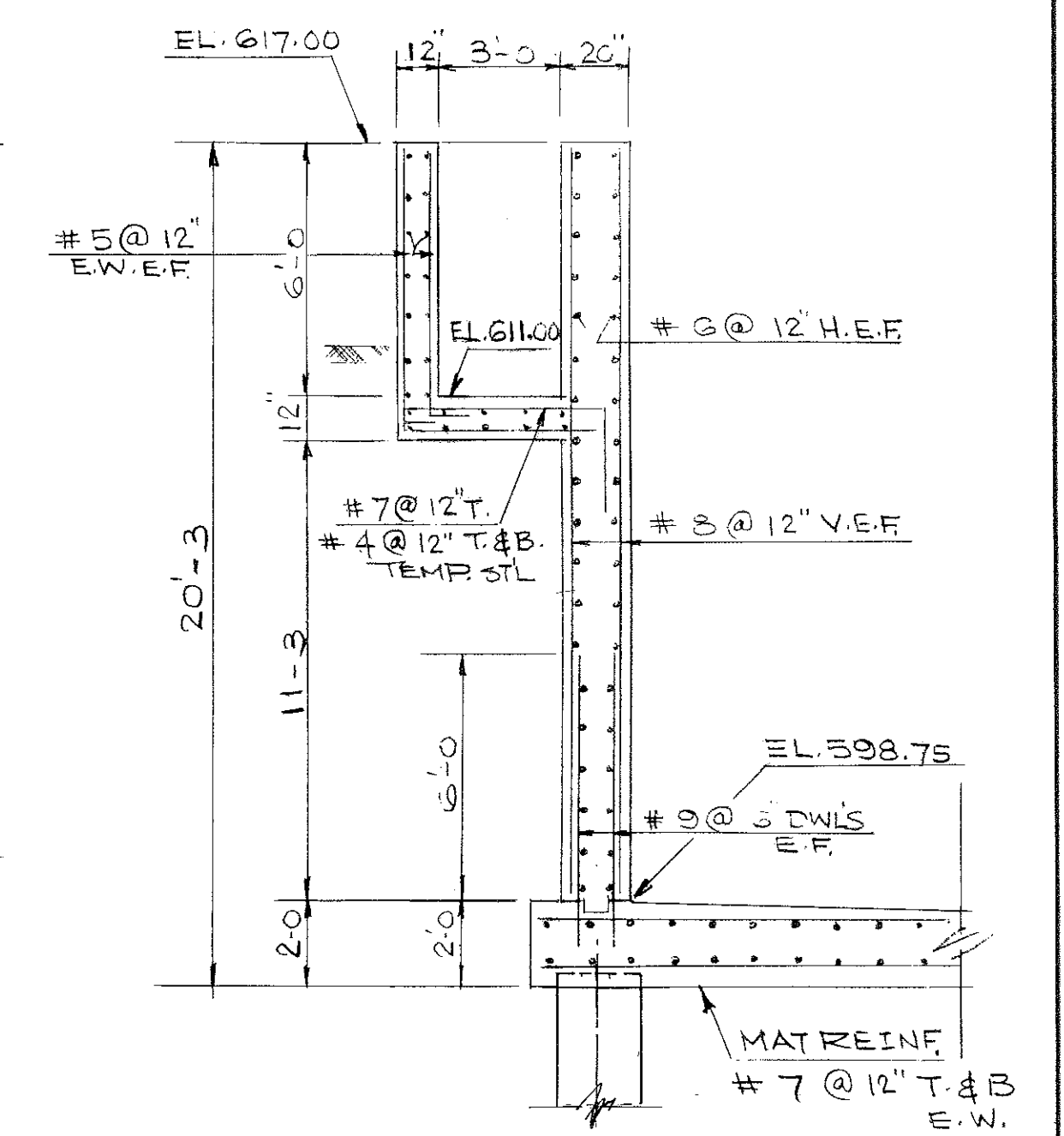
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ST.16 ST.20



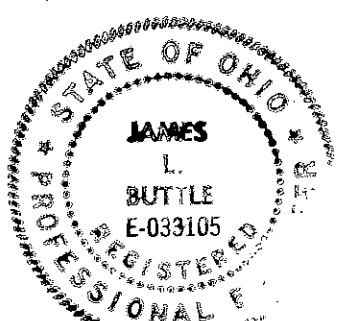
SECTION D - D
ST.16 ST.20



SECTION L - L
ST.16 ST.20

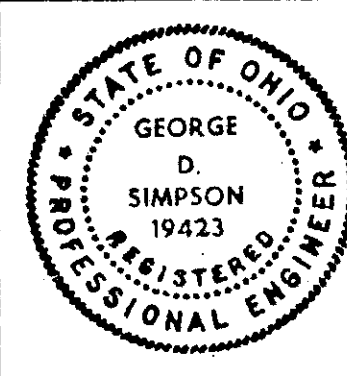
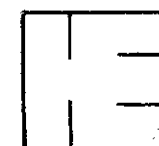


SECTION K - K
ST.16 ST.20



NO.	DESCRIPTION	DATE
1	REVISED AS BUILT	3-89
REVISIONS		

HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY HNS DRAWN BY RCB
APPROVED BY R.W. Keene
SUBMITTED BY B.D. Simpson
DATE 10-14-83

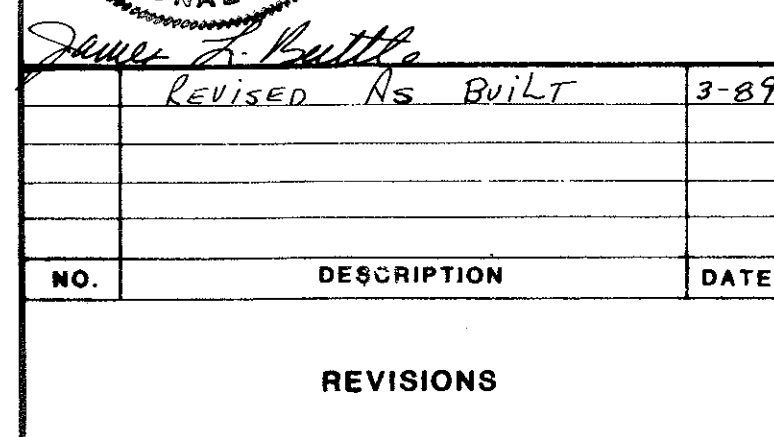
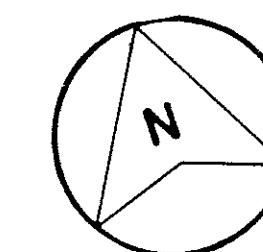
APPROVED BY
DATE 11-26-85

CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

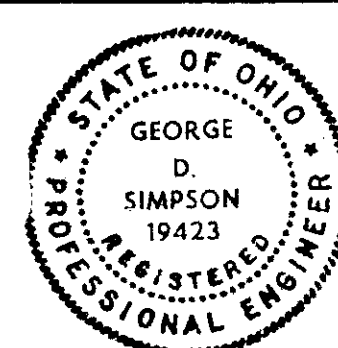
SECONDARY TREATMENT EXPANSION
CONTRACT 5
STRUCTURAL
AERATION TANKS NO. 8 & 9
SECTIONS

SCALE
1/4" = 1'-0"
FILE NO.
1430-5.057
SHEET NO.
ST.20 / 49

RECORD DRAWING 1345-303



HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



DESIGNED BY HNS DRAWN BY RCB

APPROVED BY R.W. KROTZ

SUBMITTED BY B.D. Thompson

DATE 10-14-83

APPROVED BY

Jonny J Shipper

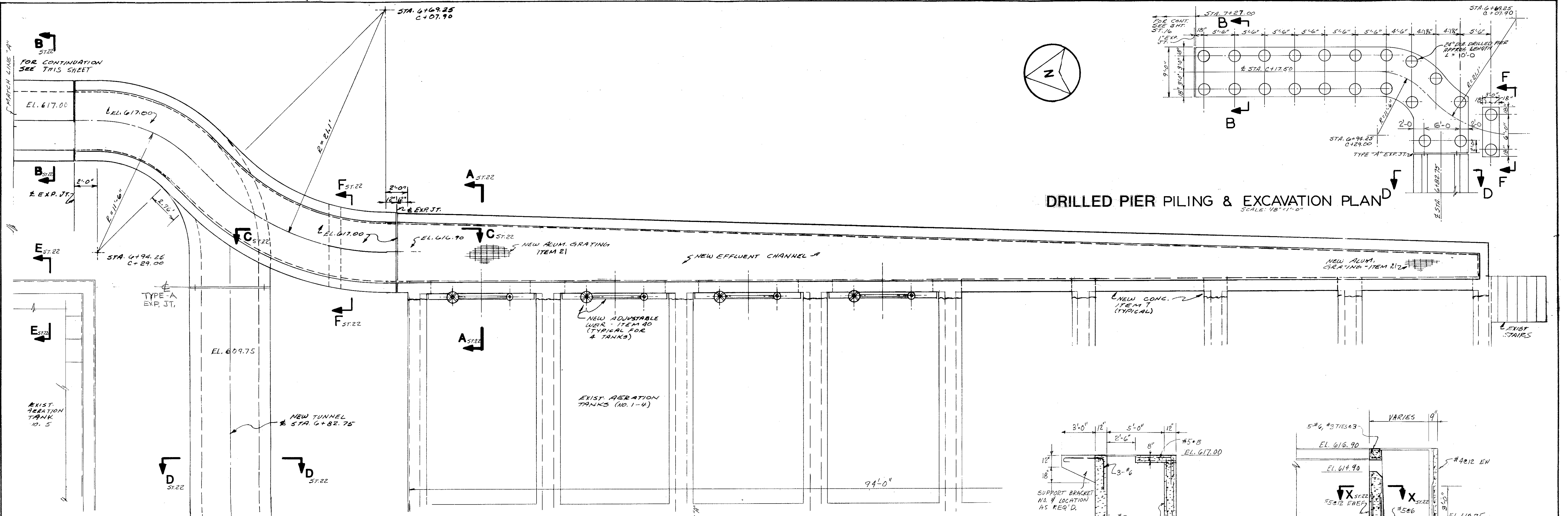
DATE 11-26-85

CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
STRUCTURAL
EXISTING AERATION TANKS NO. 1. THRU 7
NEW INFLUENT CONDUIT & TUNNEL
PLANS AND SECTIONS

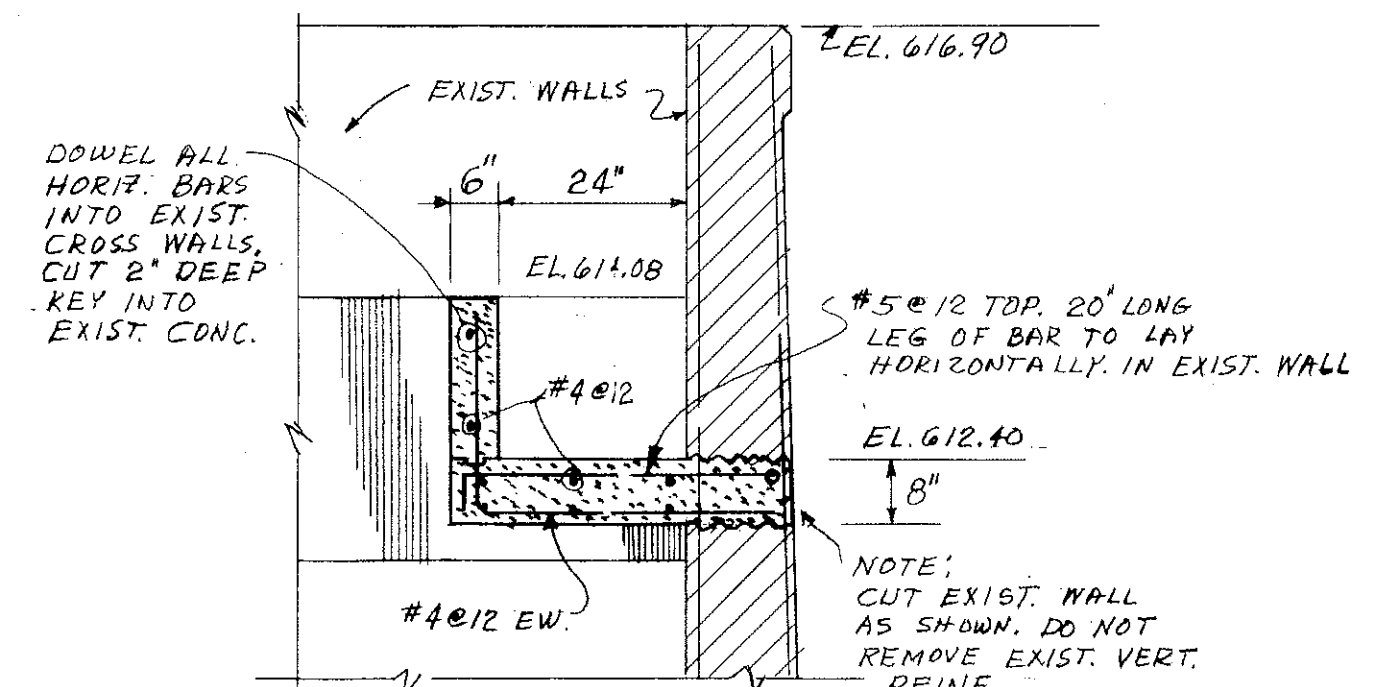
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FILE NO.
1430-5.058
SHEET NO.
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RECORD DRAWING

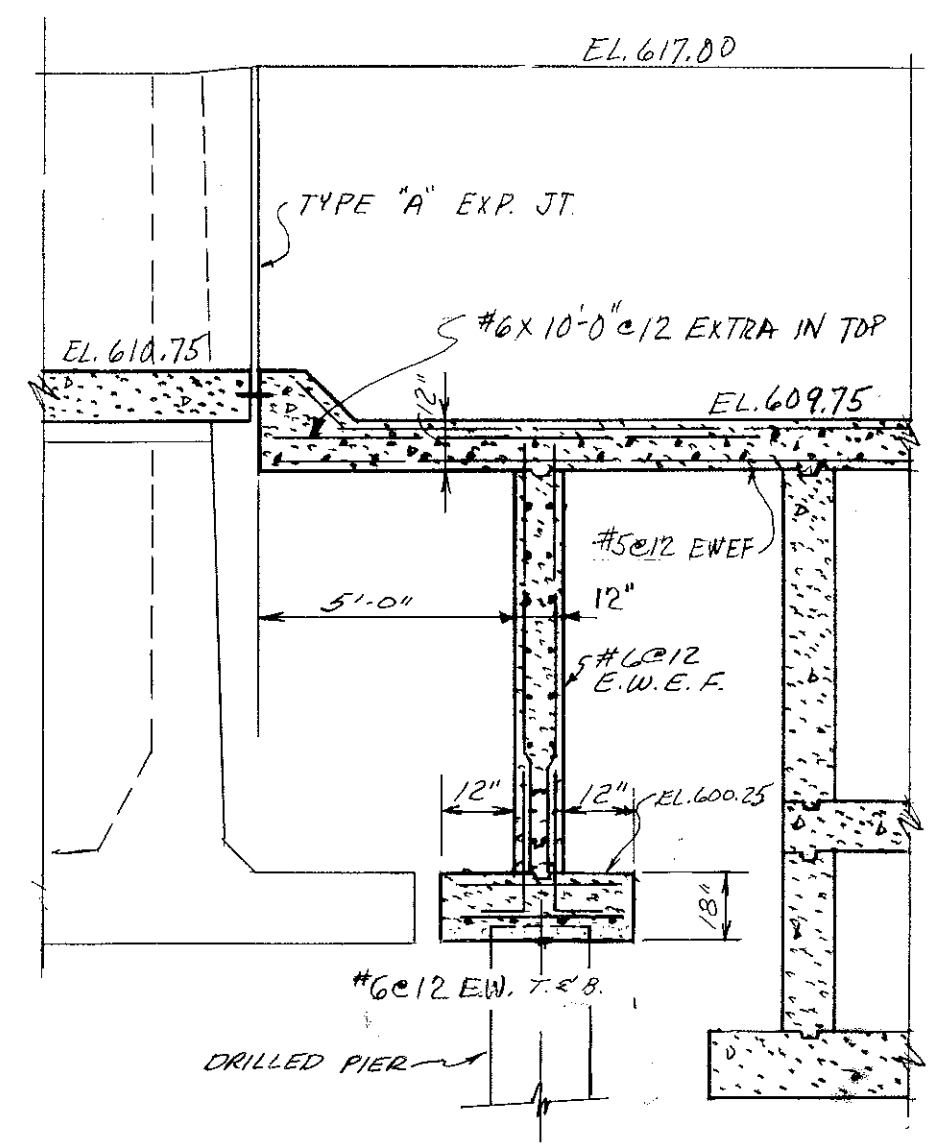


PLAN AT EL. 617.00

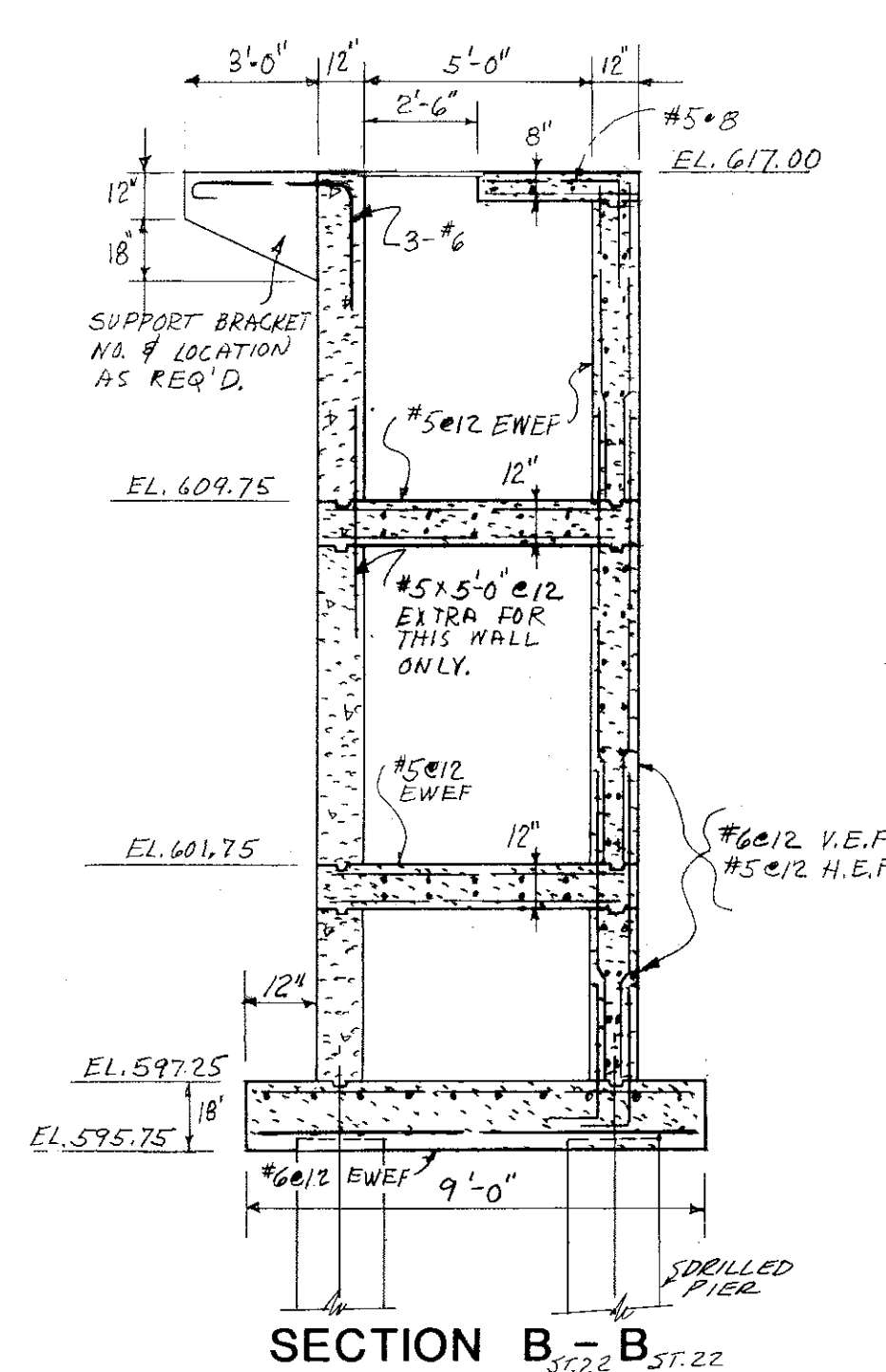
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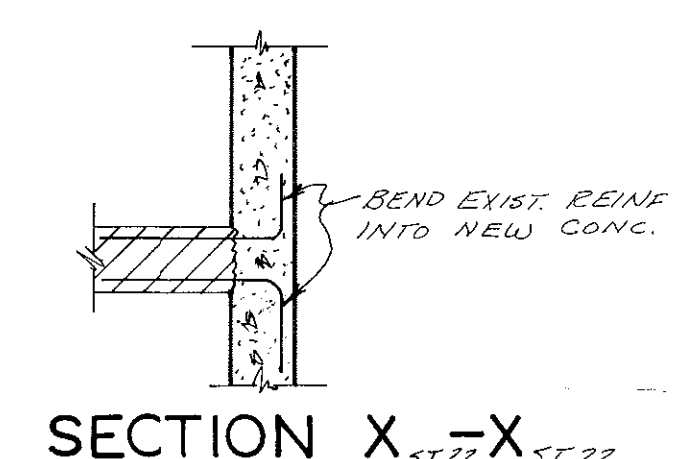
SECTION D - D



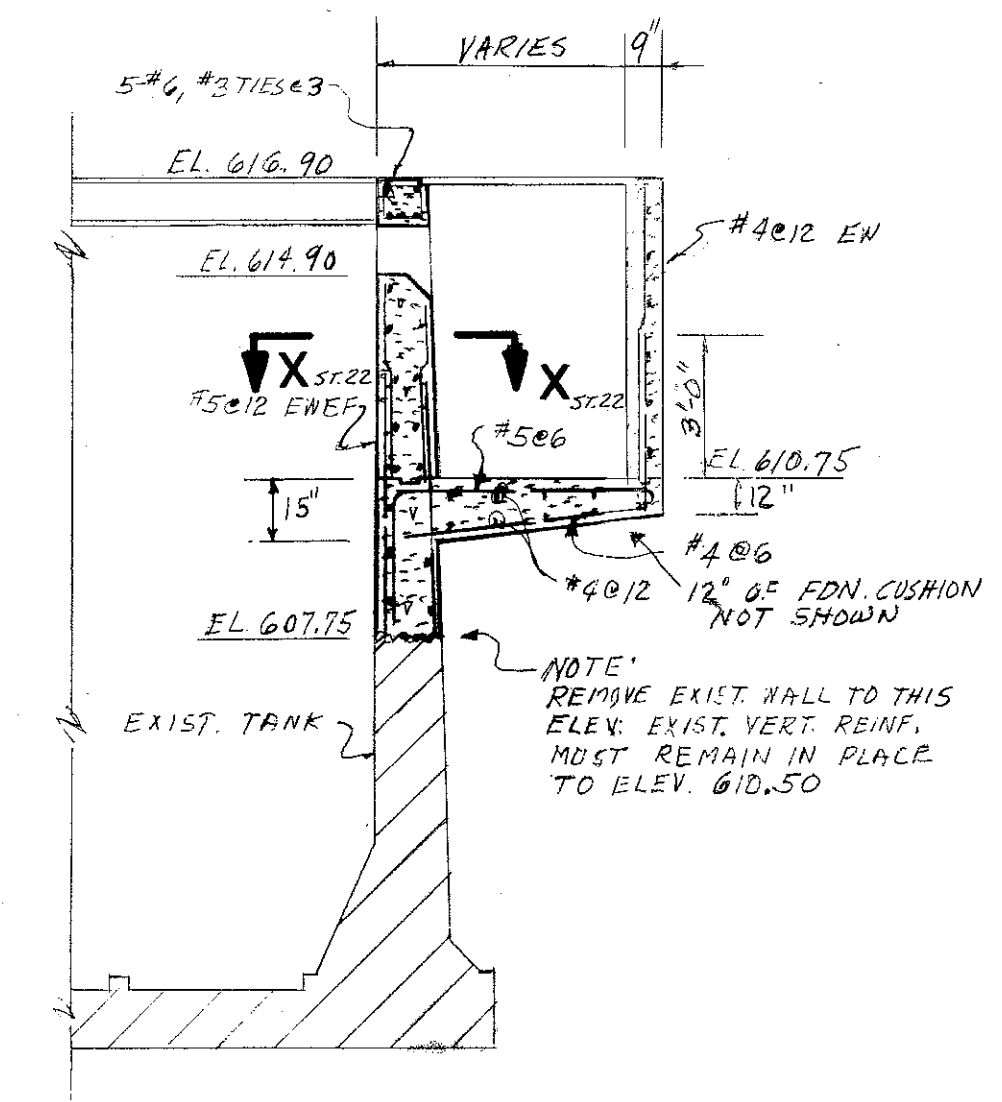
SECTION C - C



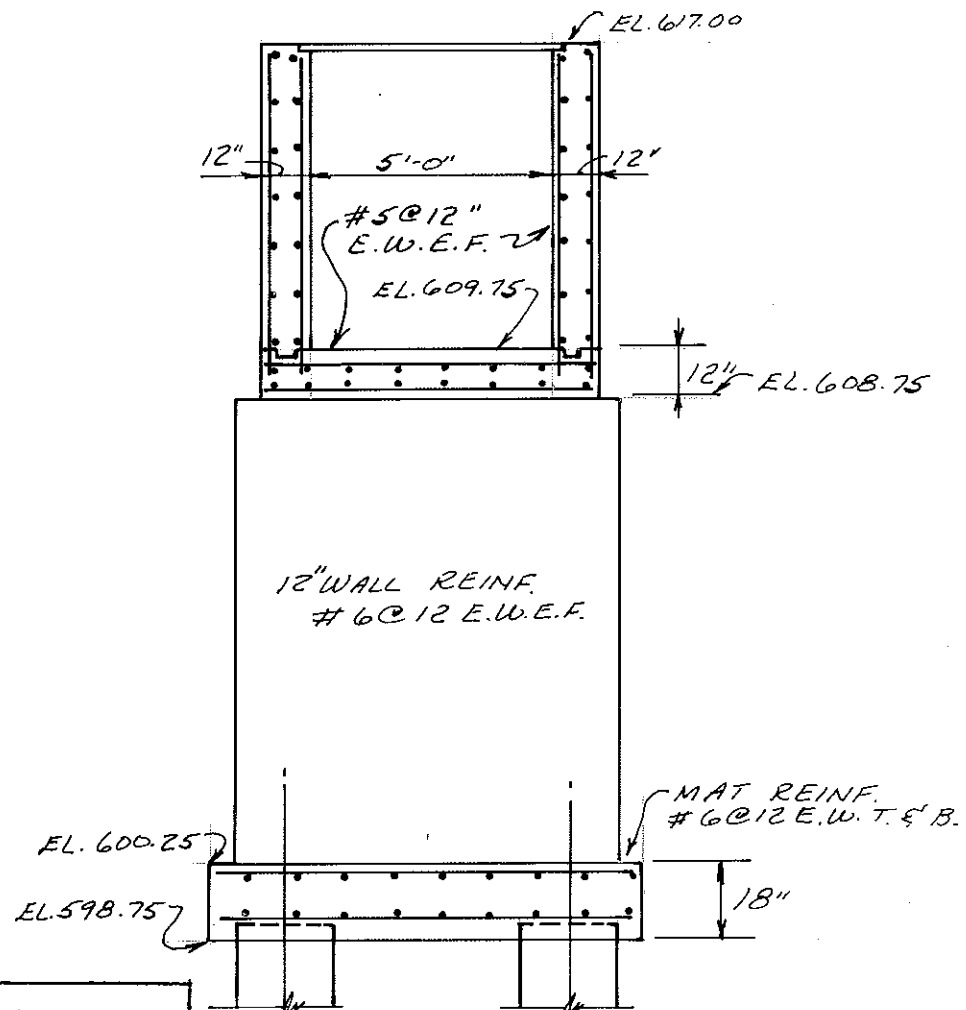
SECTION B - B



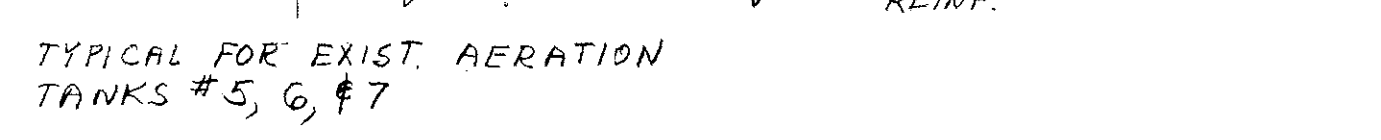
SECTION X - X



SECTION A - A

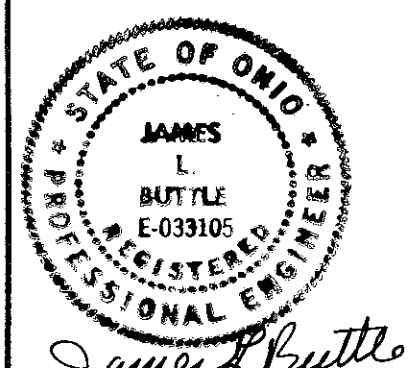


SECTION F - F



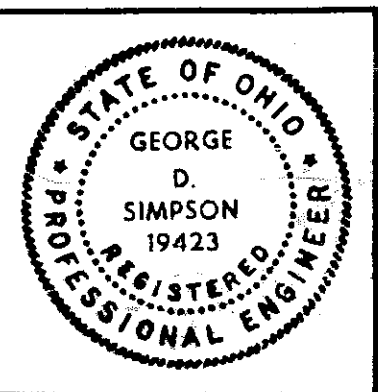
SECTION E - E

THIS IS NOT A RECORD DRAWING. SEE SUPPLEMENTAL SHEETS FURNISHED BY THE CONTRACTOR WITH SIMILAR DRAWING NUMBERS.



NO.	DESCRIPTION	DATE
1	REVISED AS BUILT	3-89
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HAVENS AND EMERSON INC.
CONSULTING ENGINEERS



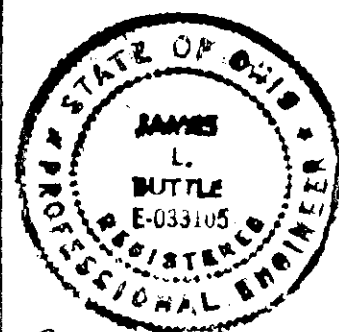
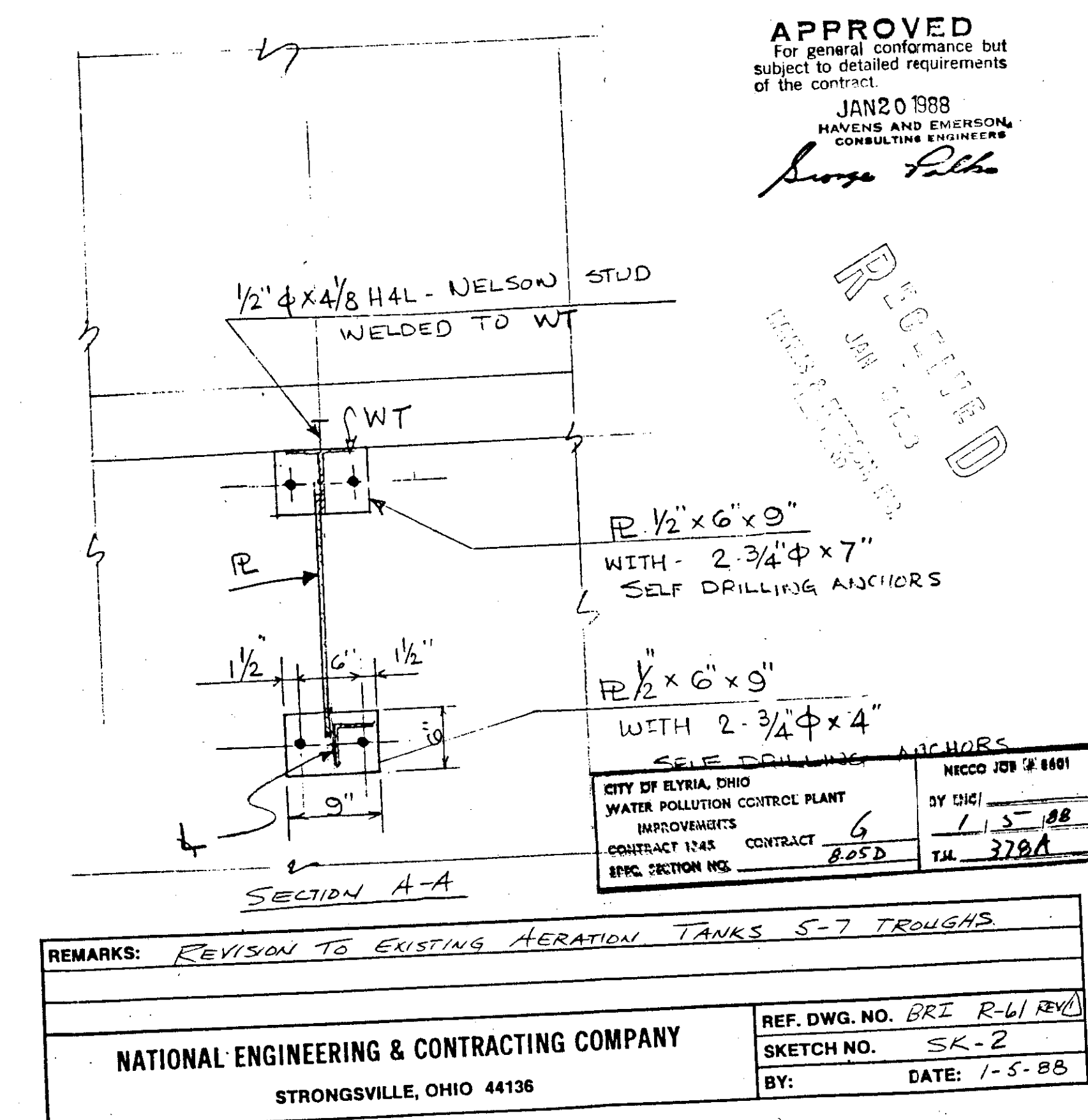
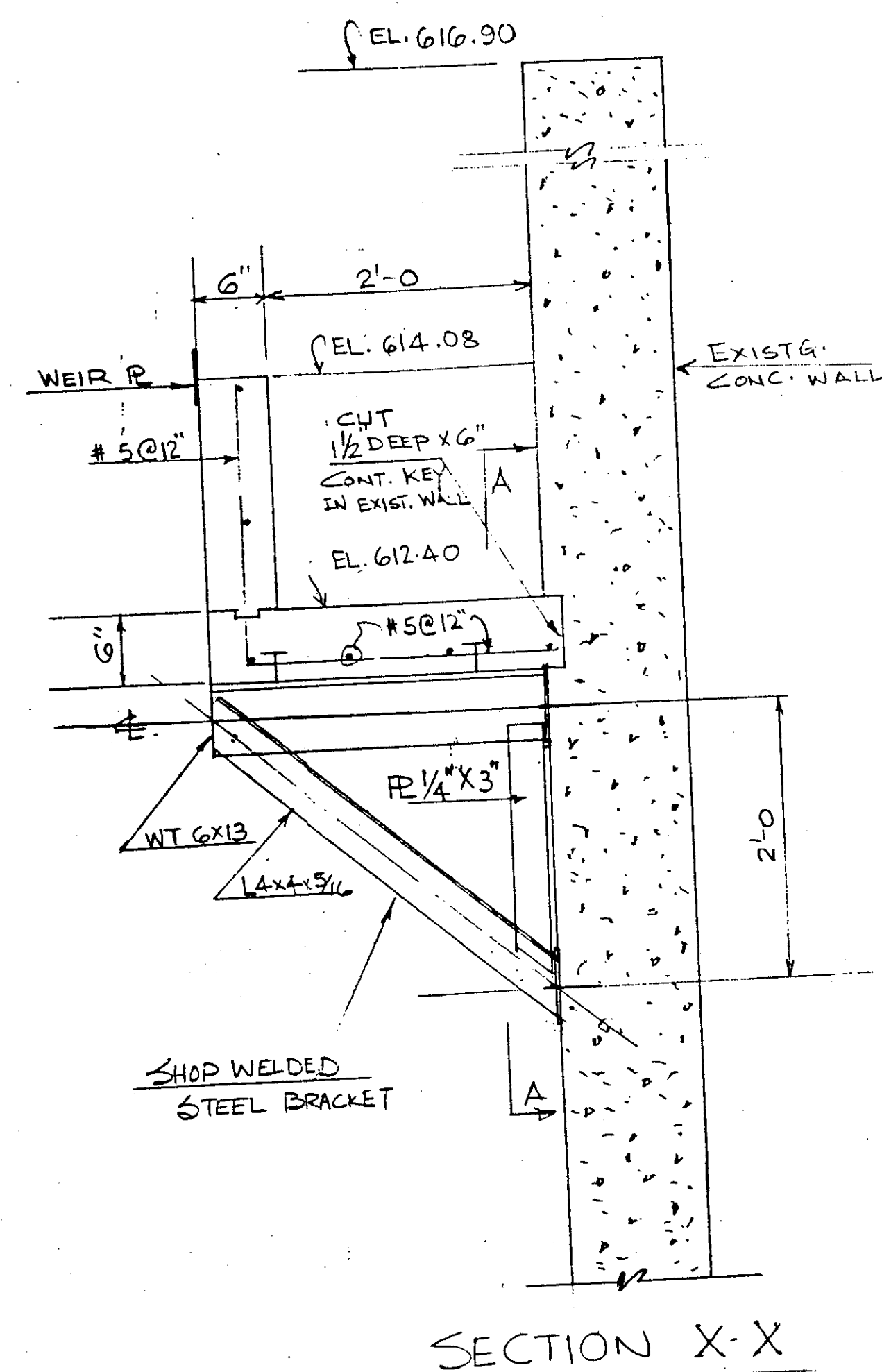
DESIGNED BY HNS DRAWN BY RCB
APPROVED BY G.W. Scott
SUBMITTED BY A.D. Simpson
DATE 10-14-83

APPROVED BY
CITY ENGINEER
DATE 11-26-85

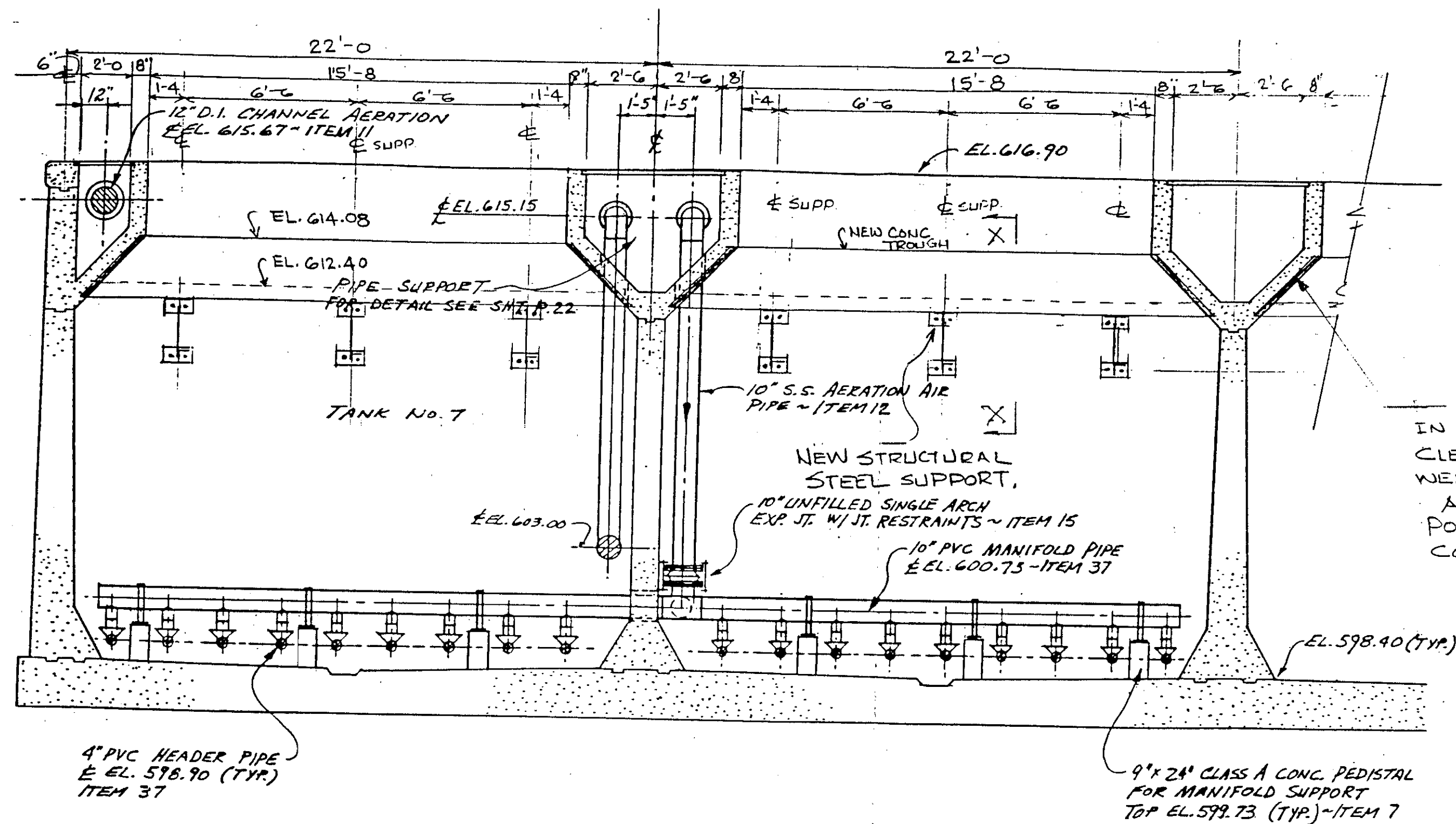
CITY OF ELYRIA, OHIO
DEPARTMENT OF PUBLIC SERVICE
WATER POLLUTION CONTROL PLANT
IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
CONTRACT 5
STRUCTURAL
EXISTING AERATION TANKS 1 - 7 MODIFICATIONS
PLANS AND SECTIONS

SCALE
1/4" = 1'-0"
FILE NO.
1430-5.059
SHEET NO.
ST. 22 / 49



NO. DESCRIPTION DATE			REVISIONS			HAVENS AND EMERSON INC. CONSULTING ENGINEERS 						DESIGNED BY: _____ DRAWN BY: _____ APPROVED BY: <u>R.W. Korte</u> SUBMITTED BY: <u>A.D. Simpson</u> HAVENS AND EMERSON INC. DATE: <u>10-14-83</u>			APPROVED BY: _____ <u>James A. Jackson</u> CITY ENGINEER DATE: <u>11-26-85</u>			CITY OF ELYRIA, OHIO DEPARTMENT OF PUBLIC SERVICE WATER POLLUTION CONTROL PLANT IMPROVEMENTS			SECONDARY TREATMENT EXPANSION CONTRACT 5 STRUCTURAL EXISTING AERATION TANKS 1 - 7 MODIFICATIONS PLANS AND SECTIONS			SCALE: <u>N.T.S.</u> FILE NO.: <u>1430-5.059</u> SHEET NO.: <u>ST.22A / 49</u>		



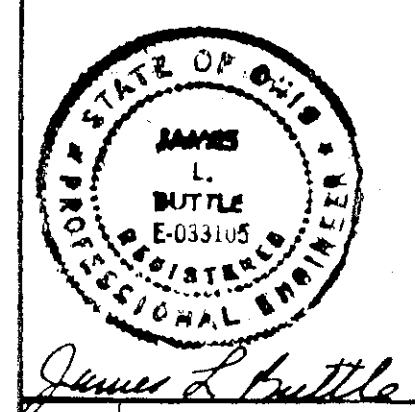
APPROVED
 For general conformance but
 subject to detailed requirements
 of the contract.
 JAN 20 1988
 HAVENS AND EMERSON,
 CONSULTING ENGINEERS
James L. Buttle

CUT 1/2\"/>

SECTION A-A
 REF. DWGS: - 1345 - 305 - SECT. E-E
 1345 - 377
 1345 - 378
 1345 - 381 - SECT. A-A
 1345 - 382 - SECT. G-G

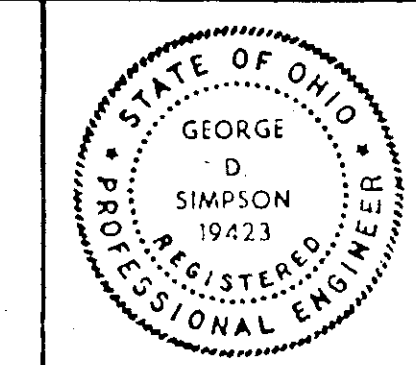
CITY OF ELYRIA, OHIO WATER POLLUTION CONTROL PLANT IMPROVEMENTS CONTRACT 1045 SPEC. SECTION NO.		CONTRACT 9 BY SPEC. 8-25D	NECCO JOB # 8601 BY SPEC. 1-5-88 T.J. 379A
REMARKS: REVISION TO EXISTING AERATION TANKS 5-7 TROUGHS.			
NATIONAL ENGINEERING & CONTRACTING COMPANY STRONGSVILLE, OHIO 44136		REF. DWG. NO. BRI R-61 REV 11	SKETCH NO. SK-1
		BY:	DATE: 1-5-88

30\"/>



NO.	DESCRIPTION	DATE

HAVENS AND EMERSON INC.
 CONSULTING ENGINEERS



DESIGNED BY _____ DRAWN BY _____
 APPROVED BY *R.W. Krotz*
 SUBMITTED BY *J.D. Simpson*
 HAVENS AND EMERSON INC.
 DATE **10-14-83**

APPROVED BY *James L. Buttle*
 CITY ENGINEER
 DATE **11-26-85**

CITY OF ELYRIA, OHIO
 DEPARTMENT OF PUBLIC SERVICE
 WATER POLLUTION CONTROL PLANT
 IMPROVEMENTS

SECONDARY TREATMENT EXPANSION
 CONTRACT 5
STRUCTURAL
 EXISTING AERATION TANKS 1 - 7 MODIFICATIONS
 PLANS AND SECTIONS

SCALE
NTS
 FILE NO.
1430-5.059
 SHEET NO.
ST.22B / 49

RECORD DRAWING

1345-305B

"General Decision Number: OH20250001 09/26/2025

Superseded General Decision Number: OH20240001

State: Ohio

Construction Types: Heavy and Highway

Counties: Ohio Statewide.

Heavy and Highway Construction Projects

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract.	
	. The contractor must pay all covered workers at least \$17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025.	
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract.	
	. The contractor must pay all covered workers at least \$13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.	

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

Modification Number	Publication Date
0	01/03/2025
1	02/07/2025
2	02/14/2025
3	02/28/2025
4	03/07/2025
5	03/14/2025
6	04/25/2025
7	05/02/2025
8	05/09/2025
9	05/16/2025
10	05/30/2025
11	06/06/2025
12	06/27/2025
13	07/11/2025
14	07/18/2025
15	07/25/2025
16	08/08/2025
17	08/15/2025
18	09/05/2025
19	09/12/2025
20	09/26/2025

BROH0001-001 06/01/2024

DEFIANCE, FULTON (Excluding Fulton, Amboy & Swan Creek Townships), HENRY (Excluding Monroe, Bartlow, Liberty, Washington, Richfield, Marion, Damascus & Townships & that part of Harrison Township outside corporate limits of city of Napoleon), PAULDING, PUTNAM and WILLIAMS COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 33.39	20.06

BROH0001-004 06/01/2023

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 32.40	19.30

BROH0003-002 06/01/2024

FULTON (Townships of Amboy, Swan Creek & Fulton), HENRY (Townships of Washington, Damascus, Richfield, Bartlow, Liberty, Harrison, Monroe, & Marion), LUCAS and WOOD (Townships of Perrysburg, Ross, Lake, Troy, Freedom, Montgomery, Webster,

Center, Portage, Middleton, Plain, Liberty, Henry, Washington,
Weston, Milton, Jackson & Grand Rapids) COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 33.39	20.06

BROH0005-003 06/01/2020

CUYAHOGA, LORAIN & MEDINA (Hinckley, Granger, Brunswick,
Liverpool, Montville, York, Homer, Harrisville, Chatham,
Litchfield & Spencer Townships and the city of Medina)

	Rates	Fringes
BRICKLAYER		
BRICKLAYERS; CAULKERS;		
CLEANERS; POINTERS; &		
STONEMASONS.....	\$ 36.64	17.13
SANDBLASTERS.....	\$ 36.39	17.13
SEWER BRICKLAYERS & STACK		
BUILDERS.....	\$ 36.64	17.13
SWING SCAFFOLDS.....	\$ 37.14	17.13

BROH0006-005 06/01/2024

CARROLL, COLUMBIANA (Knox, Butler, West & Hanover Townships),
STARK & TUSCARAWAS

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 33.39	20.06

BROH0007-002 06/01/2024

LAWRENCE

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 33.39	20.06

BROH0007-005 06/01/2023

PORTAGE & SUMMIT

	Rates	Fringes
BRICKLAYER.....	\$ 32.40	19.30

BROH0007-010 06/01/2024

PORTAGE & SUMMIT

	Rates	Fringes
MASON - STONE.....	\$ 33.39	20.06

BROH0008-001 06/01/2024

COLUMBIANA (Salem, Perry, Fairfield, Center, Elk Run,
Middleton, & Unity Townships and the city of New Waterford),
MAHONING & TRUMBULL

	Rates	Fringes
BRICKLAYER.....	\$ 33.39	20.06

BROH0009-002 06/01/2024

BELMONT & MONROE COUNTIES and the Townships of Warren & Mt.
Pleasant and the Village of Dillonvale in JEFFERSON COUNTY

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 33.39	20.06
Refractory.....	\$ 31.45	19.01

BROH0010-002 06/01/2024

COLUMBIANA (St. Clair, Madison, Wayne, Franklin, Washington,
Yellow Creek & Liverpool Townships) & JEFFERSON (Brush Creek &
Saline Townships)

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 33.39	20.06

BROH0014-002 06/01/2024

HARRISON & JEFFERSON (Except Mt. Pleasant, Warren, Brush Creek,
Saline & Salineville Townships & the Village of Dillonvale)

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 33.39	20.06

BROH0016-002 06/01/2023

ASHTABULA, GEAUGA, and LAKE COUNTIES

	Rates	Fringes

Bricklayer, Stonemason.....\$ 32.40	19.30

BROH0018-002 06/01/2024

BROWN, BUTLER, CLERMONT, HAMILTON, PREBLE (Gasper, Dixon,
Israel, Lanier, Somers & Gratis Townships) & WARREN COUNTIES:

Rates	Fringes

Bricklayer, Stonemason.....\$ 33.39	20.06

BROH0022-004 06/01/2024

CHAMPAIGN, CLARK, CLINTON, DARKE, GREENE, HIGHLAND, LOGAN,
MIAMI, MONTGOMERY, PREBLE (Jackson, Monroe, Harrison, Twin,
Jefferson & Washington Townships) and SHELBY COUNTIES

Rates	Fringes

Bricklayer, Stonemason.....\$ 33.39	20.06

BROH0032-001 06/01/2024

GALLIA & MEIGS

Rates	Fringes

Bricklayer, Stonemason.....\$ 33.39	20.06

BROH0035-002 06/01/2024

ALLEN, AUGLAIZE, MERCER and VAN WERT COUNTIES

Rates	Fringes

Bricklayer, Stonemason.....\$ 33.39	20.06

BROH0039-002 06/01/2024

ADAMS & SCIOTO

Rates	Fringes

Bricklayer, Stonemason.....\$ 33.39	20.06

BROH0040-003 06/01/2024

ASHLAND, CRAWFORD, HARDIN, HOLMES, MARION, MORROW, RICHLAND,
WAYNE and WYANDOT (Except Crawford, Ridge, Richland & Tymochtee
Townships) COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 33.39	20.06

FOOTNOTE: Layout Man and Sawman rate: \$1.00 per hour above journeyman rate.
 Free standing stack work ground level to top of stack;
 Sandblasting and laying of carbon masonry material in swing stage and/or scaffold; Ramming and spading of plastics and gunniting: \$1.50 per hour above journeyman rate.
 ""Hot"" work: \$2.50 above journeyman rate.

 BROH0044-002 06/01/2024

	Rates	Fringes
Bricklayer, Stonemason COSHOCTON, FAIRFIELD, GUERNSEY, HOCKING, KNOX, KICKING, MORGAN, MUSKINGUM, NOBLE (Beaver, Buffalo, Seneca & Wayne Townships) & PERRY COUNTIES:.....	\$ 33.39	20.06

 BROH0045-002 06/01/2023

FAYETTE, JACKSON, PIKE, ROSS and VINTON COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 35.39	17.47

 BROH0046-002 06/01/2024

ERIE, HANCOCK, HURON, OTTAWA, SANDUSKY, SENECA, WOOD (Perry & Bloom Townships) and WYANDOT (Tymochtee, Crawford, Ridge & Richland Townships) COUNTIES & the Islands of Lake Erie north of Sandusky

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 33.39	20.06

FOOTNOTE: Layout Man and Sawman rate: \$1.00 per hour above journeyman rate.
 Free standing stack work ground level to top of stack;
 Sandblasting and laying of carbon masonry material in swing stage and/or scaffold; Ramming and spading of plastics and gunniting: \$1.50 per hour above journeyman rate.
 ""Hot"" work: \$2.50 above journeyman rate.

BROH0052-001 06/01/2024

ATHENS COUNTY

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 33.39	20.06

BROH0052-003 06/01/2024

NOBLE (Brookfield, Noble, Center, Sharon, Olive, Enoch, Stock, Jackson, Jefferson & Elk Townships) and WASHINGTON COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 33.39	20.06

BROH0055-003 06/01/2024

DELAWARE, FRANKLIN, MADISON, PICKAWAY and UNION COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 33.39	20.06

CARP0002-024 05/01/2025

BROWN, BUTLER, CHAMPAIGN, CLARK, CLERMONT, CLINTON, DARKE, GREENE, HAMILTON, LOGAN, MIAMI, MONTGOMERY, PREBLE, SHELBY & WARREN

	Rates	Fringes
Carpenter & Piledrivermen.....	\$ 35.94	23.59
Diver.....	\$ 40.58	9.69

CARP0171-001 05/01/2025

MAHONING & TRUMBULL

	Rates	Fringes
CARPENTER.....	\$ 33.19	25.02

CARP0171-002 05/01/2025

BELMONT, COLUMBIANA, HARRISON, JEFFERSON & MONROE

	Rates	Fringes

CARPENTER.....	\$ 32.50	26.19

CARP0200-002 05/01/2025

ADAMS, ATHENS, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GALLIA,
GUERNSEY, HIGHLAND, HOCKING, JACKSON, LAWRENCE, LICKING,
MADISON, MARION, MEIGS, MORGAN, MUSKINGUM, NOBLE, PERRY,
PICKAWAY, PIKE, ROSS, SCIOTO, UNION, VINTON and WASHINGTON
COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 35.94	23.59
Diver.....	\$ 39.41	10.40
PILEDRIVERMAN.....	\$ 35.94	23.59

CARP0285-001 05/01/2025

CARROLL, STARK, TUSCARAWAS and WAYNE

	Rates	Fringes
CARPENTER.....	\$ 34.07	24.28

CARP0285-002 05/01/2025

COSHOCTON, HOLMES, KNOX & MORROW

	Rates	Fringes
CARPENTER.....	\$ 33.38	24.69

CARP0285-008 05/01/2025

MEDINA, PORTAGE & SUMMIT

	Rates	Fringes
CARPENTER.....	\$ 37.18	25.07

CARP0351-005 05/01/2025

LUCAS & WOOD

	Rates	Fringes
CARPENTER.....	\$ 35.44	27.56

CARP0351-006 05/01/2025

	Rates	Fringes
CARPENTER.....		

DEFIANCE, FULTON, HANCOCK,
HENRY, PAULDING & WILLIAMS
COUNTIES.....

\$ 32.05

26.13

CARP0372-002 05/01/2025

ALLEN, AUGLAIZE, HARDIN, MERCER, PUTNAM & VAN WERT

Rates

Fringes

CARPENTER.....\$ 31.80

26.33

CARP0435-005 05/01/2025

ASHTABULA, CUYAHOGA, GEAUGA & LAKE

Rates

Fringes

CARPENTER.....\$ 38.57

24.64

CARP0735-001 05/01/2025

ASHLAND, HURON & RICHLAND

Rates

Fringes

CARPENTER.....\$ 34.67

23.57

CARP0735-002 05/01/2025

LORAIN

Rates

Fringes

CARPENTER.....\$ 38.42

24.01

CARP0735-004 05/01/2025

ERIE

Rates

Fringes

CARPENTER.....\$ 36.71

24.14

CARP0744-001 05/01/2025

CRAWFORD, OTTAWA, SANDUSKY, SENECA & WYANDOT

Rates

Fringes

CARPENTER.....\$ 33.74

27.05

CARP1090-002 05/01/2025

ALLEN, AUGLAIZE, HARDIN, MERCER, PUTNAM, VAN WERT & WYANDOT

	Rates	Fringes
Piledrivermen & Diver's Tender...	\$ 35.94	28.39

DIVERS - \$250.00 per day

CARP1090-003 05/01/2025

BELMONT, HARRISON, & MONROE

	Rates	Fringes
Diver, Wet.....	\$ 58.52	24.91
Piledrivermen; Diver, Dry.....	\$ 39.01	24.91

CARP1090-004 05/01/2025

CARROLL, STARK, TUSCARAWAS & WAYNE

	Rates	Fringes
Diver, Wet.....	\$ 49.82	25.40
Piledrivermen; Diver, Dry.....	\$ 33.21	25.40

CARP1090-005 05/01/2025

ASHLAND, ASHTABULA, CUYAHOGA, ERIE, GEAUGA, HURON, LAKE,
LORAIN, MEDINA, PORTAGE, RICHLAND & SUMMIT

	Rates	Fringes
Diver, Wet.....	\$ 54.51	27.50
Piledrivermen; Diver, Dry.....	\$ 36.34	27.50

CARP1090-006 05/01/2025

COSHOCTON, HOLMES, KNOX & MORROW

	Rates	Fringes
Diver, Wet.....	\$ 54.36	22.54
Piledrivermen; Diver, Dry.....	\$ 36.24	22.54

CARP1090-007 05/01/2025

MAHONING & TRUMBULL

	Rates	Fringes
Diver, Wet.....	\$ 50.85	24.82
Piledrivermen; Diver, Dry.....	\$ 33.90	24.82

CARP1090-008 05/01/2025

COLUMBIANA & JEFFERSON

	Rates	Fringes
FILEDRIVERMAN.....	\$ 39.01	24.91

CARP1090-009 05/01/2025

CRAWFORD, DEFIANCE, FULTON, HANCOCK, HENRY, LUCAS, OTTAWA,
PAULDING, SANDUSKY, SENECA, WILLIAMS & WOOD

	Rates	Fringes
Piledrivermen & Diver's Tender...	\$ 37.98	28.63
DIVERS - \$250.00 per day		

ELEC0008-002 05/27/2024

DEFIANCE, FULTON, HANCOCK, HENRY, LUCAS, OTTAWA, PAULDING,
PUTNAM, SANDUSKY, SENECA, WILLIAMS & WOOD

	Rates	Fringes
CABLE SPLICER.....	\$ 38.98	18.96
ELECTRICIAN.....	\$ 48.40	4.5%+23.06

ELEC0032-003 06/01/2025

ALLEN, AUGLAIZE, HARDIN, LOGAN, MERCER, SHELBY, VAN WERT &
WYANDOT (Crawford, Jackson, Marseilles, Mifflin, Ridgeland,
Ridge & Salem Townships)

	Rates	Fringes
ELECTRICIAN.....	\$ 39.17	23.60

ELEC0038-002 04/28/2025

CUYAHOGA, GEAUGA (Bainbridge, Chester & Russell Townships) &
LORAIN (Columbia Township)

	Rates	Fringes
ELECTRICIAN		
Excluding Sound & Communications Work.....	\$ 46.63	24.92

FOOTNOTES;

- a. 6 Paid Holidays: New Year's Day; Memorial Day; July 4th; Labor Day; Thanksgiving Day; & Christmas Day
- b. 1 week's paid vacation for 1 year's service; 2 weeks' paid vacation for 2 or more years' service

ELEC0038-008 04/28/2025

CUYAHOGA, GEAUGA (Bainbridge, Chester & Russell Townships) &
LORAIN (Columbia Township)

	Rates	Fringes
Sound & Communication Technician		
Communications Technician...	\$ 34.30	14.95
Installer Technician.....	\$ 33.05	14.91

FOOTNOTES;

- a. 6 Paid Holidays: New Year's Day; Memorial Day; July 4th; Labor Day; Thanksgiving Day; & Christmas Day
- b. 1 week's paid vacation for 1 year's service; 2 weeks' paid vacation for 2 or more years' service

ELEC0064-003 11/25/2024

COLUMBIANA (Butler, Fairfield, Perry, Salem & Unity Townships)
MAHONING (Austintown, Beaver, Berlin, Boardman, Canfield, Ellsworth, Coitsville, Goshen, Green, Jackson, Poland, Springfield & Youngstown Townships), & TRUMBULL (Hubbard & Liberty Townships)

	Rates	Fringes
ELECTRICIAN.....	\$ 39.80	21.03

ELEC0071-005 01/06/2025

ASHTABULA, CUYAHOGA, GEAUGA, LAKE & LORAIN

	Rates	Fringes
LINE CONSTRUCTION: Equipment Operator		
DOT/Traffic Signal & Highway Lighting Projects...	\$ 39.97	27%+8.00
Municipal Power/Transit Projects.....	\$ 49.46	27%+8.25
LINE CONSTRUCTION: Groundman		

DOT/Traffic Signal & Highway Lighting Projects...	\$ 31.10	27%+8.00
Municipal Power/Transit Projects.....	\$ 38.47	27%+8.25
LINE CONSTRUCTION:		
Linemen/Cable Splicer		
DOT/Traffic Signal & Highway Lighting Projects...	\$ 43.89	27%+8.00
Municipal Power/Transit Projects.....	\$ 54.96	27%+8.25

ELEC0071-010 01/06/2025

Statewide

	Rates	Fringes
Line Construction		
Equipment Operator.....	\$ 40.44	4%+16.09
Groundman.....	\$ 29.07	4%+13.81
Lineman & Cable Splicers....	\$ 46.02	4%+17.20

ELEC0082-002 12/02/2024

CLINTON, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE & WARREN
(Wayne, Clear Creek & Franklin Townships)

	Rates	Fringes
ELECTRICIAN.....	\$ 38.00	22.49

* ELEC0082-006 11/25/2024

CLINTON, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE & WARREN
(Wayne, Clear Creek & Franklin Townships)

	Rates	Fringes
Sound & Communication Technician		
Cable Puller.....	\$ 13.85 **	5.30
Installer/Technician.....	\$ 27.70	15.71

ELEC0129-003 02/24/2025

LORAIN (Except Columbia Township) & MEDINA (Litchfield &
Liverpool Townships)

	Rates	Fringes
ELECTRICIAN.....	\$ 42.95	18.81

ELEC0129-004 02/24/2025

ERIE & HURON (Lyme, Ridgefield, Norwalk, Townsend, Wakeman,
Sherman, Peru, Bronson, Hartland, Clarksfield, Norwich,
Greenfield, Fairfield, Fitchville & New London Townships)

	Rates	Fringes
ELECTRICIAN.....	\$ 42.95	18.81

ELEC0141-003 06/02/2025

BELMONT COUNTY

	Rates	Fringes
CABLE SPLICER.....	\$ 42.94	27.74
ELECTRICIAN.....	\$ 39.25	31.23

ELEC0212-003 11/26/2018

BROWN, CLERMONT & HAMILTON

	Rates	Fringes
Sound & Communication Technician.....	\$ 24.35	10.99

ELEC0212-005 06/02/2025

BROWN, CLERMONT, and HAMILTON COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 38.05	22.97

ELEC0245-001 08/26/2024

ALLEN, HARDIN, VAN WERT & WYANDOT (Crawford, Jackson,
Marseilles, Mifflin, Richland, Ridge & Salem Townships)

	Rates	Fringes
Line Construction		
Equipment Operator.....	\$ 32.95	28%+7.85
Groundman Truck Driver.....	\$ 20.59	28%+7.85
Lineman.....	\$ 47.07	28%+7.85

FOOTNOTE: a. Half day's Paid Holiday: The last 4 hours of
the workday prior to Christmas or New Year's Day

ELEC0245-003 01/01/2025

DEFIANCE, FULTON, HANCOCK, HENRY, HURON, LUCAS, OTTAWA,
PAULDING, PUTNAM, SANDUSKY, SENECA, WILLIAMS, and WOOD COUNTIES

	Rates	Fringes
Line Construction		
Cable Splicer.....	\$ 53.90	8.10+28%
Groundman/Truck Driver.....	\$ 20.51	8.10+28%
Heli-arc Welding.....	\$ 47.17	8.10+28%
Lineman.....	\$ 46.87	8.10+28%
Operator - Class 1.....	\$ 37.50	8.10+28%
Operator - Class 2.....	\$ 32.81	8.10+28%
Traffic Signal & Lighting		
Technician.....	\$ 42.18	8.10+28%

FOOTNOTE: a. 6 Observed Holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; & Christmas Day. Employees who work on a holiday shall be paid at a rate of double their applicable classified straight-time rates for the work performed on such holiday.

ELEC0245-004 01/01/2025

ERIE COUNTY

	Rates	Fringes
Line Construction		
Cable Splicer.....	\$ 53.90	28%+8.10
Groundman/Truck Driver.....	\$ 20.51	28%+8.10
Lineman.....	\$ 46.87	28%+8.10
Operator - Class 1.....	\$ 37.50	28%+8.10
Operator - Class 2.....	\$ 32.81	28%+8.10

FOOTNOTE: a. 6 Observed Holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; & Christmas Day. Employees who work on a holiday shall be paid at a rate of double their applicable classified straight-time rates for the work performed on such holiday.

ELEC0246-001 10/28/2024

Carroll, Columbiana, Harrison and Jefferson Counties in Ohio;
Brooke and Hancock Counties in West Virginia.

Rates	Fringes

ELECTRICIAN.....\$ 44.00 30.38%+24.31

FOOTNOTE: a. 1 1/2 Paid Holidays: The last scheduled workday prior to Christmas & 4 hours on Good Friday.

ELEC0306-005 05/27/2024

MEDINA (Brunswick, Chatham, Granger, Guilford, Harrisville, Hinckley, Homer, Lafayette, Medina, Montville, Sharon, Spencer, Wadsworth, Westfield & York Townships), PORTAGE (Atwater, Aurora, Brimfield, Deerfield, Franklin, Mantua, Randolph, Ravenna, Rootstown, Shalersville, Streetsboro & Suffield Townships), SUMMIT & WAYNE (Baughman, Canaan, Chester, Chippewa, Congress, Green, Milton, & Wayne Townships)

	Rates	Fringes
CABLE SPLICER.....	\$ 46.81	20.95
ELECTRICIAN.....	\$ 42.55	20.95

ELEC0317-002 06/02/2025

GALLIA & LAWRENCE

	Rates	Fringes
CABLE SPLICER.....	\$ 32.68	18.13
ELECTRICIAN.....	\$ 41.15	29.35

ELEC0540-005 06/30/2025

CARROLL (Northern half, including Fox, Harrison, Rose & Washington Townships), COLUMBIANA (Knox Township), HOLMES, MAHONING (Smith Township), STARK, TUSCARAWAS (North of Auburn, Clay, Rush & York Townships), and WAYNE (South of Baughman, Chester, Green & Wayne Townships) COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 39.86	29.19

ELEC0573-003 06/01/2025

ASHTABULA (Colebrook, Wayne, Williamsfield, Orwell & Windsor Townships), GEAUGA (Auburn, Middlefield, Parkman & Troy Townships), MAHONING (Milton Township), PORTAGE (Charlestown, Edinburg, Freedom, Hiram, Nelson, Palmyra, Paris & Windham Townships), and TRUMBULL (Except Liberty & Hubbard Townships)

	Rates	Fringes

ELECTRICIAN.....	\$ 42.20	23.37

ELEC0575-001 05/29/2023

ADAMS, FAYETTE, HIGHLAND, HOCKING, JACKSON (Bloomfield, Franklin, Hamilton, Jefferson, Lick, Madison, Scioto, Coal, Jackson, Liberty, Milton & Washington Townships), PICKAWAY (Deer Creek, Perry, Pickaway, Salt Creek & Wayne Townships), PIKE (Beaver, Benton, Jackson, Mifflin, Pebble, PeePee, Perry, Seal, Camp Creek, Newton, Scioto, Sunfish, Union & Marion Townships), ROSS, SCIOTO & VINTON (Clinton, Eagle, Elk, Harrison, Jackson, Richland & Swan Townships)

	Rates	Fringes
ELECTRICIAN.....	\$ 37.00	22.26

ELEC0648-001 09/01/2025

BUTLER and WARREN COUNTIES (Deerfield, Hamilton, Harlan, Massie, Salem, Turtle Creek, Union & Washington Townships)

	Rates	Fringes
CABLE SPLICER.....	\$ 30.50	18.23
ELECTRICIAN.....	\$ 38.00	24.162

* ELEC0673-004 05/26/2025

ASHTABULA (Excluding Orwell, Colebrook, Williamsfield, Wayne & Windsor Townships), GEAUGA (Burton, Chardon, Claridon, Hambden, Huntsburg, Montville, Munson, Newbury & Thompson Townships) and LAKE COUNTIES

	Rates	Fringes
CABLE SPLICER.....	\$ 33.81	21.47
ELECTRICIAN.....	\$ 41.17	24.58

* ELEC0683-002 06/02/2025

CHAMPAIGN, CLARK, DELAWARE, FAIRFIELD, FRANKLIN, MADISON, PICKAWAY (Circleville, Darby, Harrison, Jackson, Madison, Monroe, Muhlenberg, Scioto, Walnut & Washington Townships), and UNION COUNTIES

	Rates	Fringes
CABLE SPLICER.....	\$ 44.00	26.40

ELECTRICIAN.....	\$ 43.00	26.37

ELEC0688-003 05/30/2022

ASHLAND, CRAWFORD, HURON (Richmond, New Haven, Ripley & Greenwich Townships), KNOX (Liberty, Clinton, Union, Howard, Monroe, Middleberry, Morris, Wayne, Berlin, Pike, Brown & Jefferson Townships), MARION, MORROW, RICHLAND and WYANDOT (Sycamore, Crane, Eden, Pitt, Antrim & Tymochtee Townships) COUNTIES

Rates	Fringes

ELECTRICIAN.....	\$ 32.30	21.83

ELEC0972-002 06/01/2024

ATHENS, MEIGS, MONROE, MORGAN, NOBLE, VINTON (Brown, Knox, Madison, Vinton & Wilkesville Townships), and WASHINGTON COUNITIES

Rates	Fringes

CABLE SPLICER.....	\$ 40.25	33.33
ELECTRICIAN.....	\$ 40.00	33.32

ELEC1105-001 05/27/2024

COSHOCTON, GUERNSEY, KNOX (Jackson, Clay, Morgan, Miller, Milford, Hilliar, Butler, Harrison, Pleasant & College Townships), LICKING, MUSKINGUM, PERRY, and TUSCARAWAS (Auburn, York, Clay, Jefferson, Rush, Oxford, Washington, Salem, Perry & Bucks Townships) COUNTIES

Rates	Fringes

ELECTRICIAN.....	\$ 39.60	24.41

ENGI0018-003 05/01/2024

ASHTABULA, CUYAHOGA, ERIE, GEAUGA, LAKE, LORAIN, MEDINA, PORTAGE, and SUMMIT COUNTIES

Rates	Fringes

POWER EQUIPMENT OPERATOR

GROUP 1.....	\$ 45.63	16.41
GROUP 2.....	\$ 45.53	16.41
GROUP 3.....	\$ 44.49	16.41
GROUP 4.....	\$ 43.27	16.41

GROUP 5.....	\$ 37.98	16.41
GROUP 6.....	\$ 46.63	16.41
GROUP 7.....	\$ 46.63	16.41

OPERATING ENGINEER CLASSIFICATIONS

GROUP 1 - Air Compressor on Steel Erection; Barrier Moving Machine; Boiler Operator on Compressor or Generator when mounted on a Rig; Cableway; Combination Concrete Mixer & Tower; Concrete Plant (over 4 yd. Capacity); Concrete Pump; Crane (All Types, Including Boom Truck, Cherry Picker); Crane-Compact, Track or Rubber over 4,000 lbs. capacity; Cranes-Self Erecting, Stationary, Track or Truck (All Configurations); Derrick; Dragline; Dredge (Dipper, Clam or Suction); Elevating Grader or Euclid Loader; Floating Equipment (All Types); Gradall; Helicopter Crew (Operator-Hoist or Winch); Hoe (all types); Hoisting Engine on Shaft or Tunnel Work; Hydraulic Gantry (Lifting System); Industrial-Type Tractor; Jet Engine Dryer (D8 or D9) Diesel Tractor; Locomotive (Standard Gauge); Maintenance Operator Class A; Mixer, Paving (Single or Double Drum); Mucking Machine; Multiple Scraper; Piledriving Machine (All Types); Power Shovel; Prentice Loader; Quad 9 (Double Pusher); Rail Tamper (with auto lifting & aligning device); Refrigerating Machine (Freezer Operation); Rotary Drill, on Caisson work; Rough Terrain Fork Lift with Winch/Hoist; Side-Boom; Slip-Form Paver; Tower Derrick; Tree Shredder; Trench Machine (Over 24" wide); Truck Mounted Concrete Pump; Tug Boat; Tunnel Machine and/or Mining Machine; Wheel Excavator; and Asphalt Plant Engineer (Cleveland District Only).

GROUP 2 - Asphalt Paver; Automatic Subgrader Machine, Self-Propelled (CMI Type); Bobcat Type and/or Skid Steer Loader with Hoe Attachment Greater than 7,000 lbs.; Boring Machine More than 48"; Bulldozer; Endloader; Horizontal Directional Drill (Over 50,000 ft lbs thrust); Hydro Milling Machine; Kolman-type Loader (production type-Dirt); Lead Greaseman; Lighting & Traffic Signal Installation Equipment (includes all groups or classifications); Material Transfer Equipment (Shuttle Buggy) Asphalt; Pettibone-Rail Equipment; Power Grader; Power Scraper; Push Cat; Rotomill (all), Grinders & Planers of All types; Trench Machine (24" wide & under); Vermeer type Concrete Saw; and Maintenance Operators (Portage and Summit Counties Only).

GROUP 3 - A-Frame; Air Compressor on Tunnel Work (low pressure); Asphalt Plant Engineer (Portage and Summit Counties Only); Bobcat-type and/or Skid Steer Loader with or without Attachments; Highway Drills (all types); Locomotive (narrow gauge); Material Hoist/Elevator; Mixer, Concrete (more than one bag capacity); Mixer, one bag capacity (Side Loader); Power Boiler (Over 15 lbs.

Pressure) Pump Operator installing & operating Well Points; Pump (4" & over discharge); Roller, Asphalt; Rotovator (lime soil stabilizer); Switch & Tie Tampers (without lifting & aligning device); Utility Operator (Small equipment); Welding Machines; and Railroad Tie Insert/Remover; Articulating/straight bed end dumps if assigned (minus \$4.00 per hour).

GROUP 4 - Backfiller; Ballast Re-locator; Bars, Joint & Mesh Installing Machine; Batch Plant; Boring Machine Operator (48" or less); Bull Floats; Burlap & Curing Machine; Concrete Plant (capacity 4 yd. & under); Concrete Saw (Multiple); Conveyor (Highway); Crusher; Deckhand; Farm-type Tractor with attachments (highway); Finishing Machine; Fireperson, Floating Equipment (all types); Forklift; Form Trencher; Hydro Hammer expect masonry; Hydro Seeder; Pavement Breaker; Plant Mixer; Post Driver; Post Hole Digger (Power Auger); Power Brush Burner; Power Form Handling Equipment; Road Widening Trencher; Roller (Brick, Grade & Macadam); Self-Propelled Power Spreader; Self-Propelled Power Subgrader; Steam Fireperson; Tractor (Pulling Sheepfoot, Roller or Grader); and Vibratory Compactor with Integral Power.

GROUP 5 - Compressor (Portable, Sewer, Heavy & Highway); Drum Fireperson (Asphalt Plant); Generator; Masonry Fork Lift; Inboard-Outboard Motor Boat Launch; Oil Heater (asphalt plant); Oiler/Helper; Power Driven Heater; Power Sweeper & Scrubber; Pump (under 4" discharge); Signalperson; Tire Repairperson; VAC/ALLS; Cranes - Compact, track or rubber under 4,000 pound capacity; fueling and greasing; and Chainmen.

GROUP 6 - Master Mechanic & Boom from 150 to 180.

GROUP 7 - Boom from 180 and over.

ENGI0018-004 05/01/2024

ADAMS, ALLEN, ASHLAND, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, LUCAS, MADISON, MARION, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, TUSCARAWAS, UNION, VAN WERT, VINTON, WARREN, WASHINGTON, WAYNE, WILLIAMS, WOOD, and YANDOT COUNTIES

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1.....	\$ 44.14	16.41
GROUP 2.....	\$ 44.02	16.41
GROUP 3.....	\$ 42.98	16.41
GROUP 4.....	\$ 41.80	16.41
GROUP 5.....	\$ 36.34	16.41
GROUP 6.....	\$ 45.14	16.41
GROUP 7.....	\$ 45.14	16.41

OPERATING ENGINEER CLASSIFICATIONS

GROUP 1 - Air Compressor on Steel Erection; Barrier Moving Machine; Boiler Operator on Compressor or Generator when mounted on a Rig; Cableway; Combination Concrete Mixer & Tower; Concrete Plant (over 4 yd. Capacity); Concrete Pump; Crane (All Types, Including Boom Truck, Cherry Picker); Crane-Compact, Track or Rubber over 4,000 lbs. capacity; Cranes-Self Erecting, Stationary, Track or Truck (All Configurations); Derrick; Dragline; Dredge (Dipper, Clam or Suction); Elevating Grader or Euclid Loader; Floating Equipment (All Types); Gradall; Helicopter Crew (Operator-Hoist or Winch); Hoe (all types); Hoisting Engine on Shaft or Tunnel Work; Hydraulic Gantry (Lifting System); Industrial-Type Tractor; Jet Engine Dryer (D8 or D9) Diesel Tractor; Locomotive (Standard Gauge); Maintenance Operator Class A; Mixer, Paving (Single or Double Drum); Mucking Machine; Multiple Scraper; Piledriving Machine (All Types); Power Shovel; Prentice Loader; Quad 9 (Double Pusher); Rail Tamper (with auto lifting & aligning device); Refrigerating Machine (Freezer Operation); Rotary Drill, on Caisson work; Rough Terrain Fork Lift with Winch/Hoist; Side-Boom; Slip-Form Paver; Tower Derrick; Tree Shredder; Trench Machine (Over 24" wide); Truck Mounted Concrete Pump; Tug Boat; Tunnel Machine and/or Mining Machine; and Wheel Excavator.

GROUP 2 - Asphalt Paver; Automatic Subgrader Machine, Self-Propelled (CMI Type); Bobcat Type and/or Skid Steer Loader with Hoe Attachment Greater than 7,000 lbs.; Boring Machine More than 48"; Bulldozer; Endloader; Hydro Milling Machine; Horizontal Directional Drill (over 50,000 ft. lbs. thrust); Kolman-type Loader (production type-Dirt); Lead Greaseman; Lighting & Traffic Signal Installation Equipment (includes all groups or classifications); Material Transfer Equipment (Shuttle Buggy) Asphalt; Pettibone-Rail Equipment; Power Grader; Power Scraper; Push Cat; Rotomill (all), Grinders & Planers of All types; Trench Machine (24" wide & under); and Vermeer type Concrete Saw.

GROUP 3 - A-Frame; Air Compressor on Tunnel Work (low pressure); Asphalt Plant Engineer; Bobcat-type and/or Skid Steer Loader with or without Attachments; Highway Drills

(all types); Locomotive (narrow gauge); Material Hoist/Elevator; Mixer, Concrete (more than one bag capacity); Mixer, one bag capacity (Side Loader); Power Boiler (Over 15 lbs. Pressure) Pump Operator installing & operating Well Points; Pump (4" & over discharge); Railroad Tie Inserter/Remover; Roller, Asphalt; Rotovator (lime soil stabilizer); Switch & Tie Tampers (without lifting & aligning device); Utility Operator (Small equipment); and Welding Machines; Articulating/straight bed end dumps if assigned (minus \$4.00 per hour).

GROUP 4 - Backfiller; Ballast Re-locator; Bars, Joint & Mesh Installing Machine; Batch Plant; Boring Machine Operator (48" or less); Bull Floats; Burlap & Curing Machine; Concrete Plant (capacity 4 yd. & under); Concrete Saw (Multiple); Conveyor (Highway); Crusher; Deckhand; Farm-type Tractor with attachments (highway); Finishing Machine; Fireperson, Floating Equipment (all types); Fork Lift; Form Trencher; Hydro Hammer except masonry; Hydro Seeder; Pavement Breaker; Plant Mixer; Post Driver; Post Hole Digger (Power Auger); Power Brush Burner; Power Form Handling Equipment; Road Widening Trencher; Roller (Brick, Grade & Macadam); Self-Propelled Power Spreader; Self-Propelled Power Subgrader; Steam Fireperson; Tractor (Pulling Sheepfoot, Roller or Grader); and Vibratory Compactor with Integral Power.

GROUP 5 - Compressor (Portable, Sewer, Heavy & Highway); Drum Fireperson (Asphalt Plant); Generator; Masonary Forklift; Inboard-Outboard Motor Boat Launch; Oil Heater (asphalt plant); Oiler/Helper; Power Driven Heater; Power Sweeper & Scrubber; Pump (under 4" discharge); Signalperson; Tire Repairperson; VAC/ALLS; Cranes - Compact, track or rubber under 4,000 pound capacity; fueling and greasing; and Chainmen.

GROUP 6 - Master Mechanic & Boom from 150 to 180.

GROUP 7 - Boom from 180 and over.

ENGI0066-023 06/01/2023

COLUMBIANA, MAHONING & TRUMBULL COUNTIES

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
ASBESTOS; HAZARDOUS/TOXIC		
WASTE PROJECTS		
GROUP 1 - A & B.....	\$ 44.63	24.30
ASBESTOS; HAZARDOUS/TOXIC		
WASTE PROJECTS		
GROUP 2 - A & B.....	\$ 44.30	24.30

ASBESTOS; HAZARDOUS/TOXIC		
WASTE PROJECTS		
GROUP 3 - A & B.....	\$ 38.47	24.30
ASBESTOS; HAZARDOUS/TOXIC		
WASTE PROJECTS		
GROUP 4 - A & B.....	\$ 34.52	24.30
ASBESTOS; HAZARDOUS/TOXIC		
WASTE PROJECTS		
GROUP 5 - A & B.....	\$ 31.13	24.30
HAZARDOUS/TOXIC WASTE		
PROJECTS		
GROUP 1 - C & D.....	\$ 40.91	24.30
HAZARDOUS/TOXIC WASTE		
PROJECTS		
GROUP 2 - C & D.....	\$ 40.61	24.30
HAZARDOUS/TOXIC WASTE		
PROJECTS		
GROUP 3 - C & D.....	\$ 35.27	24.30
HAZARDOUS/TOXIC WASTE		
PROJECTS		
GROUP 4 - C & D.....	\$ 31.65	24.30
HAZARDOUS/TOXIC WASTE		
PROJECTS		
GROUP 5 - C & D.....	\$ 28.53	24.30
ALL OTHER WORK		
GROUP 1.....	\$ 37.19	24.30
ALL OTHER WORK		
GROUP 2.....	\$ 36.92	24.30
ALL OTHER WORK		
GROUP 3.....	\$ 32.06	24.30
ALL OTHER WORK		
GROUP 4.....	\$ 28.77	24.30
ALL OTHER WORK		
GROUP 5.....	\$ 25.94	24.30

GROUP 1 - Rig, Pile Driver or Caisson Type; & Rig, Pile Hydraulic Unit Attached

GROUP 2 - Asphalt Heater Planer; Backfiller with Drag Attachment; Backhoe; Backhoe with Shear attached; Backhoe-Rear Pivotal Swing; Batch Plant-Central Mix Concrete; Batch Plant, Portable concrete; Berm Builder-Automatic; Boat Derrick; Boat-Tug; Boring Machine Attached to Tractor; Bullclam; Bulldozer; C.M.I. Road Builder & Similar Type; Cable Placer & Layer; Carrier-Straddle; Carryall-Scraper or Scoop; Chicago Boom; Compactor with Blade Attached; Concrete Saw (Vermeer or similar type); Concrete Spreader Finisher; Combination, Bidwell Machine; Crane; Crane-Electric Overhead; Crane-Rough Terrain; Crane-Side Boom; Crane-Truck; Crane-Tower; Derrick-Boom; Derrick-Car; Digger-Wheel (Not trencher or road widener); Double Nine; Drag Line; Dredge; Drill-Kenny or Similar Type; Easy Pour Median Barrier Machine (or similar type); Electromatic; Frankie Pile;

Gradall; Grader; Gurry; Self-Propelled; Heavy Equipment Robotics Operator/Mechanic; Hoist-Monorail; Hoist-Stationary & Mobile Tractor; Hoist, 2 or 3 drum; Horizontal Directional Drill Operator; Jackall; Jumbo Machine; Kocal & Kuhlman; Land-Seagoing Vehicle; Loader, Elevating; Loader, Front End; Loader, Skid Steer; Locomotive; Mechanic/Welder; Metro Chip Harvester with Boom; Mucking Machine; Paver-Asphalt Finishing Machine; Paver-Road Concrete; Paver-Slip Form (C.M.I. or similar); Place Crete Machine with Boom; Post Driver (Carrier mounted); Power Driven Hydraulic Pump & Jack (When used in Slip Form or Lift Slab Construction); Pump Crete Machine; Regulator-Ballast; Hydraulic Power Unit not attached to Rig for Pile Drillings; Rigs-Drilling; Roto Mill or similar Full Lane (8' Wide & Over); Roto Mill or similar type (Under 8'); Shovel; Slip Form Curb Machine; Speedwing; Spikemaster; Stonecrusher; Tie Puller & Loader; Tie Tamper; Tractor-Double Boom; Tractor with Attachments; Truck-Boom; Truck-Tire; Trench Machine; Tunnel Machine (Mark 21 Java or similar); & Whirley (or similar type)

GROUP 3 - Asphalt Plant; Bending Machine (Pipeline or similar type); Boring machine, Motor Driven; Chip Harvester without Boom; Cleaning Machine, Pipeline Type; Coating Machine, Pipeline Type; Compactor; Concrete Belt Placer; Concrete Finisher; Concrete Planer or Asphalt; Concrete Spreader; Elevator; Fork Lift (Home building only); Fork lift & Lulls; Fork Lift Walk Behind (Hoisting over 1 buck high); Form Line Machine; Grease Truck operator; Grout Pump; Gunnite Machine; Horizontal Directional Drill Locator; Single Drum Hoist with or without Tower; Huck Bolting Machine; Hydraulic Scaffold (Hoisting building materials); Paving Breaker (Self-propelled or Ridden); Pipe Dream; Pot Fireperson (Power Agitated); Refrigeration Plant; Road Widener; Roller; Sasgen Derrick; Seeding Machine; Soil Stabilizer (Pump type); Spray Cure Machine, Self-Propelled; Straw Blower Machine; Sub-Grader; Tube Finisher or Broom C.M.I. or similar type; & Tugger Hoist

GROUP 4 - Air Curtain Destructor & Similar Type; Batch Plant-Job Related; Boiler Operator; Compressor; Conveyor; Curb Builder, self-propelled; Drill Wagon; Generator Set; Generator-Steam; Heater-Portable Power; Hydraulic Manipulator Crane; Jack-Hydraulic Power driven; Jack-Hydraulic (Railroad); Ladavator; Minor Machine Operator; Mixer-Concrete; Mulching Machine; Pin Puller; Power Broom; Pulverizer; Pump; Road Finishing Machine (Pull Type); Saw-Concrete-Self-Propelled (Highway Work); Signal Person; Spray Cure Machine-Motor Powered; Stump Cutter; Tractor; Trencher Form; Water Blaster; Steam Jenny; Syphon; Vibrator-Gasoline; & Welding Machine

GROUP 5 - Brakeperson; Fireperson; & Oiler

IRON0017-002 05/01/2024

ASHTABULA (North of Route 6, starting at the Geauga County Line, proceeding east to State Route 45), CUYAHOGA, ERIE (Eastern 2/3), GEAUGA, HURON (East of a line drawn from the north border through Monroeville & Willard), LAKE, LORAIN, MEDINA (North of Old Rte. #224), PORTAGE (West of a line from Middlefield to Shalersville to Deerfield), and SUMMIT (North of Old Rte. #224, including city limits of Barberton) COUNTIES

	Rates	Fringes
IRONWORKER		
Ornamental, Reinforcing, & Structural.....	\$ 36.83	29.01

IRON0017-010 05/01/2024

ASHTABULA (Eastern part from Lake Erie on the north to route #322 on the south to include Conneaut, Kingsville, Sheffield, Denmark, Dorset, Cherry Valley, Wayne, Monroe, Pierpont, Richmond, Andover & Williamsfield Townships)

	Rates	Fringes
IRONWORKER		
Structural, including metal building erection & Reinforcing.....	\$ 36.83	29.01

IRON0044-001 06/01/2025

ADAMS (Western Part), BROWN, BUTLER (Southern Part), CLERMONT, CLINTON (South of a line drawn from Blanchester to Lynchburg), HAMILTON, HIGHLAND (Excluding eastern one-fifth & portion of county inside lines drawn from Marshall to Lynchburg from the northern county line through E. Monroe to Marshall) and WARREN (South of a line drawn from Blanchester through Morrow to the west county line) COUNTIES

	Rates	Fringes
IRONWORKER, REINFORCING.....	\$ 38.27	23.90

IRON0044-002 06/01/2025

CLINTON (South of a line drawn from Blanchester to Lynchburg), HAMILTON, HIGHLAND (Excluding eastern one-fifth & portion of county inside lines drawn from Marshall to Lynchburg from the northern county line through E. Monroe to Marshall) & WARREN

(South of a line drawn from Blanchester through Morrow to the west county line)

	Rates	Fringes
IRONWORKER		
Fence Erector.....	\$ 35.88	23.90
Ornamental; Structural.....	\$ 37.77	23.90

IRON0055-003 07/01/2024		

CRAWFORD (Area Between lines drawn from where Hwy #598 & #30 meet through N. Liberty to the northern border & from said Hwy junction point due west to the border), DEFIANCE (S. of a line drawn from where Rte. #66 meets the northern line through Independence to the eastern county border), ERIE (Western 1/3), FULTON, HANCOCK, HARDIN (North of a line drawn from Maysville to a point 4 miles south of the northern line on the eastern line), HENRY, HURON (West of a line drawn from the northern border through Monroeville & Willard), LUCAS, OTTAWA, PUTNAM (East of a line drawn from the northern border down through Miller City to where #696 meets the southern border), SANDUSKY, SENECA, WILLIAMS (East of a line drawn from Pioneer through Stryker to the southern border), WOOD & WYANDOT (North of Rte. #30)

	Rates	Fringes
IRONWORKER		
Fence Erector.....	\$ 26.40	24.62
Flat Road Mesh.....	\$ 29.77	21.30
Tunnels & Caissons Under Pressure.....	\$ 29.77	21.30
All Other Work.....	\$ 35.50	29.20

IRON0147-002 06/01/2025		

ALLEN (Northern half), DEFIANCE (Northern part, excluding south of a line drawn from where Rte. #66 meets the northern line through Independence to the eastern county border), MERCER (Northern half), PAULDING, PUTNAM (Western part, excluding east of a line drawn from the northern border down through Miller City to where #696 meets the southern border), VAN WERT, and WILLIAMS (Western part, excluding east of a line drawn from Pioneer through Stryker to the southern border) COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 38.00	26.39

IRON0172-002 06/01/2025		

CHAMPAIGN (Eastern one-third), CLARK (Eastern one-fourth), COSHOCTON (West of a line beginning at the northwestern county line going through Walhonding & Tunnel Hill to the southern county line), CRAWFORD (South of Rte. #30), DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, HARDIN (Excluding a line drawn from Roundhead to Maysville), HIGHLAND (Eastern one-fifth), HOCKING, JACKSON (Northern half), KNOX, LICKING, LOGAN (Eastern one-third), MADISON, MARION, MORROW, MUSKINGUM (West of a line starting at Adams Mill going to Adamsville & going from Adamsville through Blue Rock to the southern border), PERRY, PICKAWAY, PIKE (Northern half), ROSS, UNION, VINTON and WYANDOT (South of Rte. #30) COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 40.87	23.15

IRON0207-004 06/01/2025		

ASHTABULA (Southern part starting at the Geauga County line), COLUMBIANA (E. of a line from Damascus to Highlandtown), MAHONING (N. of Old Route #224), PORTAGE (E. of a line from Middlefield to Shalersville to Deerfield) & TRUMBULL

	Rates	Fringes
IRONWORKER		
Layout; Sheeter.....	\$ 37.26	28.16
Ornamental; Reinforcing;		
Structural.....	\$ 36.26	28.16

IRON0290-002 06/01/2025		

ALLEN (Southern half), AUGLAIZE, BUTLER (North of a line drawn from east to the west county line going through Oxford, Darrtown & Woodsdale), CHAMPAIGN (Excluding east of a line drawn from Catawla to the point where #68 intersects the northern county line), CLARK (Western two-thirds), CLINTON (Excluding south of a line drawn from Blanchester to Lynchburg), DARKE, GREENE, HIGHLAND (Inside lines drawn from Marshall to Lynchburg & from the northern county line through East Monroe to Marshall), LOGAN (West of a line drawn from West Liberty to where the northern county line meets the western county line of Hardin), MERCER (Southern half), MIAMI, MONTGOMERY, PREBLE, SHELBY & WARREN (Excluding south of a line drawn from Blanchester through Morrow to the western county line) COUNTIES

Rates	Fringes

IRONWORKER.....	\$ 37.39	25.35

IRON0549-003 12/01/2022

BELMONT, GUERNSEY, HARRISON, JEFFERSON, MONROE & MUSKINGUM
(Excluding portion west of a line starting at Adams Mill going
to Adamsville and going from Adamsville through Blue Rock to
the south border)

	Rates	Fringes

IRONWORKER.....	\$ 35.19	25.66

IRON0550-004 05/01/2024

ASHLAND, CARROLL, COLUMBIANA (W. of a line from Damascus to
Highlandtown), COSHOCTON (E. of a line beginning at NW Co. line
going through Walhonding & Tunnel Hill to the South Co. line),
HOLMES, HURON (S. of Old Rte. #224), MAHONING (S. of Old Rte.
#224), MEDINA (S. of Old Rte. #224), PORTAGE (S. of Old Rte.
#224), RICHLAND, STARK, SUMMIT (S. of Old Rte. #224, Excluding
city limits of Barberton), TUSCARAWAS, & WAYNE

	Rates	Fringes

Ironworkers:Structural, Ornamental and Reinforcing.....	\$ 34.70	22.88

IRON0769-004 06/01/2025

ADAMS (Eastern Half), GALLIA, JACKSON (Southern Half), LAWRENCE
& SCIOTO

	Rates	Fringes

IRONWORKER.....	\$ 39.70	29.59

IRON0787-003 06/01/2025

ATHENS, MEIGS, MORGAN, NOBLE, and WASHINGTON COUNTIES

	Rates	Fringes

IRONWORKER.....	\$ 36.10	24.65

LABO0265-008 05/01/2024

	Rates	Fringes

LABORER
ASHTABULA, ERIE, HURON,

LORAIN, LUCAS, MAHONING,		
MEDINA, OTTAWA, PORTAGE,		
SANDUSKY, STARK, SUMMIT,		
TRUMBULL & WOOD COUNTIES		
GROUP 1.....	\$ 35.95	14.45
GROUP 2.....	\$ 36.12	14.45
GROUP 3.....	\$ 36.45	14.45
GROUP 4.....	\$ 36.90	14.45
CUYAHOGA AND GEAUGA		
COUNTIES ONLY: SEWAGE		
PLANTS, WASTE PLANTS,		
WATER TREATMENT		
FACILITIES, PUMPING		
STATIONS, & ETHANOL PLANTS		
CONSTRUCTION.....	\$ 38.56	14.45
CUYAHOGA, GEAUGA & LAKE		
COUNTIES		
GROUP 1.....	\$ 37.18	14.45
GROUP 2.....	\$ 37.35	14.45
GROUP 3.....	\$ 37.68	14.45
GROUP 4.....	\$ 38.13	14.45
REMAINING COUNTIES OF OHIO		
GROUP 1.....	\$ 35.52	14.45
GROUP 2.....	\$ 35.69	14.45
GROUP 3.....	\$ 36.02	14.45
GROUP 4.....	\$ 36.47	14.45

LABORER CLASSIFICATIONS

GROUP 1 - Asphalt Laborer; Carpenter Tender; Concrete Curing Applicator; Dump Man (Batch Truck); Guardrail and Fence Installer; Joint Setter; Laborer (Construction); Landscape Laborer; Mesh Handlers & Placer; Right-of-way Laborer; Riprap Laborer & Grouter; Scaffold Erector; Seal Coating; Surface Treatment or Road Mix Laborer; Sign Installer; Slurry Seal; Utility Man; Bridge Man; Handyman; Waterproofing Laborer; Flagperson; Hazardous Waste (level D); Diver Tender; Zone Person & Traffic Control

GROUP 2 - Asphalt Raker; Concrete Puddler; Kettle Man Pipeline); Machine Driven Tools (Gas, Electric, Air); Mason Tender; Brick Paver; Mortar Mixer; Power Buggy or Power Wheelbarrow; Paint Striper; Sheeting & Shoring Man; Surface Grinder Man; Plastic Fusing Machine Operator; Pug Mill Operator; & Vacuum Devices (wet or dry); Rodding Machine Operator; Diver; Screwman or Paver; Screed Person; Water Blast, Hand Held Wand; Pumps 4" & Under (Gas, Air or Electric) & Hazardous Waste (level C); Air Track and Wagon Drill; Bottom Person; Cofferdam (below 25 ft. deep); Concrete Saw Person; Cutting with Burning Torch; Form Setter; Hand Spiker (Railroad); Pipelayer; Tunnel Laborer (without air) & Caisson; Underground Person (working in Sewer and Waterline, Cleaning, Repairing & Reconditioning); Sandblaster Nozzle Person; & Hazardous Waste (level B)

GROUP 3 - Blaster; Mucker; Powder Person; Top Lander;
Wrencher (Mechanical Joints & Utility Pipeline); Yarner;
Hazardous Waste (level A); Concrete Specialist; Concrete
Crew in Tunnels (With Air-pressurized - \$1.00 premium);
Curb Setter & Cutter; Grade Checker; Utility Pipeline
Tapper; Waterline; and Caulker

GROUP 4 - Miner (With Air-pressurized - \$1.00 premium); &
Gunite Nozzle Person

TUNNEL LABORER WITH AIR-PRESSURIZED ADD \$1.00 TO BASE RATE

SIGNAL PERSON WILL RECEIVE THE RATE EQUAL TO THE RATE PAID
THE LABORER CLASSIFICATION FOR WHICH HE OR SHE IS SIGNALING.

PAIN0006-002 05/01/2023

ASHTABULA, CUYAHOGA, GEAUGA, LAKE, LORAIN, PORTAGE (N. of the
East-West Turnpike) & SUMMIT (N. of the East-West Turnpike)

	Rates	Fringes
PAINTER		
COMMERCIAL NEW WORK;		
REMODELING; & RENOVATIONS		
GROUP 1.....	\$ 30.75	18.95
GROUP 2.....	\$ 31.15	18.95
GROUP 3.....	\$ 31.45	18.95
GROUP 4.....	\$ 37.01	18.95
COMMERCIAL REPAINT		
GROUP 1.....	\$ 29.25	18.95
GROUP 2.....	\$ 29.65	18.95
GROUP 3.....	\$ 29.95	18.95

PAINTER CLASSIFICATIONS - COMMERCIAL NEW WORK; REMODELING; &
RENOVATIONS

GROUP 1 - Brush; & Roller

GROUP 2 - Sandblasting & Buffing

GROUP 3 - Spray Painting; Closed Steel Above 55 feet; Bridges
& Open Structural Steel; Tanks - Water Towers; Bridge
Painters; Bridge Riggers; Containment Builders

GROUP 4 - Bridge Blaster

PAINTER CLASSIFICATIONS - COMMERCIAL REPAINT

GROUP 1 - Brush; & Roller

GROUP 2 - Sandblasting & Buffing

GROUP 3 - Spray Painting

PAIN0007-002 07/01/2025

FULTON, HENRY, LUCAS, OTTAWA (Excluding Allen, Bay, Bono,
Catawba Island, Clay Center, Curtice, Danbury, Eagle Beach,
Elliston, Elmore, Erie, Fishback, Gem Beach & Genova) & WOOD

	Rates	Fringes
PAINTER		
NEW COMMERCIAL WORK		
GROUP 1.....	\$ 33.66	23.88
GROUP 2.....	\$ 34.66	23.88
GROUP 3.....	\$ 34.66	23.88
GROUP 4.....	\$ 34.66	23.88
GROUP 5.....	\$ 34.66	23.88
GROUP 6.....	\$ 34.66	23.88
GROUP 7.....	\$ 34.66	23.88
GROUP 8.....	\$ 34.66	23.88
GROUP 9.....	\$ 34.66	23.88

REPAINT IS 90% OF JR

PAINTER CLASSIFICATIONS

GROUP 1 - Brush; Spray & Sandblasting Pot Tender

GROUP 2 - Refineries & Refinery Tanks; Surfaces 30 ft. or
over where material is applied to or labor performed on
above ground level (exterior), floor level (interior)

GROUP 3 - Swing Stage & Chair

GROUP 4 - Lead Abatement

GROUP 5 - All Methods of Spray

GROUP 6 - Solvent-Based Catalized Epoxy Materials of 2 or
More Component Materials, to include Solvent-Based
Conversion Varnish (excluding water based)

GROUP 7 - Spray Solvent Based Material; Sand & Abrasive
Blasting

GROUP 8 - Towers; Tanks; Bridges; Stacks Over 30 Feet

GROUP 9 - Epoxy Spray (excluding water based)

PAIN0012-008 05/01/2019

BUTLER COUNTY

	Rates	Fringes
PAINTER		
GROUP 1.....	\$ 21.95	10.20
GROUP 2.....	\$ 25.30	10.20
GROUP 3.....	\$ 25.80	10.20
GROUP 4.....	\$ 26.05	10.20
GROUP 5.....	\$ 26.30	10.20

PAINTER CLASSIFICATIONS

GROUP 1: Bridge Equipment Tender; Bridge/Containment Builder

GROUP 2: Brush & Roller

GROUP 3: Spray

GROUP 4: Sandblasting; & Waterblasting

GROUP 5: Elevated Tanks; Steeplejack Work; Bridge; & Lead
Abatement

PAIN0012-010 05/01/2019

BROWN, CLERMONT, CLINTON, HAMILTON & WARREN

	Rates	Fringes
PAINTER		
HEAVY & HIGHWAY BRIDGES- GUARDRAILS-LIGHTPOLES- STRIPING		
Bridge Equipment Tender and Containment Builder....	\$ 21.95	10.20
Bridges when highest point of clearance is 60 feet or more; & Lead Abatement Projects.....	\$ 26.30	10.20
Brush & Roller.....	\$ 25.30	10.20
Sandblasting & Hopper Tender; Water Blasting.....	\$ 26.05	10.20
Spray.....	\$ 25.80	10.20

PAIN0093-001 12/01/2024

ATHENS, GUERNSEY, HOCKING, MONROE, MORGAN, NOBLE and
WASHINGTON COUNTIES

	Rates	Fringes
PAINTER		
Bridges; Locks; Dams;		
Tension Towers; &		
Energized Substations.....	\$ 36.44	24.46
Power Generating Facilities..	\$ 33.29	24.46

PAIN0249-002 05/01/2025

CLARK, DARKE, GREENE, MIAMI, MONTGOMERY & PREBLE

	Rates	Fringes
PAINTER		
GROUP 1 - Brush & Roller....	\$ 29.15	13.97
GROUP 2 - Swing, Scaffold		
Bridges; Structural Steel;		
Open Acid Tank; High		
Tension Electrical		
Equipment; & Hot Pipes.....	\$ 33.09	13.97
GROUP 3 - Spray;		
Sandblast; Steamclean;		
Lead Abatement.....	\$ 29.90	13.97
GROUP 4 - Steeplejack Work..	\$ 30.10	13.97
GROUP 5 - Coal Tar.....	\$ 30.65	13.97
GROUP 6 - Bridge Equipment		
Tender & or Containment		
Builder.....	\$ 37.86	13.97
GROUP 7 - Tanks, Stacks &		
Towers.....	\$ 33.86	13.97
GROUP 8 - Bridge Blaster,		
Rigger.....	\$ 40.86	13.97

PAIN0356-002 09/01/2009

KNOX, LICKING, MUSKINGUM, and PERRY

	Rates	Fringes
PAINTER		
Bridge Equipment Tenders		
and Containment Builders....	\$ 27.93	7.25
Bridges; Blasters;		
andRiggers.....	\$ 34.60	7.25
Brush and Roller.....	\$ 20.93	7.25
Sandblasting; Steam		
Cleaning; Waterblasting;		
and Hazardous Work.....	\$ 25.82	7.25
Spray.....	\$ 21.40	7.25
Structural Steel and Swing		
Stage.....	\$ 25.42	7.25
Tanks; Stacks; and Towers...	\$ 28.63	7.25

PAIN0438-002 12/01/2023

BELMONT, HARRISON and JEFFERSON COUNTIES

	Rates	Fringes
PAINTER		
Bridges, Locks, Dams, Tension Towers & Energized Substations.....	\$ 36.09	19.49
Power Generating Facilities.	\$ 32.94	19.49

PAIN0476-001 06/01/2025

COLUMBIANA, MAHONING, and TRUMBULL COUNITIES

	Rates	Fringes
PAINTER		
GROUP 1.....	\$ 30.64	18.36
GROUP 2.....	\$ 40.27	18.36
GROUP 3.....	\$ 40.27	18.36
GROUP 4.....	\$ 31.14	18.36
GROUP 5.....	\$ 31.29	18.36
GROUP 6.....	\$ 35.27	18.36
GROUP 7.....	\$ 32.64	18.36

PAINTER CLASSIFICATIONS:

GROUP 1: Painters, Brush & Roller

GROUP 2: Bridges

GROUP 3: Structural Steel

GROUP 4: Spray, Except Bar Joist/Deck

GROUP 5: Epoxy/Mastic; Spray- Bar Joist/Deck; Working Above
50 Feet; and Swingstages

GROUP 6: Tanks; Sandblasting

GROUP 7: Towers; Stacks

PAIN0555-002 01/01/2025

ADAMS, HIGHLAND, JACKSON, PIKE & SCIOTO

	Rates	Fringes
PAINTER		
GROUP 1.....	\$ 33.32	21.54

GROUP 2.....	\$ 35.02	21.54
GROUP 3.....	\$ 36.72	21.54
GROUP 4.....	\$ 40.03	21.54

PAINTER CLASSIFICATIONS

GROUP 1 - Containment Builder

GROUP 2 - Brush; Roller; Power Tools, Under 40 feet

GROUP 3 - Sand Blasting; Spray; Steam Cleaning; Pressure Washing; Epoxy & Two Component Materials; Lead Abatement; Hazardous Waste; Toxic Materials; Bulk & Storage Tanks of 25,000 Gallon Capacity or More; Elevated Tanks

GROUP 4 - Stacks; Bridges

PAIN0639-001 05/01/2011

	Rates	Fringes
Sign Painter & Erector.....	\$ 20.61	3.50+a+b+c

FOOTNOTES: a. 7 Paid Holidays: New Year's Day; Memorial Day; July 4th; Labor Day; Thanksgiving Day; Christmas Day & 1 Floating Day

b. Vacation Pay: After 1 year's service - 5 days' paid vacation; After 2, but less than 10 years' service - 10 days' paid vacation; After 10, but less than 20 years' service - 15 days' paid vacation; After 20 years' service - 20 days' paid vacation

c. Funeral leave up to 3 days maximum paid leave for death of mother, father, brother, sister, spouse, child, mother-in-law, father-in-law, grandparent and inlaw provided employee attends funeral

PAIN0788-002 06/01/2024

ASHLAND, CRAWFORD, ERIE, HANCOCK, HURON, MARION, MORROW, OTTAWA (Allen, Bay, Bono, Catawba Island, Clay Center, Curtice, Danbury, Eagle Beach, Elliston, Elmore, Erie, Fishback, Gem Beach & Genoa), RICHLAND, SANDUSKY, SENECA & WYANDOT

	Rates	Fringes
PAINTER		
Brush & Roller.....	\$ 29.13	17.52
Structural Steel.....	\$ 30.73	17.52

WINTER REPAINT: Between December 1 to March 31 - 90%JR

\$.50 PER HOUR SHALL BE ADDED TO THE RATE OF PAY FOR THE CLASSIFICATION OF WORK:

While working swingstage, boatswain chair, needle beam and horizontal cable. While operating sprayguns, sandblasting, cobblasting and high pressure waterblasting (4000psi).

\$1.00 PER HOUR SHALL BE ADDED TO THE RATE OF PAY FOR THE CLASSIFICATION OF WORK:

For the application of catalized epoxy, including latex epoxy that is deemed hazardous, lead abatement, or for work on material where special precautions beyond normal work duties must be taken. For working on stacks, tanks, and towers over 40 feet in height.

PAIN0813-005 12/01/2008

GALLIA, LAWRENCE, MEIGS & VINTON

	Rates	Fringes
PAINTER		
Base Rate.....	\$ 24.83	10.00
Bridges, Locks, Dams &		
Tension Towers.....	\$ 27.83	10.00

PAIN0841-001 07/01/2025

MEDINA, PORTAGE (South of and including Ohio Turnpike), and
SUMMIT (South of and including Ohio Turnpike) COUNTIES

	Rates	Fringes
Painters:		
GROUP 1.....	\$ 31.93	18.15
GROUP 2.....	\$ 32.58	18.15
GROUP 3.....	\$ 32.68	18.15
GROUP 4.....	\$ 32.78	18.15
GROUP 5.....	\$ 33.18	18.15
GROUP 6.....	\$ 38.60	18.15
GROUP 7.....	\$ 33.18	18.15

PAINTER CLASSIFICATIONS:

GROUP 1 - Brush, Roller & Paperhanger

GROUP 2 - Epoxy Application

GROUP 3 - Swing Scaffold, Bosum Chair, & Window Jack

GROUP 4 - Spray Gun Operator of Any & All Coatings

GROUP 5 - Sandblast, Painting of Standpipes, etc. from
Scaffolds, Bridge Work and/or Open Structural Steel,
Standpipes and/or Water Towers

GROUP 6 - Public & Commerce Transportation, Steel or
Galvanized, Bridges, Tunnels & Related Support Items
(concrete)

GROUP 7 - Synthetic Exterior, Drywall Finisher and/or Taper,
Drywall Finisher and Follow-up Man Using Automatic Tools

PAIN0841-002 07/01/2025

CARROLL, COSHOCTON, HOLMES, STARK, TUSCARAWAS & WAYNE

	Rates	Fringes
PAINTER		
Bridges; Towers, Poles & Stacks; Sandblasting Steel; Structural Steel & Metalizing.....	\$ 33.18	18.15
Brush & Roller.....	\$ 31.93	18.15
Spray; Tank Interior & Exterior.....	\$ 32.78	18.15

PAIN1020-002 07/01/2025

ALLEN, AUGLAIZE, CHAMPAIGN, DEFIANCE, HARDIN, LOGAN, MERCER,
PAULDING, PUTNAM, SHELBY, VAN WERT, and WILLIAMS COUNTIES

	Rates	Fringes
PAINTER		
Brush & Roller.....	\$ 27.59	18.54
Drywall Finishing & Taping..	\$ 28.34	18.54
Lead Abatement.....	\$ 29.34	18.54
Spray, Sandblasting Pressure Cleaning, & Refinery.....	\$ 28.34	18.54
Swing Stage, Chair, Spiders, & Cherry Pickers...	\$ 27.84	18.54
Wallcoverings.....	\$ 28.34	18.54

All surfaces 40 ft. or over where material is applied to or
labor performed on, above ground level (exterior), floor
level (interior) - \$.50 premium

Applying Coal Tar Products - \$1.00 premium

PAIN1275-002 05/01/2025

DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, MADISON, PICKAWAY, ROSS
& UNION

	Rates	Fringes
PAINTER		
Bridges.....	\$ 37.26	15.16
Brush; Roller.....	\$ 30.20	15.16
Sandblasting; Steamcleaning; Waterblasting (3500 PSI or Over) & Hazardous Work.....	\$ 32.35	15.16
Spray.....	\$ 32.15	15.16
Stacks; Tanks; & Towers.....	\$ 34.46	15.16
Structural Steel & Swing Stage.....	\$ 30.50	15.16

PLAS0109-001 06/01/2025

MEDINA, PORTAGE, STARK, and SUMMIT COUNTIES

	Rates	Fringes
PLASTERER.....	\$ 33.00	23.83

PLAS0109-003 06/01/2025

CARROLL, HOLMES, TUSCARAWAS, and WAYNE COUNTIES

	Rates	Fringes
PLASTERER.....	\$ 33.00	23.83

PLAS0132-002 07/01/2025

BROWN, BUTLER, CLERMONT, HAMILTON, HIGHLAND, WARREN COUNTIES

	Rates	Fringes
PLASTERER.....	\$ 31.35	17.65

PLAS0404-002 05/01/2018

ASHTABULA, CUYAHOGA, GEAUGA, AND LAKE COUNTIES

	Rates	Fringes
PLASTERER.....	\$ 29.63	17.11

PLAS0404-003 05/01/2018

LORAIN COUNTY

	Rates	Fringes
PLASTERER.....	\$ 28.86	17.11

PLAS0526-022 05/01/2018		

COLUMBIANA, MAHONING, and TRUMBULL COUNTIES

	Rates	Fringes
PLASTERER.....	\$ 28.86	17.11

PLAS0526-023 05/01/2018		

BELMONT, HARRISON, and JEFFERSON COUNTIES

	Rates	Fringes
PLASTERER.....	\$ 28.21	17.11

PLAS0886-001 07/01/2024		

FULTON, HANCOCK, HENRY, LUCAS, PUTNAM, and WOOD COUNTIES

	Rates	Fringes
PLASTERER.....	\$ 33.73	23.25

PLAS0886-003 07/01/2024		

DEFIANCE, ERIE, HURON, OTTAWA, PAULDING, SANDUSKY, and SENECA

	Rates	Fringes
PLASTERER.....	\$ 33.73	23.25

PLAS0886-004 07/01/2024		

ALLEN, AUGLAIZE, HARDIN, LOGAN, MERCER, and VAN WERT

	Rates	Fringes
PLASTERER.....	\$ 33.73	23.25

PLUM0042-002 07/01/2025		

ASHLAND, CRAWFORD, ERIE, HURON, KNOX, LORAIN, MORROW, RICHLAND
& WYANDOT

Rates	Fringes

Plumber, Pipefitter, Steamfitter.....	\$ 43.02	26.45

PLUM0050-002 06/30/2025

DEFIANCE, FULTON, HANCOCK, HENRY, LUCAS, OTTAWA, PAULDING,
PUTNAM, SANDUSKY, SENECA, WILLIAMS & WOOD

	Rates	Fringes
Plumber, Pipefitter, Steamfitter.....	\$ 51.00	32.56

PLUM0055-003 05/05/2025

ASHTABULA, CUYAHOGA, GEAUGA, LAKE, MEDINA (N. of Rte. #18 &
Smith Road) & SUMMIT (N. of Rte. #303, including the corporate
limits of the city of Hudson)

	Rates	Fringes
PLUMBER.....	\$ 44.86	30.03

PLUM0083-001 07/01/2023

BELMONT & MONROE (North of Rte. #78)

	Rates	Fringes
Plumber and Steamfitter.....	\$ 35.94	37.35

PLUM0094-002 05/01/2025

CARROLL (Northern Half), STARK, and WAYNE COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER.....	\$ 47.48	27.14

PLUM0120-002 05/01/2025

ASHTABULA, CUYAHOGA, GEAUGA, LAKE, LORAIN (the C.E.I. Power
House in Avon Lake), MEDINA (N. of Rte. #18) & SUMMIT (N. of
#303)

	Rates	Fringes
PIPEFITTER.....	\$ 49.17	28.55

PLUM0162-002 06/01/2024

CHAMPAIGN, CLARK, CLINTON, DARKE, FAYETTE, GREENE, MIAMI,
MONTGOMERY & PREBLE

	Rates	Fringes
Plumber, Pipefitter, Steamfitter.....	\$ 43.05	27.18

PLUM0168-002 06/01/2025		

MEIGS, MONROE (South of Rte. #78), MORGAN (South of Rte. #78)
& WASHINGTON

	Rates	Fringes
PLUMBER/PIPEFITTER.....	\$ 40.92	37.20

PLUM0189-002 06/01/2024		

DELAWARE, FAIRFIELD, FRANKLIN, HOCKING, LICKING, MADISON,
MARION, PERRY, PICKAWAY, ROSS & UNION

	Rates	Fringes
Plumber, Pipefitter, Steamfitter.....	\$ 43.25	26.94

PLUM0219-002 06/01/2025		

MEDINA (Rte. #18 from eastern edge of Medina Co., west to
eastern corporate limits of the city of Medina, & on the county
road from the west corporate limits of Medina running due west
to and through community of Risley to the western edge of
Medina County - All territory south of this line), PORTAGE, and
SUMMIT (S. of Rte. #303) COUNTIES

	Rates	Fringes
Plumber and Steamfitter.....	\$ 46.87	28.39

PLUM0392-002 06/01/2025		

BROWN, BUTLER, CLERMONT, HAMILTON & WARREN

	Rates	Fringes
PLUMBER/PIPEFITTER.....	\$ 43.30	27.40

PLUM0396-001 06/01/2025		

COLUMBIANA (Excluding Washington & Yellow Creek Townships & Liverpool Twp. - Secs. 35 & 36 - West of County Road #427), MAHONING and TRUMBULL COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER.....	\$ 40.55	29.25

PLUM0495-002 06/01/2025		

CARROLL (Rose, Monroe, Union, Lee, Orange, Perry & Loudon Townships), COLUMBIANA (Washington & Yellow Creek Townships & Liverpool Township, Secs. 35 & 36, West of County Rd. #427), COSHOCTON, GUERNSEY, HARRISON, HOLMES, JEFFERSON, MORGAN (South to State Rte. #78 & from McConnelsville west on State Rte. #37 to the Perry County line), MUSKINGUM, NOBLE, and TUSCARAWAS COUNTIES

	Rates	Fringes
Plumber, Pipefitter, Steamfitter.....	\$ 39.32	37.60

PLUM0577-002 06/01/2025		

ADAMS, ATHENS, GALLIA, HIGHLAND, JACKSON, LAWRENCE, PIKE, SCIOTO & VINTON

	Rates	Fringes
Plumber, Pipefitter, Steamfitter.....	\$ 42.65	28.56

PLUM0776-002 07/01/2025		

ALLEN, AUGLAIZE, HARDIN, LOGAN, MERCER, SHELBY and VAN WERT COUNTIES

	Rates	Fringes
Plumber, Pipefitter, Steamfitter.....	\$ 42.76	30.81

TEAM0377-003 05/01/2025		

STATEWIDE, EXCEPT CUYAHOGA, GEAUGA & LAKE

	Rates	Fringes
TRUCK DRIVER		

GROUP 1.....	\$ 34.26	18.85
GROUP 2.....	\$ 35.26	18.85

TRUCK DRIVER CLASSIFICATIONS

GROUP 1 - Asphalt Distributor; Batch; 4- Wheel Service;
4-Wheel Dump; Oil Distributor & Tandem

GROUP 2 - Tractor-Trailer Combination: Fuel; Pole Trailer;
Ready Mix; Semi-Tractor; & Asphalt Oil Spraybar Man When
Operated From Cab; 5 Axles & Over; Belly Dump; End Dump;
Articulated Dump; Heavy Duty Equipment; Low Boy; & Truck
Mechanic

TEAM0436-002 05/01/2025

CUYAHOGA, GEAUGA & LAKE

	Rates	Fringes
TRUCK DRIVER		
GROUP 1.....	\$ 34.92	19.30
GROUP 2.....	\$ 35.73	19.30

GROUP 1: Straight & Dump, Straight Fuel

GROUP 2: Semi Fuel, Semi Tractor, Euclids, Darts, Tank,
Asphalt Spreaders, Low Boys, Carry-All, Tourna-Rockers,
Hi-Lifts, Extra Long Trailers, Semi-Pole Trailers, Double
Hook-Up Tractor Trailers including Team Track & Railroad
Siding, Semi-Tractor & Tri-Axle Trailer, Tandem Tractor &
Tandem Trailer, Tag Along Trailer, Expandable Trailer or
Towing Requiring Road Permits, Ready-Mix (Agitator or
Non-Agitator), Bulk Concrete Driver, Dry Batch Truck,
Articulated End Dump

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher
minimum wage under Executive Order 14026 (\$17.75) or 13658
(\$13.30). Please see the Note at the top of the wage
determination for more information. Please also note that the
minimum wage requirements of Executive Order 14026 are not
currently being enforced as to any contract or subcontract to
which the states of Texas, Louisiana, or Mississippi, including
their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave

for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than "SU", "UAVG", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE:

UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

- a) a survey underlying a wage determination
- b) an existing published wage determination
- c) an initial WHD letter setting forth a position on a wage determination matter
- d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"