



**E-54 Regional Lift Station - RFCSP  
Solicitation Number: CO-00537  
Job No.: 22-2502**

**ADDENDUM 4  
October 28, 2022**

To Respondent of Record:

This addendum, applicable to project referenced above, is an amendment to the proposal, plans and specifications and as such will be a part of and included in the Contract Documents. Acknowledge receipt of this addendum by entering the addendum number and issue date on the space provided in submitted copies of the Respondent Questionnaire.

<b>RESPONSES TO QUESTIONS</b>
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**QUESTION 1:**

**Spec 15020 – 2.3 A 1. Please verify you want the Fusion Bonded Epoxy Lining for Ductile Iron Pipe & Fittings. Ceramic Epoxy is a much more common lining for the interior of ductile iron pipe in Sewage Service (P/401). There are some limitations to the length of the spools that may be used with Fusion Bonded Epoxy Lining. Please verify that it is acceptable to use an additional shorter spool piece if the length of them as shown on the drawings is too long for the coaters to apply the FBE Lining.**

*RESPONSE: Ceramic epoxy will be allowed by SAWS (Reference Specification Section 15020 – Piping System, Ductile Iron Pipe, attached to this addendum). Shorter lengths of DI acceptable to accommodate liner application. See Changes to the Specifications #2.*

**QUESTION 2:**

**In the bid document 10-c Schedule of Manufacturers and Suppliers (Sheet 96 of 813) Main Electrical Disconnect is referenced as in Specification Section 16930, should that be 16170? Please confirm.**

*RESPONSE: Refer to revised Schedule of Manufacturers and Suppliers provided with Addendum 2.*

**QUESTION 3:**

**I was looking at this solicitation, my question is regarding the documentation of the project, can this also be in a 3D walkthrough?**

*RESPONSE: No.*

**QUESTION 4:**

**Can you please provide a scale on Fossil Ridge demo & a detail on the SCADA concrete?**

*RESPONSE: Scale for Fossil Ridge Lift Station is unavailable. Detail for the Fossil Ridge SCADA concrete is unavailable.*

**QUESTION 5:**

**Is there a detail on the building foundation concrete?**

*RESPONSE: Reference Sheet S2.30: Generator Pad and Electrical Building and Tower Plans in the bid documents.*

**QUESTION 6:**

**Is the following note correct?**

**“Contractor shall engage a Texas licensed structural engineer to provide a signed and sealed set of structural plans, details and specification for the structural components of the pollution abatement basin including inlet discharge and bypass components. Contractor shall also provide for structural engineer’s construction certification upon completion of basin”.**

*RESPONSE: Note removed from Sheet C4.07 in Addendum #2. Sheet C4.07 was replaced in its entirety in Addendum #2.*

**QUESTION 7:**

**On the Addendum 1 SCADA System specs 1.04 PLC Input/Output List. They talk about an attached Appendix A I/O List. I did not see it with this addendum. Can you please provide the I/O list?**

*RESPONSE: Reference Appendix A provided with Addendum 2.*

**QUESTION 8:**

**Boring B-5 shows voids in the lower depths below the LS foundation and the geotechnical report mentions karstic features in the geology. It looks like there is 6” to 12” of limestone below the bottom of the 2’ select fill in this one boring before you hit the voids at 50 ft. below grade. This is very close to the foundation elevation. Can an allowance for additional soil borings be provided to confirm the overall dimensions of the void in that area?**

*RESPONSE: Geotechnical Report provided in the solicitation is for informational purposes only. An allowance for additional borings will not be provided.*

**QUESTION 9:**

**What is the separation distance between the double barrel 20in HDPE?**

*RESPONSE: Wall to wall separation distance is 4’ as shown on Sheet C4.05, Detail C4.05C.*

**QUESTION 10:**

**The structural plans call for #7 horizontals at 5ft. on center in all walls. Is this a typo?**

*RESPONSE: Rebar Spacing revised to 6” O.C. (Reference revised plan sheet S3.0: Section, attached to this Addendum). See Changes to the Plans #2.*

**QUESTION 11:**

**Cement suppliers have changed over to the TYPE 1L “environmentally friendly” cement. The specs are calling for Type II or I/II which are no longer available. Is the Type 1L cement acceptable?**

*RESPONSE: No objection to using Type 1L cement (Reference Specification Section 03300 – Cast-in-Place Concrete, attached to this addendum). See Changes to the Specifications #1.*

**QUESTION 12:**

**What manufacturer & size is required for water stops at the concrete construction joints?**

*RESPONSE: 4” Greenstreak dumbbell PVC waterstop or approved equal (Reference Sheet S3.0: Section, and Specification Section 03300 - Cast-In-Place Concrete, attached to this Addendum). See Changes to the Plans #2 and Changes to the Specifications #1.*

**QUESTION 13:**

**What is the dimension of the step in at each successive 15’ construction joint?**

RESPONSE: Step dimension shall be 6" (Reference revised plan sheet S3.0: Section, attached to this Addendum). See Changes to the Plans #2.

**QUESTION 14:**

**Contract documents refer to Section 16451 for lightning protection. Please provide this specification as pertaining to electrical building lightning protection.**

RESPONSE: Specification 16451 was included in Addendum No. 2.

**CHANGES TO THE SPECIFICATIONS**

1. Remove Specification Section 03300 – Cast-In-Place Concrete in its entirety and replace with the revised version attached to this addendum.
2. Remove Specification Section 15020 – Piping System, Ductile Iron Pipe in its entirety and replace with the revised version attached to this addendum.

**CHANGES TO THE PLANS**

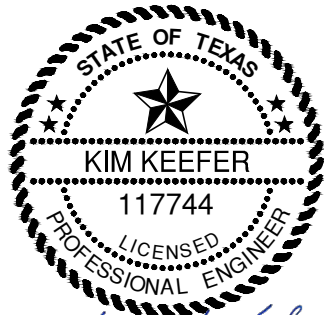
1. Remove Sheet S2.2: Wet Well Slab Plan in its entirety and replace with revised version attached to this addendum.
2. Remove Sheet S3.0: Section in its entirety and replace with revised version attached to this addendum.
3. Remove Sheet S3.1: Section in its entirety and replace with revised version attached to this addendum.

**ADDENDUM**

This Addendum, including these three (3) pages, is thirty-eight (38) pages with attachments in its entirety.

Attachments:

- Specification Section 03300 – Cast-In-Place Concrete (25 pages)
- Specification Section 15020 – Piping System, Ductile Iron Pipe (7 pages)
- Sheet S2.2: Section (1 page)
- Sheet S3.0: Section (1 page)
- Sheet S3.1: Section (1 page)



*Kim A. Keefer* 10/28/22

Kim Keefer, P.E.  
Pape-Dawson Engineers, Inc.

**SECTION 03300**  
**CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section specifies cast-in place concrete, including concrete materials, mixture design, placement procedures, concrete joints, embedment items, finishes, and curing for the following:
1. Footings.
  2. Foundation walls.
  3. Floors and slabs-on-grade.
  4. Floor and slab treatments.
  5. Suspended slabs.
  6. Equipment pads, pipe supports, light pole bases, thrust blocks and manhole bases.
  7. Framing members and walls.
  8. Waterproofing foundations.
  9. Modification and repair to existing concrete
- B. Related Sections include the following:
- C. Specify Sections in subparagraphs below that contain requirements Contractor might expect to find in this Section but are specified in other Sections. Do not list Sections that are referenced elsewhere in the Section.
1. Division 2 Section 02300 "Earthwork" for drainage fills under slabs-on-grade.

**1.3 REFERENCES**

- A. Definitions:
1. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
  2. Defective Area: Surface defects that include honeycomb, rock pockets, indentations greater the 3/16-inch, cracks 0.005 inch wide and larger and any crack that leaks for liquid containment basins and below grade habitable spaces, cracks 0.010 inch wide and larger in non-fluid holding structures, spalls, chips, air bubbles greater than 3/4 – inch in diameter, pinholes, bug holes, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins and other projections, form popouts, textureirregularities, and stains and other color variations that cannot be removed by cleaning.

3. Exposed Surfaces: Concrete surfaces that can be seen inside or outside of structures regardless whether concrete is above water, dry at all times, or can be seen when structure is drained.
  4. Hydraulic Structures: Liquid containment basins.
  5. New Concrete: Less than 60 days old.
  6. Slurry Concrete: Mixture of sand, 3/8-inch minus aggregate, cement, and water for wall construction joints.
- B. Reference Standards:
1. American Concrete Institute/ACI International (ACI):
    - a. 117 – Specifications for Tolerances for Concrete Construction
    - b. 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
    - c. 301 – Specification for Structural Concrete
    - d. 302.1R – Guide for Concrete Floor and Slab Construction
    - e. 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete
    - f. 304.2R – Placing Concrete by Pumping Methods
    - g. 305R – Hot Weather Concreting
    - h. 306.1 - Standard Specification for Cold Weather Concrete
    - i. 308.1 – Standard Practice for Curing Concrete
    - j. 318/318R – Building Code Requirements for Structural Concrete and Commentary
    - k. 350/350R – Code Requirements for Environmental Engineering Concrete Structures and Commentary.
  2. ASTM International (ASTM):
    - a. C31 – Standard Practice for Making and Curing Concrete Test Cylinders in the Field.
    - b. C33 – Standard Specification for Concrete Aggregates
    - c. C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
    - d. C42 – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
    - e. C94 – Standard Specification for Ready-Mixed Concrete
    - f. C143 – Standard Test Method for Slump of Hydraulic Cement Concrete
    - g. C150 – Standard Specification for Portland Cement
    - h. C171 – Standard Specification for Sheet Materials for Curing Concrete
    - i. C172 – Standard Practice for Sampling Fresh Concrete
    - j. C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

- k. C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
  - l. C260 – Standard Specification for Air-Entraining Admixtures for Concrete
  - m. C309 – Standard Specification for Liquid Membrane-forming Compounds for Curing Concrete
  - n. C494 – Standard Specification for Chemical Admixtures for Concrete
  - o. C595 – Standard Specification for Blended Hydraulic Cements
  - p. C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
  - q. C920 – Specification for Elastomeric Joint Sealants
  - r. D226 – Specification for Asphalt-Saturated Organic Felt used in roofing and Waterproofing
  - s. D227 – Specification for coal-Tar Saturated Organic Felt Used in Roofing and Waterproofing
  - t. D994 – Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
  - u. D1056 – Specification for Flexible Cellular materials – Sponge or Expanded Rubber
  - v. D1751 – Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient bituminous Types)
  - w. D1752 – Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural construction
  - x. E1155 – Standard test method for Determining FF Floor Flatness and FL Floor Levelness numbers
- 3. Corps of Engineers (CE): CRD-572 Specifications for Polyvinylchloride Waterstop
  - 4. National Ready-Mixed Concrete Association (NRMCA): Certification of Ready-Mixed Concrete Production facilities (Checklist with instructions)
  - 5. NSF International (NSF): 61-Drinking Water System Components-Health Effects

#### 1.4 SUBMITTALS

##### A. Action Submittals:

- 1. Product Data: Provide data on joint devices, attachment accessories, curing compounds, admixtures, tests performed to establish mix designs, and physical capacity of mixing plant and trucking facilities.
  - a. Design Mixtures: For each concrete mixture.
  - b. Gradation for coarse and fine aggregates, and combined together. List grading, percent passing through each sieve size.
- 2. Placement Drawings: Concrete, identifying location of each type of construction joint.

3. Detailed Cold Weather Concreting Plan for cold weather curing and protection of concrete placed and cured in weather below 40°F.
  4. Detailed Hot Weather Concreting Plan for hot weather placements including curing and protection for concrete placed in ambient temperatures greater than 90°F.
  5. Concrete repair methods and materials.
  6. Record Drawings: Accurately record actual locations of embedded utilities and components which are concealed from view.
- B. Informational Submittals:
1. Pre-installation conference minutes.
  2. Manufacturer's application instructions for bonding agent and bond breaker.
  3. Material Certificates: For each of the following as applicable signed by manufacturers:
    - a. Cementitious materials.
    - b. Admixtures.
    - c. Form materials and form-release agents.
    - d. Fly Ash.
    - e. Aggregates.
    - f. Waterstops.
    - g. Curing compounds.
    - h. Floor and slab treatments.
    - i. Bonding agents.
    - j. Bond Breaker.
    - k. Adhesives.
    - l. Vapor retarders.
    - m. Semi-rigid joint filler.
    - n. Joint-filler strips.
    - o. Repair materials.
  4. Statement of Qualifications:
    - a. Mix Designer.
    - b. Batch Plant.
  5. Test Reports.
    - a. Admixtures, test reports showing chemical ingredients and percentage of chloride in each admixture and fly ash.
    - b. Source test analysis report for fly ash, including percentage of chloride content.
    - c. Statement identifying aggregates reactivity. Determine water-soluble chloride in each component of aggregates in accordance with ASTM C1218.

- d. For each trial concrete mix design and signed by a qualified mix designer.
  - e. Cylinder compressive test results for laboratory concrete mixes.
6. Batch Ticket Information: Provide a delivery ticket for each batch of concrete before unloading containing the information listed in ASTM C94, Article 13 "Batch Ticket Information."

**1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA "Certification of Ready Mixed Concrete Production Facilities."
- B. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301, "Specification for Structural Concrete,"
  - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- C. Qualifications: Water stop manufacturer shall demonstrate a minimum of 5 years continuous experience in the manufacturer of PVC water stops.
- D. Pre-installation Conference: Conduct conference at Project site.

**1.6 PROJECT CONDITIONS**

- A. Environmental Conditions:
  - 1. General:
    - a. The concrete shall be mixed in quantities required for immediate use. Any concrete, which is not in place within the time limits specified, shall not be used. Concrete shall not be re-tempered.
    - b. Concrete shall not be placed if impending weather conditions would impair the quality of the finished work.
  - 2. Concrete Temperature:
    - a. No concrete shall be placed when the temperature of the concrete to be placed is greater than 90°F or less than 50°F. The temperature of the concrete to be placed shall be taken immediately before placement, with the point of measurement being in the chute or bucket.
  - 3. Cold Weather:
    - a. No concrete shall be mixed or placed when the atmospheric temperature is at or below 40°F. The temperature shall be taken in the shade away from artificial heat.
    - b. In cases where the temperature drops below 40°F after the concreting operations have been started, protection shall be provided in accordance with the requirements of ACI-306R. Sufficient heating apparatus such as stoves, salamanders, or steam equipment and fuel to provide heat shall be supplied.



- c. The concrete shall be protected when placed under all weather conditions. Should concrete placed under such conditions prove unsatisfactory, remove and replace the concrete at no cost to the OWNER.
  - d. When the air temperature is below 40°F, water used for mixing shall be heated to raise the concrete temperature to 70°F. The temperature of the mixing water shall not exceed 165°F when entering the mixer.
  - e. If heating the mixing water does not raise the placing temperature of the concrete to 70°F, the aggregate must also be heated, either by steam or dry heat, to raise the placing temperature of the concrete to the required temperature. In no case shall the aggregate temperature exceed 150°F as it enters the mixer. The heating apparatus shall heat the mass of the aggregate uniformly and preclude the occurrence of hot spots, which burn the material.
  - f. Salts, chemicals, or other foreign materials shall not be mixed with the concrete to prevent freezing. The use of calcium chloride is not permitted.
4. Hot Weather:
- a. Hot weather is defined as any combination of high air temperature, low relative humidity, and wind velocity that impairs the quality of the concrete. Hot weather concreting shall be in accordance with ACI-305R and Hot Weather Concreting Plan.
    - 1) Concrete shall be placed in the forms without the addition of any more water than that required by the design (slump). No excess water shall be added on the concrete surface for finishing.
    - 2) Control of initial set of the concrete and extending the time for finishing operations may be accomplished with the use of approved water-reducing and set-retarding admixture, as specified.
  - b. Maximum time intervals between the addition of mixing water and/or cement to the batch, and the placing of concrete in the forms shall not exceed the following (excluding HRWR admixture use) limits indicated in Table 1.

<b>Table 1</b>	
<b>Maximum Time Concrete Placement</b>	
Concrete Temperature	Maximum Time From Addition of Water to Placement
Non-Agitated Concrete Up to 80°F	30 Minutes
Over 80°F	15 Minutes
Agitated Concrete Up to 75°F	90 Minutes
75°F to 89°F	60 Minutes
Over 90°F (maximum permissible concrete temperature)	45 Minutes

- 1) The use of an approved set-retarding admixture will permit the extension of the above time maximums by 30 minutes, for agitated concrete only.

- 2) The use of an approved high range water-reducing (HRWR) admixture will allow placement time extensions as determined by the manufacturer.
- c. The maximum temperature of concrete shall not exceed 90°F at the time the concrete is placed. The temperature of the concrete shall be reduced by the use of chilled water or ice.
- d. The maximum temperature of concrete with high range water reducing admixture shall not exceed 100°F at the time concrete is placed.
- e. Under extreme heat, wind, or humidity conditions, concreting operations maybe suspended if the quality of the concrete being placed is not acceptable.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Verify delivered materials are in accordance with specifications and manufacturer's product data sheets prior to unloading and storage.
- B. Storage: Store waterstops and joint materials under tarps to protect from oil, dirt, and sunlight.

### PART 2 - PRODUCTS

#### 2.1 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  1. Portland Cement: ASTM C 150, Type II or I/II, or 1L. Supplement with the following:
    - a. Fly Ash: ASTM C 618, Class C. Fly ash may be used for replacement of up to 15 percent of cement content by weight except for paving concrete.
  2. Aggregates: Furnished from one source complying with ASTM C33.
    - a. Coarse Aggregate: ASTM C33, Class 3S, coarse aggregate or better, graded.
      - 1) Clean, uncoated, processed aggregate containing no clay, mud, loam or other deleterious substances.
      - 2) Crushed stone, processed from natural rock or stone.
      - 3) Wash gravel, either natural or crushed. Use of slag and pit or bank run gravel is not permitted.
      - 4) Coarse Aggregate Size: Size to be ASTM C33, Nos. 57 or 67, except that No. 467 may be used for footings, foundation mats and walls 16 inches or greater in thickness.
    - b. Fine Aggregates: ASTM C33, fine aggregate, free of materials with deleterious reactivity to alkali in cement.
      - 1) Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances. Dune sand, bank run sand and manufactured sand are not acceptable.
  - c. Water: Clean and portable containing less than 500 ppm of chlorides.

**2.2 ADMIXTURES**

- A. General: Furnish from one manufacturer having characteristics compatible with each other and free of chlorides or other corrosive materials.
- B. Air-Entraining Admixture: ASTM C 260; MB-VR manufactured by Master Builders, Inc., Cleveland, OH, or approved equivalent.
- C. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will 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 C 494, Type A.
  - 2. Retarding Admixture: ASTM C 494, Type B
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C1017, Type II.
  - 7. Available Products:
    - a. Type A or Type D Available Products:
      - 1) Master Builders, Inc., Cleveland, OH; Pozzolith or Polyheed.
      - 2) W.R. Grace & Co., Cambridge MA; WRDA with HCYL.
      - 3) Euclid chemical Co., Cleveland, OH; Eucon WR-91.
    - b. Type F or Type G Available Products:
      - 1) Master Builders, Inc., Cleveland, OH; Rheobuild or Polyheed at dosage greater than 10 ounces per 100 pounds of cement.
      - 2) W.R. Grace & Co., Cambridge MA; Daracem 100.
      - 3) Euclid chemical Co., Cleveland, OH; Eucon 537.
- D. Superplasticized Concrete: Where Type F or G admixture is used, add to mix in accordance with admixture manufacturer's recommendations at concrete batch plant, unless specific approval is obtained from admixture manufacturer for adding it to the mix at the placement site, in which case it shall be added under supervision and direction of a representative of the Independent Testing Laboratory. After addition of Type F or G admixture, slump of normal weight concrete at truck discharge shall be between 7 inches and 9 inches.

**2.3 WATER STOPS**

- A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricated corners, intersections, and directional changes shall be used. As option, provide with factory-installed metal eyelets.
  - 1. Profile: Center bulb with parallel ribs on each side of strip center.
  - 2. Dimensions: As shown on the Drawings, non-tapered.

3. Available Products:
  - a. Four Seasons Industries Durajoint, Garrettsville, OH.
  - b. Greenstreak Plastic Products, St. Louis, MO.
  - c. Vinylex Corp., Knoxville, TN.
  - d. Paul Murphy Plastic Co.

#### 2.4 CURING MATERIALS

- A. Evaporation Retarder: When required to temporarily reduce moisture loss from concrete surfaces waiting finishing in hot, dry, and windy conditions, provide a 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./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, and ASTM C 1315, Type 1, Class A.
- E. Clear Sealer (One Component Penetrating Silane Sealer):
  1. Available Products:
    - a. Chemrex, Inc., Shakopee, MN; MASTERSEAL SL.
    - b. Euclid Chemical Co., Cleveland, OH; Eucoguard 200.
- F. Clean Floor Hardener:
  1. Colorless, aqueous premixed solution of zinc and magnesium fluosilicate.
  2. Each gallon of fluosilicate solution shall contain a minimum of two (2) pounds of crystals.
  3. Available Manufacturers:
    - a. Chemrex, Inc., Shakopee, MN.
    - b. Euclid Chemical Co., Cleveland, OH.
    - c. Sonneborn, Minneapolis, MN.
- G. Water: Clean and potable, containing less than 500 ppm chlorides.

#### 2.5 CONCRETE MIXTURES

- A. General Requirements:
  1. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  2. Concrete Mix Design: Select and proportion ingredients using trial batches; sample and test concrete mix through approved independent testing laboratories in accordance with ACI 211.1.

- B. Class "A": Provide Class "A" concrete with the following mix design limitations where Class "A" concrete is specified to result in concrete placed in the field of minimum compressive strength of 4000 psi at 28 days based on test cylinders which are taken during concrete placement.

<u>Unit</u>	<u>Measurement</u>
Minimum Compressive Strength (7 day)	3000 psi Minimum
Compressive Strength (28 day)	4000 psi
Coarse Aggregate	ASTM C33, No. 57 or 67
Fine Aggregate	ASTM C33
Water/Cementious Ratio (max.)	0.44 by weight
Air Entrainment	5-7 percent
Superplasticizer Type F or G only manufacturer Slump with Superplasticizer	As recommended by 7 inches to 9 inches
Slump without Superplasticizer without Superplasticizer (for Piers)	3 inches $\pm$ 1 inch Slump 6 inches $\pm$ 1 inch
Minimum Cementious Content	564 pounds per cubic yard

- C. Class "B": Provide concrete with the following mix design limitations where Class "B" concrete is specified to result in concrete placed in the field of minimum compressive strength of 3000 psi at 28 days based on test cylinders which are taken during concrete placement.

<u>Unit</u>	<u>Measurement</u>
Minimum Compressive Strength (7 day)	2250 psi minimum
Minimum Compressive Strength (28 day)	3000 psi
Coarse Aggregate	ASTM C33, No. 467
Fine Aggregate	ASTM C33
Water/Cementious Ratio (max.)	0.50 by weight
Air Entrainment	4-6 percent
Slump with Superplasticizer	7 inches to 9 inches
Slump without Superplasticizer	3 inches $\pm$ 1 inch
Minimum Cementious Content	470 pounds per cubic yard

- D. Class "C": Provide concrete with the following mix design limitations where Class "C" concrete is specified to result in concrete placed in the field of minimum compressive strength of 2500 psi at 28 days based on test cylinders which are taken during concrete placement.

<u>Unit</u>	<u>Measurement</u>
Minimum Compressive Strength (7 day)	1500 psi
Minimum Compressive Strength (28 day)	2500 psi
Coarse Aggregate	ASTM C33, No. 467
Fine Aggregate	ASTM C33

- |                                      |                           |
|--------------------------------------|---------------------------|
| Water/Cementitious Ratio (maximum)   | 0.62 by weight            |
| Entrainment                          | Air<br>None               |
| Slump - Plus or minus 1 inch (50 mm) | 4 inches                  |
| Minimum Cement Content               | 376 pounds per cubic yard |
- E. Class "D" Provide concrete with the following mix design limitations where Class "D" concrete is specified to result in concrete placed in the field of minimum compressive strength of 5000 psi at 28 days based on test cylinders which are taken during concrete placement.

**Unit****Measurement**

- |                                       |                                   |
|---------------------------------------|-----------------------------------|
| Minimum Compressive Strength (7 day)  | 3500 psi                          |
| Minimum Compressive Strength (28 day) | 5000 psi                          |
| Coarse Aggregate                      | ASTM C33, No. 57                  |
| Fine Aggregate                        | ASTM C33                          |
| Water/Cementitious Ratio (max.)       | 0.40 by weight                    |
| Air Entrainment                       | 3 percent                         |
| Superplasticizer Type F               | As recommended by<br>manufacturer |
| Slump with Superplasticizer           | 7 inches to 10 inches             |
| Slump without Superplasticizer        | 4 inches $\pm$ 1 inch             |
| Minimum Cementitious Content          | 650 pounds per cubic yard         |
- F. Non-structural concrete topping mix shall be as follows:

**Unit****Measurement**

- |   |  |
|---|--|
| Minimum Compressive Strength (28 day)                               | 3000 psi                                   |
| Coarse Aggregate  | Max. Size 3/8-inch, ASTM<br>C33            |
| Fine Aggregate  | ASTM C33                                   |
| Water/Cementitious Material Ratio (max.)<br>or minus 1 inch (50 mm) | 0.50 by weight<br>Slump - Plus<br>3 inches |
| Minimum Cementitious Material Content                               | 470 pounds per cubic yard                  |
- G. The concrete mix designs listed above for the various classes shall be proportioned to produce 28 days concrete compression strength above the specified 28 days concrete compression strength when cylinder test is made from concrete mixed and moisture cured in the laboratory as follows:

**Specified 28 days****Laboratory 28 days**

strength	test cylinder
f'c = 3000 psi and under	f'c + 1000
f'c = 4000 to 5000 psi	f'c + 1200

Adjustment in the limitation listed in mix design shall be made to produce the required strength of laboratory main and cured cylinder.

- H. Use accelerating admixtures in cold weather only when approved by ENGINEER. Use of admixtures will not relax cold weather placement requirements.
- I. Do not use calcium chloride in concrete or in any admixture.
- J. Use set retarding admixtures during hot weather only when approved by ENGINEER.
- K. Use air entraining agent in all concrete mix except for interior slabs subject to abrasion or unless otherwise shown.
- L. Maximum chloride ion content for corrosion protection shall meet Table 4.4.1 listed in ACI 318/318R (1999). Testing for chloride ion content shall conform to AASHTO T260.

## 2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and furnish batch ticket information.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Design, erect, shore, brace, and maintain formwork in accordance with Division 3 Section 03100 "Concrete Formwork."
- B. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- C. Plastic Vapor Retarders: When shown on the Drawings; place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions. Lap joints 6 inches and seal with manufacturers recommended tape.
- D. Place steel reinforcement as shown on the Drawings and in accordance with Division 3 Section 03200 "Concrete Reinforcement."

### 3.2 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: When fresh concrete is placed against a hardened concrete surface, the joint between the two pours is called a construction joint. Unless otherwise specified, all joints in water bearing members shall be provided with a water stop. The surface of the first pour will receive a coating of a bond breaker as shown on the Drawings.
  - 1. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by ENGINEER.
  - 2. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
  - 3. The slab reinforcement shall be stopped 4-1/2 inches from the joint; which is provided with a sleeve-type dowel, to allow shrinkage of the concrete of the second pour. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 4. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  - 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.

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 as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  8. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated.
1. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
    2. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
    3. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Saw cut joints within 4 to 12 hours of concrete placement.
    4. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
    5. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants are indicated.
    6. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
  - D. Expansion Joints: To allow concrete to expand freely, a space is provided between the two pours, the joint is formed as shown on the Drawings.
    1. Place a filler joint material against the first pour, which acts as a form for the second pour. Unless otherwise specified, all expansion joints in hydraulic structures shall be provided with a center-bulb type water stop.
    2. Premolded expansion joint materials shall be installed with the edge at the indicated distance below the finished concrete surface, having a tapered, dressed, and oiled wood strip secured to at the edge thereof during concrete placement. Remove strip to form space for sealing material to be applied.
    3. To assure alignment, provide a doweled joint as shown on the Drawings.
    4. Place a joint sealing material in the space provided.
  - E. Doweled Joints: When shown on Drawings, install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

### 3.3 WATERSTOPS

- A. Provide waterstops in all horizontal and vertical joints in foundation slabs and peripheral



walls of all structures up to a minimum of 12-inches above final ground level and all walls and slabs of hydraulic structures to a minimum of 12-inches above maximum liquid level. In addition, provide waterstops in joints of interior walls of hydraulic structures when shown on drawings.

- B. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricates joints in waterstops according to manufacturer's written instructions. Use manufacturer's thermostatic splicing tool.
- C. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

### 3.4 CONCRETE PLACEMENT

- A. Preparation Before Placing Concrete:
  - 1. Verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
  - 2. Verify requirements for concrete cover over sides and under reinforcement.
  - 3. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.
  - 4. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
  - 5. In locations where new concrete is to be dowelled to existing work, clean, brush, and drill holes in existing concrete, insert steel dowels and pack solid with non-shrinkgrout, unless capsule anchors or other form of fastening is shown on Plans.
- B. Do not add water to concrete during delivery, at Project site, or during placement.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. 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.
- D. 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. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  2. Maintain reinforcement in position on chairs during concrete placement.
  3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  4. Slope surfaces uniformly to drains where required.
  5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. 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.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. 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.
- G. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

### 3.5 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to view as indicated in Finish Schedule.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete, and as indicated in the Finish Schedule.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete

surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part Portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.6 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. 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: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel- finish concrete surfaces.
- E. Waterproofing: If listed in Schedule of Concrete Finishes, the exterior of concrete walls not exposed to view and is located underground shall receive a waterproofing application. Provide a compatible bonding agent per manufacturer's instructions. Waterproofing material shall be NSF 61 certified.
- F. Sealing Joints: Apply sealant at all expansion and isolation joints, construction joints in slabs on grade, and at other locations as shown on Drawings. Refer to Division 2 Section 02764 "Pavement Joint Sealants" for information regarding sealant materials.
- G. Anchor Bolts: Set anchor bolts, which are specified in other Sections, in accordance with manufacturer's instructions. Provide accurately made templates for positioning anchor bolts.
- H. Other Embedded Items:
1. CONTRACTOR shall coordinate requirements for embedded items ensuring items are accurately placed.
  2. Voids in sleeves, inserts, anchors, and related items shall be filled temporarily to prevent entry of concrete.

3. Steel items, except reinforcing shall be galvanized, unless otherwise specified or shown on the Drawings. Galvanized embedded items shall not be in contact with the reinforcing steel or ungalvanized steel items.
  4. Conduits, pipes and inserts of aluminum shall not be embedded in structural concrete unless effectively coated or covered to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.
  5. Conduits and pipes embedded within a slab, wall, or beam (other than passing through) shall satisfy the following:
    - a. Not larger in outside dimension than 1/3 the overall thickness of slab, wall or beam in which they are embedded.
    - b. Not be spaced closer than three diameters or widths on center.
    - c. Not significantly impair the strength of the member.
- 3.7 CONCRETE PROTECTING AND CURING
- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
  - B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturers' written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
  - C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
    1. Moisture Curing: Keep surfaces continuously moist for 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. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
- 3.8 JOINT FILLING
- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
- 3.9 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, but not less than 1 inch in depth. 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. 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 a 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 mixture as original concrete except without coarse aggregate. Place, compact, and finish blending with adjacent finished concrete. Cure in same manner as adjacent concrete.
    - 5. 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.
- F. Repair materials and installation not specified above may be used, subject to ENGINEER'S approval.

### 3.10 FIELD QUALITY CONTROL

#### A. General:

1. Provide adequate facilities for safe storage and proper curing of concrete test cylinders onsite for first 24 hours, and for additional time as may be required before transporting to testing laboratory.
2. Provide concrete for testing of slump, air content, and for making cylinders from point of discharge into forms. When concrete is pumped, samples shall be taken from discharge end of pump hose.
3. Evaluation will comply with the requirements of ACI 301 and Specifications.
4. Specimens shall be made, cured, and tested in accordance with ASTM C31 and ASTM C39.
5. Frequency of testing may be changed at discretion of ENGINEER.

#### B. Normal Placement Testing:

1. Number of Test Cylinders: Number of sets of concrete test cylinders for each concrete pour shall be as listed in Table No. 1. A "set" consists of six (6) test cylinders; two tested at 7-days, two at 28-days, and two held in reserve.

**Table No. 1**

**Test Cylinder Requirements**

Concrete Poured, CY	Minimum No. Sets
0 to 25	1
25 to 75	2
75 to 150	3
150 to 250	4
250 to 400	5
400 to 550	6

2. One (1) slump test will be conducted for each set of test cylinders in accordance with ASTM C143. Test shall be taken at point of discharge at site. Loads with slump exceeding limit will not be allowed for structural concrete.
3. One (1) air content test will be conducted for each load of concrete at point of discharge in accordance with either ASTM C173 or C231.
4. Measurement of the concrete temperature will be conducted for each load of concrete during periods of cold or hot weather conditions. Concrete having a temperature outside the prescribed limits will not be accepted for placement.

#### C. Cold Weather Placement Testing:

1. During cold weather concrete placement, cast test cylinders for field curing as follows. Use method that will produce greater number of specimens:
    - a. Six (6) extra test cylinders from last 100 cubic yards of concrete placed.
    - b. Minimum three (3) test cylinders for each two hours of placing time or for each 100 cubic yards.
  2. These test cylinders shall be in addition to those cast for lab testing as described above.
  3. Protect test cylinders from weather until they can be placed under same protection as provided for concrete of structure they represent.
  4. Keep field test cylinders in same protective environment as parts of structure they represent to determine if specified strength has been obtained.
  5. Test cylinders in accordance with ASTM C31 and ASTM C39.
  6. Use test results to determine specified compressive strength has been obtained prior to falsework removal or for prestressing.
- D. Tolerances:
1. Walls: Measure and inspect walls for compliance with tolerances specified in Division 3 Section 03100 "Concrete Formwork."
  2. Slab Finish Tolerances and Slope Tolerances:
    - a. Floor flatness measurements shall be made day after floor is finished and before shoring is removed to eliminate effects of shrinkage, curing, and deflection.
    - b. Support 10-foot long straightedge at each end with steel gauge blocks of thickness equal to specified tolerance.
    - c. Compliance with designated limits in four of five consecutive measurements is satisfactory, unless defective conditions are observed.
- E. Water Leakage Testing:
1. Determine integrity and water tightness of finished exterior and interior of waterholding concrete structures.
  2. Water Holding Structures:
    - a. Perform leakage test after concrete structure is complete and capable of resisting hydraulic pressure of the water test. Concrete shall have achieved its full design strength.
    - b. Perform leakage test before backfill, brick facing, grout topping slab, coatings, or other work, which will cover the concrete surfaces, has begun.
    - c. Install temporary bulkheads, cofferdams, pipe blind flanges, and close valves. Inspect each and determine it provides a complete seal.
    - d. Fill with water to test level shown, or maximum liquid level if a test level is not indicated. Maintain level for 72 hours prior to start of test to allow water adsorption, structural deflection, and temperature to stabilize.

- e. Measure evaporation and precipitation by floating a partially filled, transparent, calibrated, open top container.
  - f. Measure water surface at two points 180 degrees apart, if possible and where attachments, such as ladders exist, at 24 hour intervals. Using a sharp pointed hook gauge and fixed metal measure capable of reading to 1/100 of an inch.
  - g. Continue test for a period of time sufficient to produce at least 1/2-inch drop in water surface based on assumption leakage will occur at maximum allowable rate specified or for 72 hours, whichever is lesser time.
3. Acceptable Criteria:
- a. Volume loss shall not exceed 0.075 percent of contained liquid volume in 24 hour period, correcting for evaporation, precipitation, and settlement.
  - b. No damp spots or seepage visible on exposed surfaces. Damp spot is defined as sufficient moisture to be transferred to dry hand upon touching.
4. Repairs When Test Fails: Dewater structure; fill leaking cracks with crack repair epoxy.
- F. Testing of Deficient Concrete in Place:
1. The strength of concrete will be considered potentially deficient if the average of three consecutive strength test results fail to equal or exceed the specified strength or if any individual strength test falls below the specified strength by more than 500 psi. The ENGINEER may require core test, structural analysis or load testing.
  2. Core Tests:
    - a. Cores shall be as large as possible and at least 2-inches in diameter. Obtain and test scores in accordance with ASTM C42.
    - b. Obtain 3 representative cores from each member or area of concrete, which is considered potentially deficient. The location of coring will be determined by ENGINEER so as to least impair the strength of the member.
    - c. Concrete in the area represented by coring will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength and no single core is less than 75 percent of the specified strength.
    - d. Core holes shall be patched in accordance with Division 3 Section 03600 "Grout, Non-Shrink."

### 3.11 MANUFACTURER'S SERVICES

- A. Provide the following manufacturer's representative for assistance as required.
1. Batch Plant Representative:
    - a. Observe how concrete mixes performed, being present during the placement of the initial type of mix.
    - b. Assist with concrete mix design, performance, placement, weather problems, and other problems, which may occur throughout the concrete placement work.
    - c. Establish control limits on concrete mix designs.
  2. Admixture Manufacturer's Representative:



- a. Demonstrate special features, product performance, product mixing, testing, and placement or installation for each type of admixture.
  - b. Observe how concrete mixes are performing.
  - c. Assist with concrete mix design, performance, placement, weather problems, and other problems, which may occur throughout the concrete placement work, including instructions for additional admixture.
  - d. Provide equipment for control adding air-entraining admixture or high range water reducing admixture at Project site to maintain proper slump and air content.
3. Bonding Agent Manufacturer's Representative: Demonstrate product performance, product mixing, and placement.

### 3.12 SCHEDULE OF CONCRETE TYPES

- A. Class "A", 4,000 psi at 28 days, unless otherwise specified:
1. Foundations, walls, slabs, beams, girders, columns, drilled piers, and all other concrete work except as noted below.
- B. Class "B", 3,000 psi at 28 days:
1. Secondary elements such as equipment bases, pipe supports, curbs and gutters, sidewalks, manhole bases, and pipe/conduit encasements.
- C. Class "C", 2,000 psi at 28 days:
1. Concrete fill, working or seal slab, and thrust blocks.
- D. Class "D", 5,000 psi at 28 days:
1. Wet well: foundation, walls, slab.

### 3.13 SCHEDULE OF CONCRETE FINISHES

- A. Form Tolerances: As specified in Division 3 Section 03100 "Concrete Formwork."
- B. Finishes: Provide concrete finishes as scheduled in Table No. 2 "Concrete Finishes and Tolerances."
- C. Delete below grade concrete exterior surface waterproofing requirement if not applicable.
- D. Waterproofing Exterior Concrete Surfaces Below Grade:
1. The exterior of all concrete walls not exposed to view and placed below ground level shall be given a waterproofing application of Thoroseal Foundation Coating as manufactured by Thoro System Products., or approved equivalent.
  2. Acryl®60 to mixing water per manufacturer's recommendations to improved bonding qualities.
- E. Delete painting of exposed concrete surfaces requirement if not applicable.
- F. Exterior, Exposed Wall Coating: Apply exterior, exposed wall coating where specifically shown on the Drawings or in Schedules in accordance with Division 9 Section 09910 "Painting and Protective Coatings."

**Table No. 2**  
**Concrete Finishes and Tolerances**

Area	Type of Finish <sup>1</sup>	Required Form Tolerances <sup>2</sup>	Floor Flatness <sup>3</sup> FF	Floor Levelness <sup>3</sup> FL
<b>Exterior Wall Surfaces</b>				
Above grade, exposed, non-painted (Above a point 24-inches below finish grade)	Rubbed	Class A		
Above grade, exposed, painted (Above a point 24-inches below finish grade)	Rubbed	Class A		
Backfilled or waterproofed (Below a point 24-inches below finish grade)	Rough-Formed	Class C		
<b>Interior Wall Surfaces</b>				
Covered water-holding tanks and basins, not painted or coated.	Smooth-Formed	Class B		
<b>Exterior Slabs</b>				
Roof slab exposed	Float		SOV: 20 MLV: 15	SOV: 15 MLV: 10
Other water-holding tanks and basins	Float		SOV: 20 MLV: 15	SOV: 15 MLV: 10
Sidewalks, stairs, landings	Broom <sup>4</sup>		SOV: 25 MLV: 17	SOV: 20 MLV: 15
Other Exterior Slabs	Trowel		SOV: 25 MLV: 17	SOV: 20 MLV: 15
<b>Interior Slabs</b>				
Plant floors, pipe galleries, and other dry areas	Trowel <sup>5</sup>		SOV: 25 MLV: 17	SOV: 20 MLV: 15
Buildings, floors to receive covering or hardened floor treatment.	Trowel <sup>5</sup>		SOV: 35 MLV: 24	SOV: 35 MLV: 24
Hydraulic Channels	Float	Class B		
Underside of elevated slabs.	Smooth-Formed	Class B		
Reference Division 2 Section 03100 "Concrete Formwork" for required form tolerances. Reference this Section for information regarding type of finish. F-number system for verifying floor flatness and levelness as defined in ASTM E1155. When shown on drawings, apply slip-resistant finish. When shown on drawings, apply slip-resistant or dry-shake floor hardener finish. SOV: Specified Overall Value MLV: Minimum Local Value				

### 3.14 MODIFICATION AND REPAIR TO EXISTING CONCRETE

- A. Cut, repair, reuse, demolish, excavate or otherwise modify parts of the existing structures or appurtenances, as indicated on the Contract Drawings, specified, or necessary to permit completion of the work. Finishes, joints, reinforcements, sealants, etc. are specified under respective sections of Specification. All work shall conform to other requirements of this Section and to detail Drawings.
- B. Mix proportions of materials used in the modifications and repair to existing concrete as indicated on the Drawings shall be:

1. When new material other than non-shrink grout is shown to be connected to existing concrete, add the following cement mixtures to design depending on the depths called for or shown on the Drawings:

- a. Less than or equal to 2 inches in depth.

<u>Material</u>	<u>Volume</u>
Cement	1.0
Sand	2.0
Water = 5 gals/200 lbs. cement	

- b. Greater than 2 inches to 12 inches in depth.

<u>Material</u>	<u>Volume</u>
Cement	1.0
Pea Gravel	2.5
Sand	2.0
Water = 5 gals/100 lbs. Cement	

- c. Greater than 12 inches in depth: Concrete as specified under Part 2 of this Section.

2. Non-shrink Grout: As specified under Division 3 Section 03600 "Grout, Non-shrink".

3. Epoxy Bonding Agent:

- a. Epoxy bonding agent shall be a two-component epoxy adhesive specifically formulated for bonding old concrete to new (plastic) concrete.
- b. The mixing ratio shall be as recommended by the manufacturer for the ambient temperature when placed. Furnish manufacturer's specific instruction for specific job application and obtain ENGINEER'S review prior to purchase.
- c. Epoxy bonding agent shall conform to ASTM C-881 and corresponding tests for bond strength and shrinkage as specified in ASTM C-882, C-883, and C-884.
- d. Available Product and Manufacturer:
  - 1) "Sikastix 370, Sikdadur Hi-Mod", by Sika Corporation, Lindhurst, New Jersey.
  - 2) Pro Bond 821 or 822" by Protex Industries, Denver, Colorado.
  - 3) Concessive 1170" by Adhesive Engineering Company, San Carlos, California.
- e. The properties of the cured material shall meet the following:
  - 1) Compressive Strength (ASTM D-695)48 hour - 1000 psi  
28 day - 7000 psi
  - 2) Tensile Strength (ASTM D-638)7 day - 4000 psi  
Bond Strength (ASTM C-882 or C-884) - 1500 psi
- f. Approval Requirements: CONTRACTOR must furnish notarized certification that the material proposed for use meets all of the above requirements and that the material has been previously used successfully for the purpose described.

- g. Epoxy Protectant: Sikagard 62 by Sika Chemical Corporation, Lindhurst, New Jersey, or equal.

C. Demolition of Existing Concrete:

1. Concrete shown to be removed on the Drawings shall be done by line drilling at limits of concrete to be removed followed by jack-hammering in areas where concrete is to be taken out.
2. CONTRACTOR shall be responsible for removing concrete in such a manner that surrounding concrete or existing reinforcing to be left in place and existing in place equipment is not damaged.
3. Sawcutting at limits of concrete to be removed shall be done if indicated on the Drawings.

D. Connection to Existing Concrete:

1. Roughen surface of existing concrete to be connected to new materials by sandblasting, chipping, or scarifying. Thoroughly clean area of concrete to receive new materials of loose particles and dust or other contaminating objects.
2. Existing reinforcing to be left in place as shown on the Drawings shall be wire brushed to remove rust or concrete on the bar. The existing reinforcing shall be cut, bent, lapped, or welded to new reinforcing as shown on the Drawings and provided with a minimum of 1 inch of cover all around and at ends of the bar. The reinforcing shall be thoroughly cleaned of loose particles and dust before incorporating in new materials.
3. After existing concrete surface has been roughened and cleaned as specified above, apply epoxy-bonding agent at connection surface. The field preparation and application of the epoxy-bonding agent shall conform strictly with the manufacturer's recommendations. Immediately pour new cement mixture or non-shrink grout as detailed on the Drawings.

**END OF SECTION**

**SECTION 15020  
PIPING SYSTEM, DUCTILE IRON PIPE**

**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section provides requirements for ductile iron piping system for exposed and buried applications and includes:
  - 1. Mechanical joint, push-on and flanged ductile iron pipe, sizes 4-inch through 24-inch.
  - 2. Mechanical joint and flanged ductile iron and cast iron fittings, sizes 4-inch through 24-inch.
  - 3. Gaskets and fasteners.
  - 4. Protective coatings, linings and encasements.
- B. Related Sections:
  - 1. This Section contains material requirements for pipe, fittings, specials, and appurtenances for the steel piping systems, as well as Part 1- General and Part 3- Execution additional requirements not specified in the above referenced Section.

**1.3 REFERENCES**

- A. American Water Works Association (AWWA):
  - 1. C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
  - 2. C105/21.5 - Polyethylene Encasement for Gray and Ductile Cast-Iron Piping for Water and Other Liquids.
  - 3. C110-C21.10 - American National Standard for Gray-Iron and Ductile-Iron Fittings, 3-inch through 48-inch for Water and Other Liquids.
  - 4. C111/A21.11 - American National Standard for Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
  - 5. C115/A21.15 - American National Standard for Flanged Cast-Iron and Ductile-Iron Pipe with Threaded Flanges.
  - 6. C150/A21.50 - American National Standard for the Thickness Design of Ductile Iron Pipe.
  - 7. C151/A21.51 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water and Other Liquids.
  - 8. C153/A21.10 - Ductile-Iron Compact Fittings for Water Service.
  - 9. C600 - Installation of Ductile Iron Water Mains and Their Appurtenances.
  - 10. C606 - Grooved and Shouldered Joints.
  - 11. M41 - Manual Ductile Iron Pipe and Fittings.

- B. ASTM International, Inc. (ASTM):
  - 1. A48 - Specification for Gray Iron Castings.
  - 2. A193 - Specification for Alloy-Steel and Stainless Steel bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
  - 3. A194 - Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, of Both.
  - 4. A307 - Specification for Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength.
  - 5. A320 - Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low Temperature Service.
  - 6. A536 - Specification for Ductile Iron Castings.
  - 7. A563 - Specification for Carbon and Alloy Steel Nuts.
  - 8. A674 - Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or other Liquids.
  - 9. D1330 - Specification for Rubber Sheet Gaskets.
- C. National Sanitation Foundation (NSF):
  - 1. NSF/ANSI 61 - Drinking Water Components – Health Effects.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  - 1. Pipe layout drawings shall include plan, elevations, sections, details, and attachments to other work.
  - 2. Pipe layout schedule/drawings including pipeline stationing, elevation, and restrained joint locations.
  - 3. Schedule of materials furnished.
  - 4. Pipe layout drawings and data shall clearly indicate where pipe requiring special provisions are to be located, connections to equipment, valves, and related items.
- C. Material Certificates:
  - 1. Certificate of Compliance with all applicable and appropriate reference standards certifying that all pipe, fittings, and specials, and other products and materials furnished, comply with the applicable provision of the Specification.
  - 2. Certification of Adequacy of Design: The Certificate of Adequacy of Design shall show the necessary provisions required in the design of the pipe to comply with applicable sections of this Specification. A Professional Engineer registered in the state where the Project is located shall seal the Certificate of Adequacy of Design.
- D. Field quality-control test reports.

#### 1.5 PROJECT REQUIREMENTS

- A. Restrained Pipe and Fitting Joints, Buried Piping:

1. Restrained joints shall be used for a sufficient distance from each bend, tee, elbow, plug, or other fitting to resist thrust that will develop at the design pressure.
2. CONTRACTOR shall provide restraint length calculations in accordance with AWWA M41 based on the laying conditions, soil conditions, depth of cover, and pressures to determine the number of restrained joints that will be required.
3. For the purposes of thrust restraint, design pressures shall be the working pressure shown, plus the additional surge allowance for potable water, service water, and pump discharge piping. The design pressure shall be 1.5 times the design test pressure indicated for all other piping.

## PART 2 - PRODUCTS

### 2.1 PIPE AND FITTINGS

- A. General: Ductile iron with a thickness design for the pressures and laying conditions complying with the requirements of AWWA C150 and the manufactured in accordance with AWWA C151.
  1. Comply with the following minimum thickness class, unless otherwise indicated in the Pipe Schedule.
    - a. Class 51, pipe 6-inch and smaller.
    - b. Class 50, pipe 8-inch and larger.
    - c. Class 53 for threaded flanged joints.
    - d. Class 53 for grooved end pipe, grooved in accordance with AWWA C606.
- B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
  2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
  2. Gaskets: AWWA C111, rubber.
- D. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends, conforms to AWWA C606, 250 psi minimum working pressure fittings.
  1. Grooved-End, Ductile-Iron Pipe Appurtenances:
    - a. May be used as an alternate to flanged joints for exposed locations.
    - b. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Anvil International, Inc.

- 2) Victaulic Company of America.
- E. Flanged-Joint, Ductile-Iron Pipe: AWWA C151, flanged ends.
1. Flange Joints: Comply with the requirements of AWWA C115.
    - a. Class 150 or Class 250 as designated on Drawings or Pipe Schedule.
  2. Bolting:
    - a. Exposed or Atmospherically Exposed: ASTM A307, carbon steel, Grade A hex head bolts; ASTM A563, Grade A hex head nuts; and ASTM F436 hardened steel washers.
    - b. Wetted, Submerged or Buried: ASTM A193 or ASTM A320, Type 316 stainless steel bolts; ASTM A194, Type 316, nuts; and washers of the same material as the bolts.
    - c. Gaskets:
      - 1) Flange, Flat Face: Full-faced, AWWA C111, 1/8-inch thick rubber, factory cut.
      - 2) Flange, Raised Face: Use flat ring gasket.
- 2.2 SPECIAL PIPE FITTINGS
- A. Ductile-Iron, Flexible Expansion Joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include 2 gasketed ball-joint sections and 1 or more gasketed sleeve sections, rated for 250-psi and for offset and expansion indicated.
1. Available Manufacturers:
    - a. EBAA Iron Sales, Inc.
    - b. Romac Industries, Inc.
    - c. Star Pipe Products.
- B. Ductile-Iron Deflection Fittings: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for up to 15 degrees of deflection.
1. Available Manufacturers:
    - a. EBAA Iron Sales, Inc.
- C. Ductile-Iron Expansion Joints: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressures and for expansion indicated.
1. Available Manufacturers:
    - a. Dresser, Inc.; DMD Div.
    - b. EBAA Iron Sales, Inc.
    - c. JCM Industries.
- D. Flange adapter: For joining steel pipe to cast iron, provide Dresser Style 127 or equal. Gasket to be Buna-S, Grade 27.



- E. Dismantling Joint: Double-ended flange adapter, allowing longitudinal adjustment in piping system, similar to Dresser Style 131 or equal.
- F. Reducing and Transition Coupling: Required for making reduction in sizes of piping; changing classes of piping; or joining steel and cast iron pipe, provide Dresser Style 62 or equal.

## 2.3 PROTECTIVE COATINGS, LININGS, AND ENCASEMENT

### A. Pipe and Fittings Interior:

- 1. Fusion Bonded Epoxy: Apply a high build, fusion bonded epoxy lining per AWWA C116, minimum 16 mils dry film thickness, per AWWA C116.
- 2. Ceramic Epoxy: Apply 40 mils Protecto 401 Ceramic Epoxy (or approved equal) per manufacturers' recommendations.

### B. Pipe and Fittings Exterior:

- 1. Exposed Piping: Provide shop coat primer required for the coating system specified in Division 9 Section 09910 "Painting and Protective Coating."
- 2. Buried Piping: Provide shop applied 1-mil bituminous coating system per AWWA C151 for pipe and AWWA C110 for fittings.

### C. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105.

- 1. Form: Sheet or tube.
- 2. Material: LLDPE film of 0.008-inch minimum thickness or high-density, cross-laminated PE film of 0.004-inch minimum thickness.

### D. Color: Black.

## 2.4 VENT AND DRAIN VALVES

- A. Pipelines 2-1/2-Inch Diameter and Larger: 3/4-inch vent, 1-inch drain, unless indicated otherwise on the Drawings.
- B. Pipelines 2-Inch Diameter and Smaller: 1/2-inch vent, 1-inch drain, unless indicated otherwise on the Drawings.
- C. Install vents and drains at piping system high points (vents) and low points (drains) as required by final installation configuration. Provide line size ball valves for all vents and drains.

## 2.5 INSULATED CONNECTIONS

- A. Provide dielectric insulation kits, including gaskets, insulating sleeves and washers for each bolt and nuts, where flanges are to be cathodically insulated. Metal hardware such as backup washers shall be Type 316 stainless steel.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### A. Laying Buried Pipe:

- 1. Install pipe to the lines, grades and elevations shown on the Drawings, complying with the requirements of AWWA C600.
- 2. Unless otherwise shown on the Drawings, within the plant site, bury piping with a

minimum cover of 3-feet. Off-site, bury lines 12 inches and smaller with a minimum cover of 4-feet and lines 14 inches and larger with a minimum cover of 5-feet.

3. Do not lay pipe in water, or when the trench or weather is unsuitable for work. Keep water out of trench until jointing is complete. When work is not in progress, close ends of pipe and fittings securely so no trench water, earth or other substances will enter pipes or fittings.
  4. Keep the inside of the pipe free from foreign matter during operations by plugging or other approved method.
  5. Provide pipe bedding. Place pipe so that the full length of each section rests solidly upon the pipe bed, with recesses excavated to accommodate bells and joints. Take up and relay pipe when the grade or joint is disturbed after laying.
  6. Lay pipe with bells facing the direction of the laying except when making enclosures.
  7. Buried pipe and fittings shall be polyethylene wrapped in accordance with AWWA C105.
  8. Provide a restrained push-on joint or mechanical joint ten feet from outside face of structures.
- B. Restrained Joints: Unless otherwise indicated on the drawings, the CONTRACTOR shall use mechanical restrained pipe joints and fittings (no thrust blocks). The length of pipe requiring thrust restraint shall be calculated as described in Chapter 13 of AWWA M-11.
1. All joints requiring thrust restraint shall be welded (buried) in accordance with AWWA C-206 or restrained with mechanical systems (exposed).
  2. CONTRACTOR shall design restrained joints based on the specified pressures as shown in the Piping Schedule or Drawings and in accordance with AWWA M-11.
  3. The design for restrained joints, including the length necessary to resist the design thrust, for the embedded conditions, shall be performed and sealed by a Professional Engineer in the state where the Project is being constructed.
  4. CONTRACTOR shall bear all costs for the design and will not receive reimbursement from the OWNER.

### 3.2 CLEANING

- A. All piping systems shall be thoroughly cleaned and flushed and all construction debris or foreign material removed. The CONTRACTOR shall provide all temporary connections, equipment and the like for cleaning.

### 3.3 FIELD QUALITY CONTROL

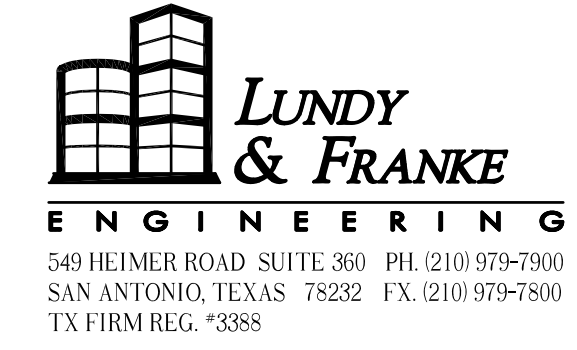
- A. Sterilization: Clean and sterilized potable water lines in accordance with Division 15 Section 15070 "Piping Systems, Field Testing."
- B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently.
- C. Hydrostatic Tests: Conduct testing in accordance with Division 15 Section 15070 "Piping Systems, Field Testing."
- D. Prepare reports of testing activities.

**3.4 PIPING SCHEDULE**

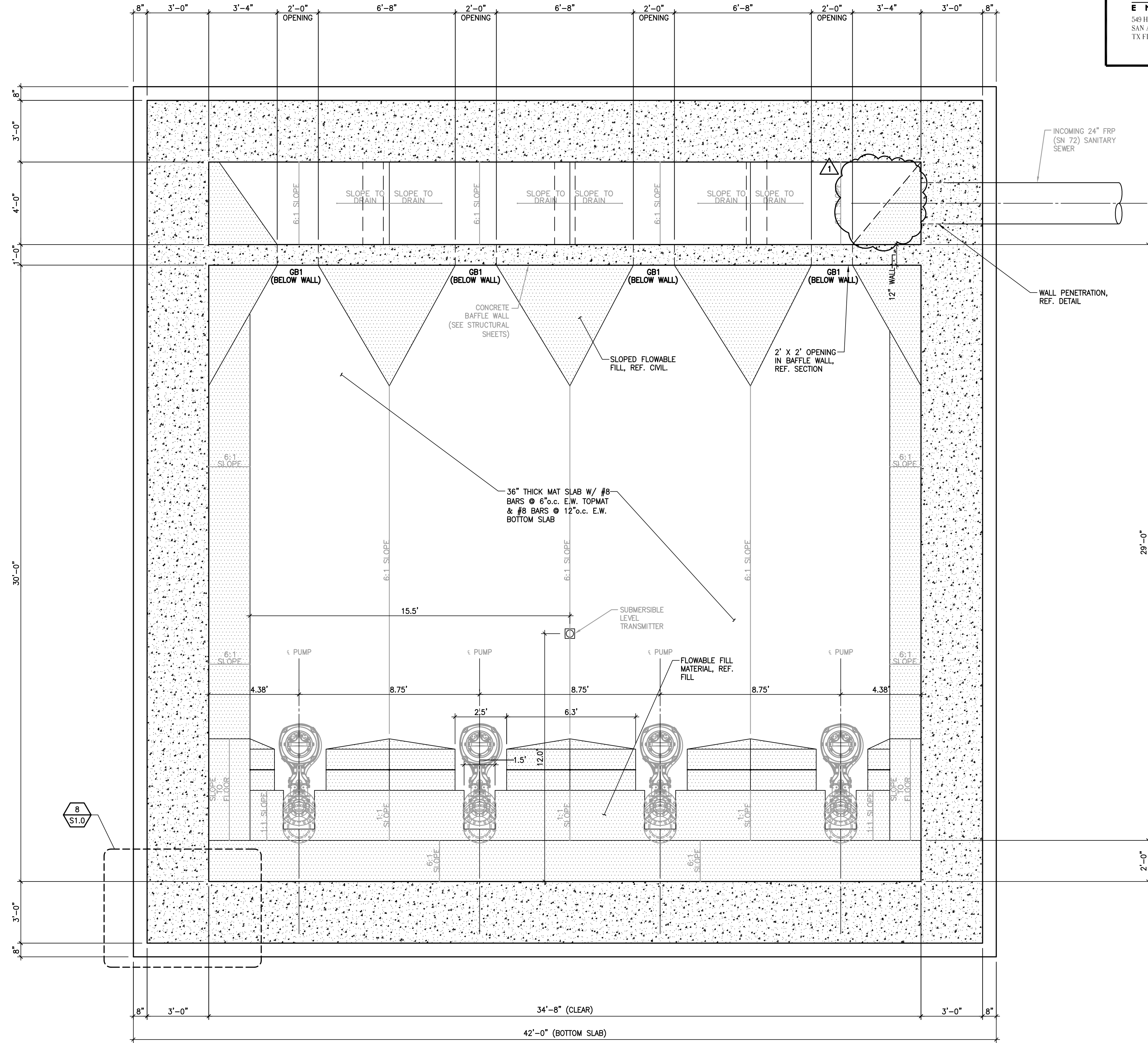
A. As shown on the Drawings.

**END OF SECTION**

LA PROJECT NO.: 13-171-00  
 LA FILE NO.: E54LST2-2



DATE	10/27/22
NO.	1
REVISION	
ADDENDUM #	



**WET WELL SLAB PLAN**  
 SCALE: 3/8" = 1'-0" (N.T.S.)

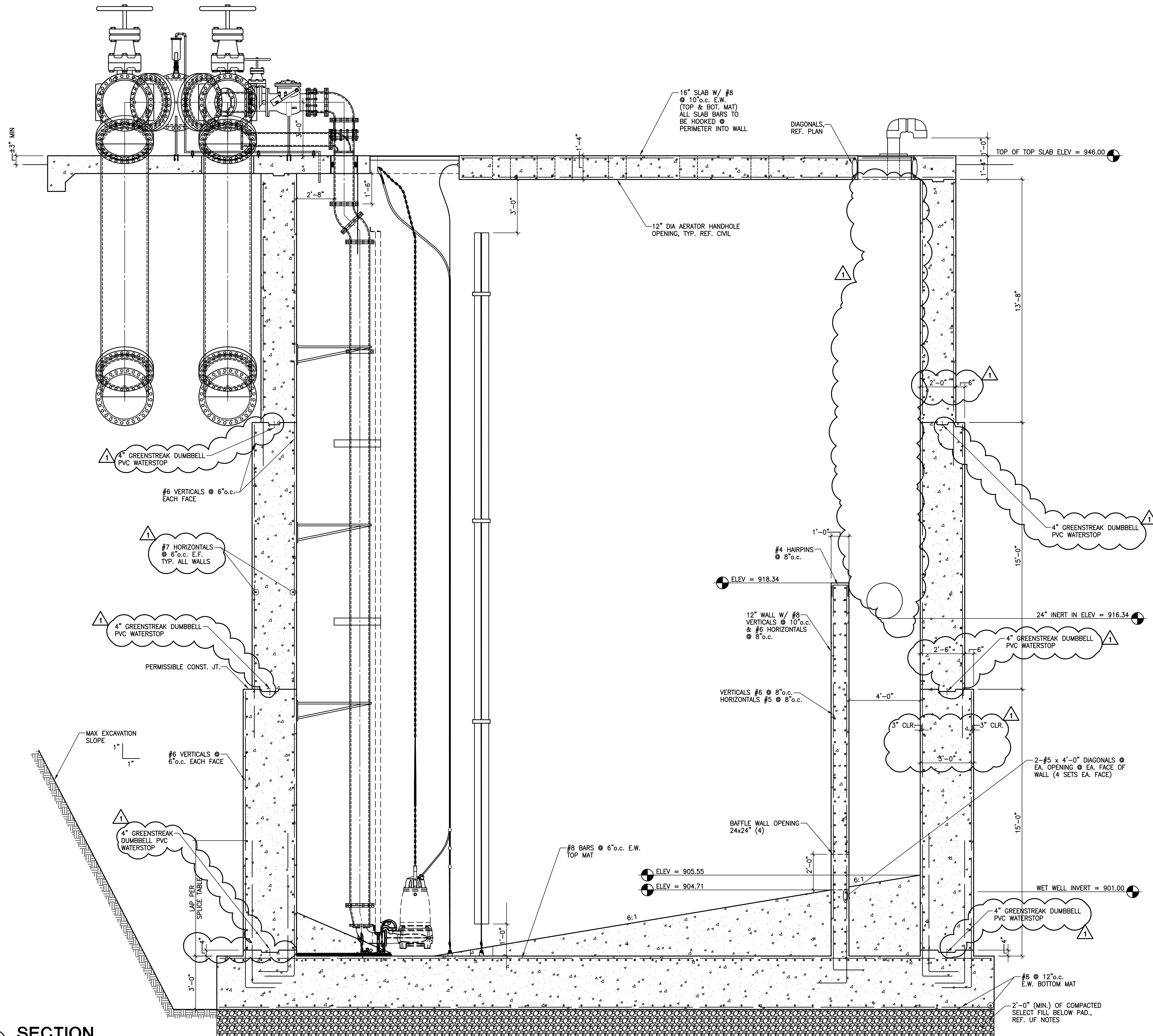
**PAPE-DAWSON ENGINEERS**  
 SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
 2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
 TUBE FIRM REGISTRATION #170 | TBPLS FIRM REGISTRATION #10028800

E-54 REGIONAL LIFT STATION PLANS  
 REGIONAL LIFT STATION  
 WET WELL SLAB PLAN

SAWS JOB NO.	22-2502
JOB NO.	11500-51
DATE	May 2022
DESIGNER	J.H.
CHECKED S.J.F.	DRAWN S.J.F.
SHEET	<b>S2.2</b>



NO.	REVISION	ADDENDUM #
1		



1 SECTION

E-54 REGIONAL LIFT STATION PLANS  
REGIONAL LIFT STATION  
SECTION

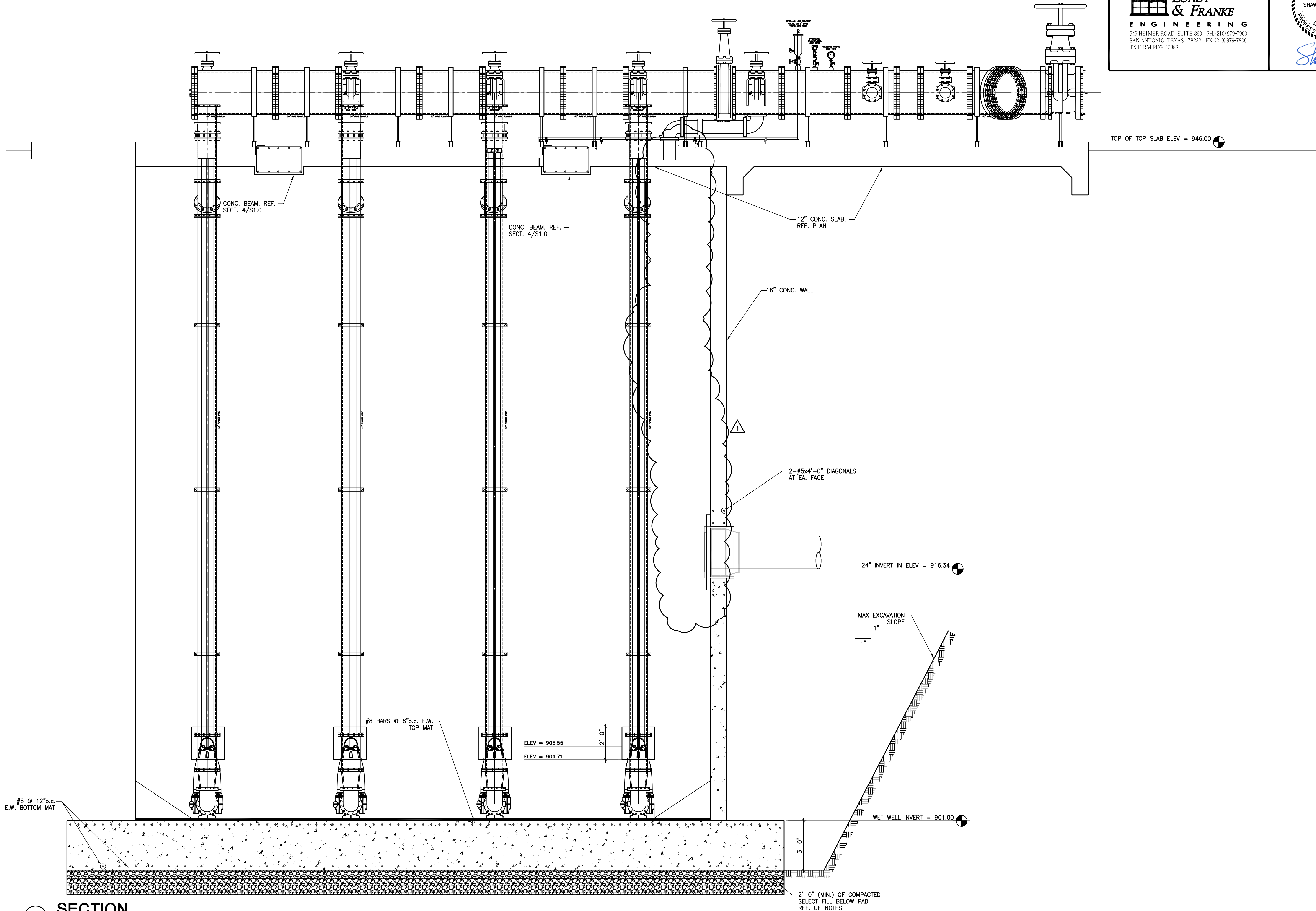
LA PROJECT NO.: 13-171-00  
LA FILE NO.: E54LST3-0

LA PROJECT NO.: 13-171-00  
 LA FILE NO.: E54LST3-1

**LUNDY & FRANKE**  
 ENGINEERING  
 540 HEIMER ROAD SUITE 360 PH. (210) 979-7900  
 SAN ANTONIO, TEXAS 78222 FX. (210) 979-7800  
 TX FIRM REG. #3388

DATE: 10/27/22  
 STATE OF TEXAS  
 SHAWN J. FRANKE  
 82639  
 LICENSED PROFESSIONAL ENGINEER  
*Shawn Franke*

NO.	REVISION	ADDENDUM #
1		



**1 SECTION**

**PAPE-DAWSON ENGINEERS**  
 SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
 2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
 TUBE FIRM REGISTRATION #170 | TBPLS FIRM REGISTRATION #10028800

E-54 REGIONAL LIFT STATION PLANS  
 REGIONAL LIFT STATION  
 SECTION

SAWS JOB NO. 22-2502  
 JOB NO. 11500-51  
 DATE May 2022  
 DESIGNER J.H.  
 CHECKED S.J.F., DRAWN S.J.F.

SHEET **S3.1**

SCALE: 3/8" = 1'-0"