Beaver Water District

PLANT EXPANSION PROGRAM
CONTRACT 23-3
16 MG CLEARWELL

Conformed to Bid

February 4, 2025



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B&V Project No. 417134

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1/8/2025

BEAVER WATER DISTRICT
PLANT EXPANSION PROGRAM
CONTRACT 23-3 - 16 MG CLEARWELL

ADDENDUM NO. 1

January 8, 2025

A. SCOPE. This Addendum No. 1 consists of pages AD1-1 through AD1-5 and covers the following additions and changes to the specifications and drawings for this project and contains the following attachments:

- Addendum No. 1 Revised Drawings

B. SPECIFICATIONS.

1. Section 01 50 00 Temporary Facilities
    a. Paragraph 1.4.B.1.a, revise "240 volts, 60 Hz, 3 phase" to "120/240 volts, 60 Hz, single phase".
    b. Delete Paragraph 1.4.B.1.b entirely.

C. DRAWINGS.

1. Drawing 000-C-100, Sheet 22 of 82. REPLACE sheet with revised drawing attached.
2. Drawing 000-C-310, Sheet 33 of 82. REPLACE sheet with revised drawing attached.
3. Drawing 000-C-314, Sheet 37 of 82. REPLACE sheet with revised drawing attached.
4. Drawing 000-C-401, Sheet 39 of 82. REPLACE sheet with revised drawing attached.
5. Drawing 000-C-402, Sheet 40 of 82. REPLACE sheet with revised drawing attached.
6. Drawing 000-C-403, Sheet 41 of 82. REPLACE sheet with revised drawing attached.
7. Drawing 045-M-501, Sheet 73 of 82. REPLACE sheet with revised drawing attached.

D. CLARIFICATIONS.

1. The passivation [in the gate] spec required Ferroxyl test, our company standard does not use that method, but we offer the attached in lieu of that and we have had great success with it. would this be acceptable to the engineer?
    a. *The Metal Slide Gates specification (Section 40 05 59.13) states, "After fabrication, pickled surfaces shall be subjected to a 24 hour water test* ***OR*** *a ferroxyl test to detect the presence of residual embedded iron. All pickled surfaces damaged during fabrication including welded areas shall be repickled or passivated in accordance with ASTM A380 as needed to remove all traces of iron contamination." A 24-hour water test can be used in lieu of the ferroxyl test. Methodology for the water test is*

stated in ASTM A380. Other methods listed in ASTM A380 can be considered on a case-by-case basis after the bid.

2. The [gate] spec mentions wall thimbles which the gate folks would provide, but also mentions wall pipes which the contractor would supply. Our design does not require the use of a wall thimble so we would not want to provide a wall thimble. the contractor would have to provide a wall pipe in order to mount their pipe. Which method should be used?
   a. *A steel wall sleeve shall be provided by the Contractor for all slide gates. The wall sleeve shall be compatible with the wall mounted slide gate frame provided by the gate manufacturer.*

3. The material for the wall pipe is called out to be steel [in the gate specification]. We only manufacture in stainless steel which would be significantly more expensive than a contractor provided wall pipe.
   a. *See response to question 2 above.*

4. Drawing 045-M-101 calls out for a future slide gate not called out in the gate schedule 45- TW-GSD-0002 and calls out for a 72" wall pipe with blind flange. Who is responsible to provide this? the contractor or gate manufacturer? Same for 45-TW-GSD- 0004, 0005 on 45-M-101
   a. *Contractor shall provide wall pipe, blind flange, and wall plate for future slide gates.*

5. Wall thimbles are not shown for the other gates. We do not require them for our gate function. Are they required?
   a. *See response to question 2 above.*

6. 40 05 57-5 2.5 A Lovejoy universal joint with grease filled protective boot. We are unfamiliar with this requirement, see no need for it and assume it refers to the valves not the gates. Please confirm.
   a. *The paragraph is referring to extension stems on valves.*

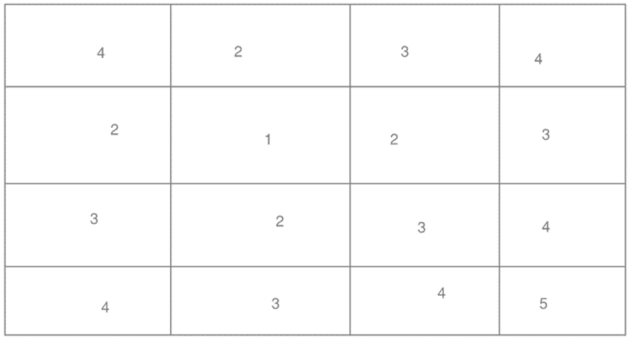
7. Please provide CAD files for the existing site and proposed site plans.
   a. *CAD files won't be provided during the bid phase.*

8. Please provide as-builts for the existing clearwell and wet well structure.
   a. *Per the General Conditions Article 5.03.A.6 the existing drawings can be viewed at the Owner's facility during regular business hours within 48hrs notice.*

9. The Plan and Profile drawing at Sta 305+00 to 313+00 (Drawing 000-C-311) includes a note specifying the "Boundary for extents of grading for pond fill." However, the pond fill is not depicted on the Overall Site Grading plan (Sheet 000-C-200). Please confirm that the pond is to be filled to match the surrounding grades out to the specified boundary.

a. *The pond is to be filled in to the proposed grade as shown in the profile on sheet 000-C-311.*

10. Specification Section 03 30 13-3.1.K.2.a states "A section near the center of each structure shall be placed first." Please confirm that this is meant for the overall structure and not the four (4) quadrants separated by the Expansion Joints (EJ's). Additionally, please clarify what is required by "Placement shall be scheduled so that two adjacent sides of each section are free, except at closures."
    a. *03 30 13-3.1.K.2.a is intended for the overall structure. The placement statement is intended to provide direction on order of concrete pour placement. Concrete shall be placed so that at least two sides of the section are free. See below for sample pour sequence that follows this statement (starting with 1).*



11. Detail E / 045-M-501 for the overflow weir does not match Section 3 / 045-S-302. Detail E indicates the lower closure for the weir cover extending out from the wall where Section 3 indicates the outside of the wall with a single plane. Please confirm that the mesh screen assembly should be recessed deeper into the opening such that the exterior of the wall can remain in the same plane.
    a. *The wall shall be poured in a single plane as shown on 045-S-302. The upper closure anchor rods and hinge assembly shall be recessed 1-2 inches so that the hinged metal cover plate will close tightly against the mesh screen unless there is water pressure to open it.*

12. SIR-5, Section D. 3. a. v. relates to the Project Approach section of the proposal and states "Provide a Quality Management Plan (QMP) describing...". Is this a brief write up regarding how we will utilize a QMP "…to ensure the completeness, workmanship, accuracy, and successful completion of the Project." or do you want an actual template/example of a QMP submitted that is NOT counted within the total allowable page count?
    a. *This requirement is just asking for a brief description of the firms QMP and how it will be used on the project. We do not want a copy of the firms QMP submitted as a part of the proposal.*

13. Instructions to Bidders, Article 12 – Preparation of Bid, 12.01 A. indicates that the bid is to be scanned to .pdf and submitted electronically, though it also states, "the Bid

Form must be completed in ink and the Bid Form Signed in ink." 12.01 B. directs the bidder to prepare its bid on a paper copy of the bid form. Please confirm this bid is to be submitted only electronically and a paper copy Is not required.

a. *Bidder shall complete the bid form in ink on a hard copy, scan that to PDF, and submit the PDF electronically. Paper copy of the bid is not required to be submitted.*

14. [General Conditions Article] 7.04D states Until Final Completion contractor shall have responsible charge and care of the Work and of all equipment and materials to be used therein, including equipment and materials which have been furnished by Owner and shall bear the risk of injury, loss, or damage to any part thereof by action of the elements or from any other cause. Should this say Substantial Completion? If not this implies that contractor be responsible for owner's operation of the plant after substantial and prior to final.
    a. *This clause of the General Conditions does not required Contractor to be responsible for Owners operations between Substantial and Final Completion.*

15. Article 9.G of the Agreement states we are to apply to the state for possible tax exemption. Are we to assume for the bid that taxes are required for this project?
    a. *Per Article 9.01.G the Owner will submit the language to the state for an opinion, but this does not have an impact on the bid price. The only items that will be exempt from taxes are those that are associated with the 24-inch and larger diameter piping, valves, and gates as those will be purchased by Contract as Purchasing Agent per Article 9.01.A. All other material will have to have taxes paid on them.*

16. Drawing 045-S-303, detail B, calls for a Fall Arrest Post Base manufactured by DBI-SALA manufacturer # 8516777. This part number is no longer listed in the DBI-SALA catalog. Please confirm DBI-SALA part number 8519819 is an acceptable alternative.
    a. *DBI-Sala part number 8519819 may be used.*

17. Sheet 000-C-501, detail A calls for 3" asphalt on 10" of Aggregate base. Detail B has notes calling for 3" asphalt surface on 10" of AC base on an unspecified aggregate base course. Please confirm the asphalt patching at road crossings is to be 3" of asphalt surface mix on 10" of aggregate base course, not 10" of Asphalt base mix.
    a. *AC Pavement patch shall consist of 3" AC surface course above 10" of aggregate base course.*

18. The project specifications, Section 01 50 00 - 1.C, require a field office trailer for the Resident Project Representative (RPR) with a minimum size of 20' x 36', providing 720 square feet. Would a unit with dimensions of 64' x 12', resulting in 768 square feet, be an acceptable alternative?
    a. *Alternative dimensions of the required RPR trailer can be evaluated after the Bid.*

19. The Davis Bacon does not include ironworker. What rate should be used for ironworkers?

a. *Structural ironworker should be $19.39 hourly rate with no fringe, reinforcing ironworker should be $14.00 hourly rate with no fringe.*

20. In lieu of slab bolsters or chairs, can concrete bricks be used to support Foundation and Slab Reinforcement? The concern is that bolsters/chairs tend to sink into the aggregate base reducing the effective cover at the bottom and exceeding it at the top. Please see attached cut sheet.
    a. *Alternative rebar support can be evaluated after the Bid. Bidders should plan on following the specifications for purposes of the Bid.*

E. ACKNOWLEDGEMENT BY BIDDER

Each bidder shall acknowledge receipt of all addenda in the space provided on the Bid Form.

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1/16/2025

BEAVER WATER DISTRICT
PLANT EXPANSION PROGRAM
CONTRACT 23-3: 16 MG CLEARWELL

ADDENDUM NO. 2

January 16, 2025

A. **SCOPE.** This Addendum No. 2 consists of pages AD2-1 through AD2-13 and covers the following additions and changes to the specifications and drawings for this projectand contains the following attachments:

- Pre-Bid Meeting Minutes
- Geotechnical Boring Logs

B. **SPECIFICATIONS.**

1. Section 40 05 24 – Steel Pipe

   a. Delete Paragraph 3.11.C.2 entirely and replace with the following:

      "After the protective coating has been applied to the coupling and tie bolts, the entire mechanical coupling shall be encapsulated with a three part wax tape system as indicated on the Drawings. The wax tape shall extend a minimum of 6 inches onto the shop coated pipe on each side of the coupling, including covering all epoxy coated steel. A primer shall be applied to the piping on each side of the coupling prior to installing the wax tape outer wrap. There shall be no bare or unprotected ferrous metal surfaces."

   b. Paragraph 3.11.D.1 – replace the words "shrink sleeve" with "three part wax tape system".

   c. Delete Paragraph 3.11.D.2 entirely and replace with the following:

      "The tie rods and bolts of the harness rings or lugs of the restrained coupling assembly shall be protected by wrapping them with wax tape in accordance with AWWA C217. A primer shall be applied prior to applying the wax tape. The application of wax tape shall be as recommended by the wax tape manufacturer."

   d. Delete Paragraph 3.11.D.3 entirely and replace with the following:

      "Following the application of the wax tape, the entire restrained mechanical coupling assembly, including coupling, tie bolts and nuts, pipe, and harness rings or lugs, shall be encapsulated by wax tape and an outer tape wrap. The wax tape shall extend a minimum of 6 inches onto the pipe beyond the end of the tie rods. The wax tape outer wrap shall extend a minimum of 6 inches onto the shop coated pipe beyond each end. A primer shall be applied to the piping on each side of the harness assembly prior to

installing the wax tape wrap. There shall be no bare or unprotected ferrous metal surfaces."

2. Section 40 05 64.11 – AWWA Butterfly Valves Schedule

a. Add the following item to the schedule table:

45-FW-VBF-0008	36	Finished Water	B20	150B-F*		130	16	WN	Yes	No

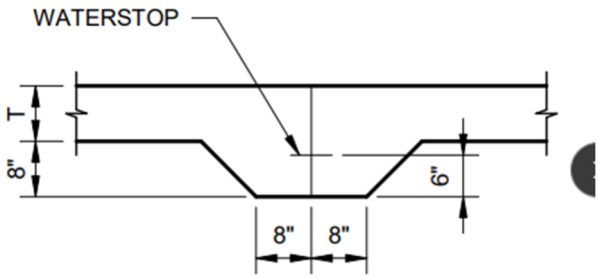
C. DRAWINGS.

1. Drawing 000-G-004, Sheet 5 of 82.

a. Remove keynote 1 callout.

2. Drawing 000-S-005, Sheet 13 of 82.

a. Replace the Slab to Slab (T<12") detail with the following:



SLAB TO SLAB (T<12")

3. Drawing 000-C-100, Sheet 22 of 82.

a. In Note 1, replace "THE EARTHWORK SPECIFICATION" with "THE EXCAVATION AND FILL FOR STRUCTURES SPECIFICATION."

b. Add the following Note 14:

"14. Contractor shall provide temporary 24-inch CMP for any new construction access off of existing roads to maintain drainage course."

4. Drawing 000-C-402 and 000-C-403, Sheets 40 and 41 of 82.

a. Add 36-inch butterfly valve (45-FW-VBF-008) on north side 36-inch tee.

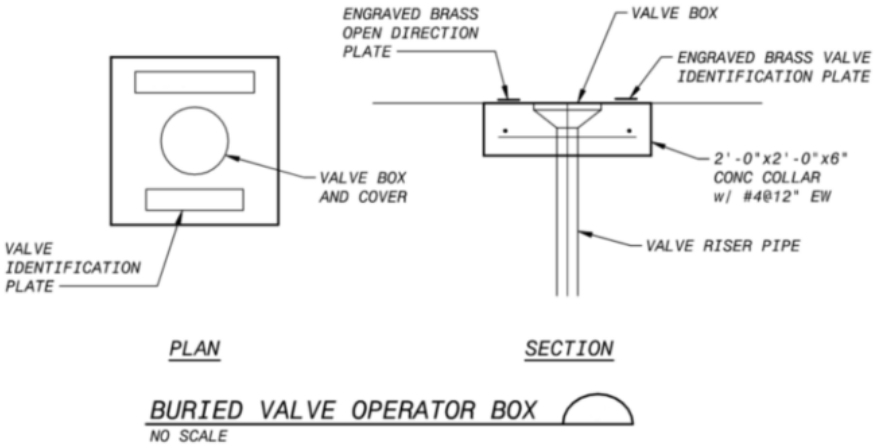
5. Drawing 000-C-503, Sheet 44 of 82.

a. DETAIL A. Delete Note 1 and replace with the following:

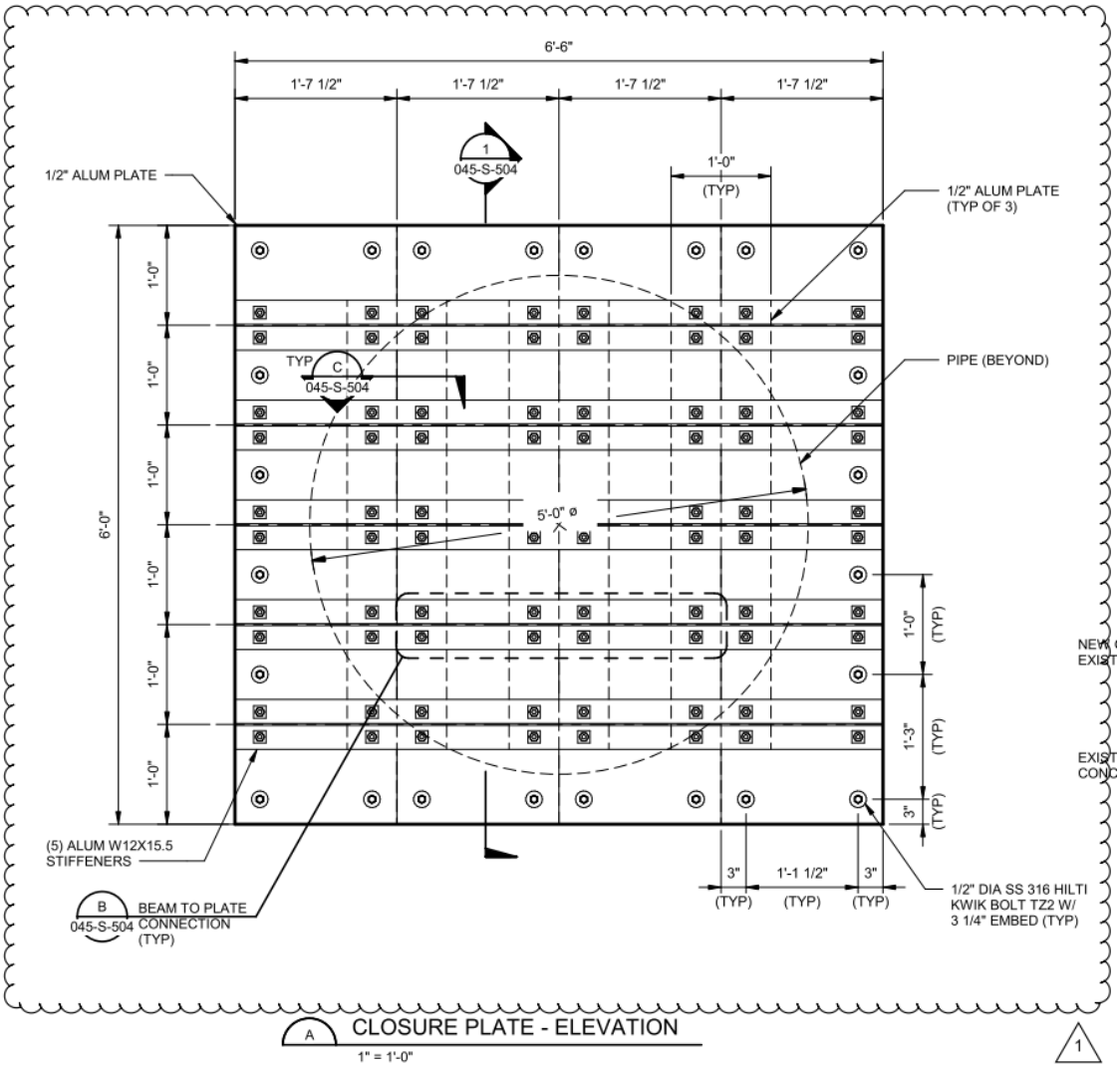
"1. The inside diameter of the manhole shall be 12' unless otherwise noted on the Drawings."

6. Drawing 000-C-504, Sheet 45 of 82.
   a. DETAIL A. Remove callout "1/2" EXP JT MATL AT EACH SIDE OF ACCESS DRIVE, AT BUILDING CORNERS, AND 50' SPACING." Replace callout with "1/2" EXP JT MATL AT EACH SIDE OF ACCESS DRIVE, AT BUILDING CORNERS, AND 40' SPACING."

7. Drawing 000-C-505, Sheet 46 of 82.
   a. Add the following Detail E:



8. Drawing 045-S-504, Sheet 66 of 82.
   a. Replace Detail A with the following:



D. CLARIFICATIONS.

1. On DWG 045-M-501, Detail D, Note 7 states "USE WAX TAPE TO PROTECT ALL BURIED FERROUS SURFACES INCLUDING PAINTED SURFACES. FOR PROTECTION OF ADJACENT PIPE BARREL SURFACES, SHRINK WRAP MAY BE USED IN LIEU OF WAX TAPE. SEE SPECIFICATIONS." Please confirm that this only at the sleeve.
   a. *Note 7 refers to corrosion protection for the the buried ferrous surfaces of the wall sleeve.*

2. Detail A on 000-C-504 indicates "1/2" EXP JT MATL AT EACH SIDE OF ACCESS DRIVE, AT BUILDING CORNERS, AND 50' SPACING" whereas specfication section 32 16 16 3.2.B calls for "One-half inch expansion joints shall

be provided where sidewalks abut a curb, structure, existing sidewalk, at changes in directions, and at intervals of not more than 40 feet." Please confirm that expansion joints in sidewalks are to be located at 50' spacing per detail A / 000-C-504.

a. *The detail should indicate 40' spacing to match the specifications. This change has been made in the addenda herein.*

3. Contract Drawing 045-M-101 indicates the two (2) 84" future connections with the note "84" WALL PIPE WITH BLIND FLANGE AND COVER PLATE PER B/045-M-502". Per this detail, a "BLIND FLANGE" is indicated on the submerged side of the wall and "3/8" PLATE" on the buried side. Per 40 05 24-2.2 Materials, Blind Flanges at Flanged Joint are to be "ANSI/AWWA C207, Class D except as otherwise indicated on the Drawings or specified." Please confirm that the blind flanges on the submerged side are to be ANSI/AWWA C207, Class D (please note that blind flanges of this size are custom and weigh in excess of 10,000 lbs).
   a. *Correct.*

4. Contract Documents include Detail A / 000-S-006 and Specification Section 03 01 26.76 that relate to Concrete Surface Repair at the exisitng clearwell. Neither include information as to the square footage that should be inlcuded as part of the Contract Price. Please confirm that any concrete surface repairs required at the existing clearwell will be treated as a changed condition and submitted for payment via change order or provide the square footage of surface to be included for each type of repair indicated in Detail A / 000-S-006.
   a. *Confirmed. Surface repair details are for the excavation of the clearwell wall associated with the concrete boss installation. Until excavation occurs, it is unknown what, if any, concrete repairs will be needed.*

5. Specification section 31 23 11.7, Will a soldier pile with soil nail and shotcrete system be allowed for Temporary Earth retention?
   a. *Contractor shall assume temporary shoring and that it may not be left in place permanently. After award of the Contract, any locations of permanent shoring can be reviewed in detail.*

6. Please confirm the existing shop building and house shown in the path of the Temporary Haul Route near Frisco Church Road will be remove by others before start of construction.
   a. *The shop building and house will be removed by others before construction.*

7. 31 23 11.3, Part 2.1,C,2 states "No rocks or stones shall be placed in the upper 18 inches of any fill or embankment." Please confirm screening the soils with 1/2" openings will be adequate.
    a. *Means and methods of ensuring there are no larger particles in the backfill are up to the Contractor's discretion so long as the specification requirement is met.*

8. Please confirm 24" culvert will be adequate where temporary construction entrances will block the existing ditch flow lines.
    a. *A 24-inch culvert is sufficient – this requirement will be added by addendum herein. Contractor is responsible for maintaining construction site entrances throughout the project, including if and when storm events damage or impede the entrances.*

9. Drawing 000-G -004 is missing general keynote 1
    a. *The callout was mistakenly left on the drawing. Please disregard and refer to item C.1 of this addendum for change to the Drawings.*

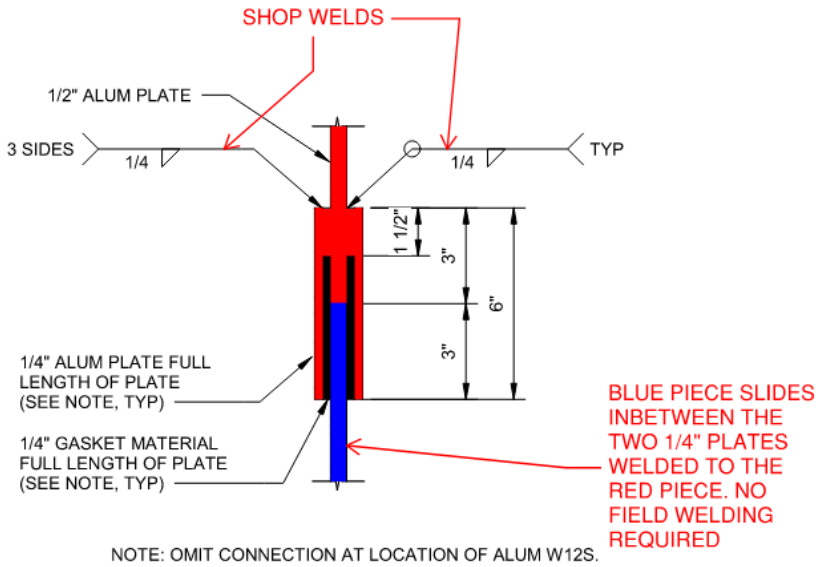
10. Drawing 000-C-100 note 16 states contractor shall not excavate beyond the extents of the concrete wall boss. This will require some form of shoring for the approximately 28' deep excavation. Will a form of permanent shoring, for example soil nails and shotcrete be acceptable or will any shoring used need to be removed?
    a. *For the purposes of the bid, Contractor shall assume temporary shoring will be removed and no permanent shoring left in place. After award of the Contract, specific locations of permenant shoring may be reviewed. A maximum of 14' can be disturbed for the installation of the 11' wide wall boss, but that includes the space for any shoring system plus the wall boss itself.*

11. Drawing 045-S-503 does the existing Clearwell's wet well wall have waterproofing on it? If so will waterproofing be required at the new concrete boss? Drawing 045-S-503 detail B shows the opening in the concrete boss to be 5'-0", drawing 045-M-502 shows the opening to be 5'-2" please confirm opening size.
    a. *It is unknown whether the existing clearwell exterior walls have waterproofing, but it is assumed that it does not. If it does have waterproofing, then the concrete boss will also require waterproofing, but that will be addressed via Change Order. The opening in the existing wall is shown as 5'-0" on both drawings. The 5'-2" dimension is the minimum dimension for the wall sleeve in the new concrete boss.*

12. Drawing 045-S-503 detail B, is expandable waterstop needed on the existing wall cored opening?
    a. *Yes, two rows of expandable waterstop are called out on Detail B.*

13. Drawing 045-S-504 detail A shows the wall opening to be 4'-6" and it is actually 5'-0", is the closure plate large enough to cover the 5'-0" diameter opening? There could potentially be issues coring into the gasket.
    a. *The wall opening is 5'-0". See changed detail in this addenda herein.*

14. Drawing 045-S-504, it was stated in the pre-bid conference that the closure plate was to be carried into the wet well in pieces and assembled in the wet well. Detail C shows the plates to be welded at the splices and no welding is allowed underwater. Is the intent for the entire closure plate to be lowered into the wet well then transported to the far wall of the wet well? If the closure plate is to be carried into the wet well in one piece our diving subcontractor has expressed concern carrying the entire plate past running pumps. Would it be possible to shut down all pumps for the time required to walk the plate across the wet well, no more than 2 hours?
    a. *Shutdown of the wetwell for any duration is not acceptable. The intent of Detail C on 045-S-504 is for one portion of the ½" aluminum plate to slide in between the two ¼" aluminum plates that are shop welded to the other ½" aluminum plate. See image below.*



C ALUM PLATE TO PLATE CONNECTION
045-S-504 3" = 1'-0"

15. Can oversized holes and washers be used at the Kwik bolt wall connections?
    a. *Yes.*

16. SIR p 4 - 2. b.i requests that key subcontractors be identified. Can more guidance be provided in defining "key" subcontractors? Should subcontractors with a certain contract value or more be listed?
    a. *Key subcontractors are defined in SIR C.3. There is not necessarily a dollar value associated with being a key subcontract, but we would expect the Proposer to indicate on the organization chart if any significant portions of the project would be subcontracted out, including but not limited to, earthwork, pipe laying, concrete work, diving services, and electrical and instrumentation.*

17. Spec 03 30 13, 3.2, D, 3 is there a maximum allowable depth for mortar puddle for the walls and is it required on all walls or just water retaining walls?
    a. *Maximum depth shall be 3". Mortar puddle shall be used for all walls.*

18. Plan sheet 000-C-350 shows a 12' dia drainage manhole and refers you to A/000-C-503. Note 1 refers you to the size of the manhole per pipe sizes - 5' dia is called out for 12" to 24" pipe. Would this manhole be 4' dia since the pipe is 8" that is running to and from it?
    a. *The note states the size of the mahole "UNLESS OTHERWISE NOTED ON THE DRAWINGS." The size of the manhole is indicated on sheet 000-C-350. Note 1 on Detail A will be revised in this addendum herein.*

19. If a 12' dia Manhole is required for the drainage manhole - would a 10' be acceptable, several precast guys have been requesting this due to 12' not being a common size. If a 10' dia precast manhole is not acceptable could we do a 12' ID Square Cast in Place Vault?
    a. *A 12' square cast-in-place vault is an acceptable alternative to the 12' diameter ID mahhole.*

20. Are concrete thrust blocks required on all bends of the steel yard pipe? If so will they all need to be designed like the one that is called out on sheet 000-C-401 and on A/000-C-510. Or is that the only thrust block required for the yard piping? Please clarify.
    a. *The only thrust blocks that are required are called out and detailed on the Drawings. No other thrust blocks are required.*

21. What does the contractor need to do when the 1/2" sample line is pulled through the existing 2" conduit that is shown near the existing clearwell on sheet 000-C-305?
    a. *BWD will capture this line and route it to an owner-supply and owner-installed water quality panel. After the panel connection is made, the contractor is responsible for sample pump startup.*

22. 03 30 00 Just confirming that you are wanting a Shrinkage test every 1,000 Cubic Yards. With this structure being so large there will be several tests needing to be done - shrinkage tests will generally take a few months to complete. Please clarify.
    a. *The reference being made here is to Section 03 30 00, Paragraph 3.3.K. This specific requirement is under the Owner Field Control Testing for which the Contractor is NOT responsible for. This is an optional test that the Owner may conduct during the project.*

23. Will Mass Concrete mix design be used on the clearwell?
    a. *No.*

24. On sheet 000-C-100 the temporary haul road to the spoils pile goes through 2 metal shops. Is the contractor suppose to demolish these 2 structures? Or will these be demolished by the owner before hand?
    a. *See response to Clarification #6 above.*

25. Will barbwire be required for the temporary fence around the site?
    a. *No, temporary fence around the site should be 8' tall chain link per Note 2 on Sheet 000-C-100 – no barb wire is required at the top of the chain link fence.*

26. The gates that are called out to be installed cannot be installed on a driven post - for the gate locations could there be a concrete footing for gate connections?
    a. *Yes, concrete footings can be installed for the temporary fence gates.*

27. Are the 26' double leaf gates really 52? Sheet 000-C-100 called out 26' but shows it being the width of the haul road of 50'? please clarify length of gate.
    a. *The haul route corridor being provided is 50', but it is not anticipated the whole route will be a haul road (unless the Contractor deems that necessary). The 26' double leaf gates are correct, however, if the Contractor requires larger gates for their operations, larger gates can be provided if acceptable to Owner/Engineer.*

28. Is the contractor responsible of removing the water service and utility work to the RPR trailer and the contractors trailer? Will the temp power stay in place as well? Please clarify.
    a. *All temporary power will become property of the owner at the end of the Project. Water services for the RPR trailer and stubs ups for future contractor connections shall become property of the Owner at the end of the Project. Contractor is not responsible for removing their temporary power/water services to their trailer.*

29. Does the contractor need to disinfect the existing clearwell after the divers get done with their work?
    a. *The existing clearwell will remain in service at all times during construction and cannot be taken offline for disinfection. Per Detail A/Sheet 045-M-502 note 1, "All materials, equipment, and personnel must be disinfected prior to entering clearwell."*

30. Could you provide a valve box detail for the yard pipe valves?
    a. *Blow off valve vault valve box product number specified on sheet 000-C-509. Valve boxes for yard pipe valves are specified in the Valve and Gate Actuators specification. A detail has been added to the addenda herein for the valve box.*

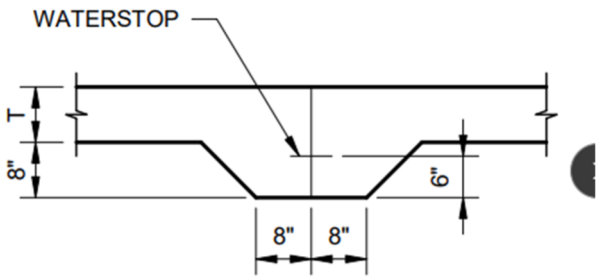
31. Does the spoils that is not being used for backfill have to stay onsite at the given spoil location or can this be hauled offsite?
    a. *For purpose of the bid, Contractor shall assume that all excavated materials will be placed at the onsite spoils area. After award of the Contract, alternative means of spoils disposal can be reviewed.*

32. Will concrete mixes that are approved on the current Beaver Water District/Black and Veatch project be transferable to this project? Or will all new tests have to be conducted for every mix design, even if it is the same? (i.e. ASR, Chloride Ion, Shrinkage, etc.)
    a. *Testing will need to be completed for the 16 MG Clearwell project per the specifications. Testing for approved mix designs on other projects is not transferable.*

33. Does the new clearwell need to be dampproofed on the exterior walls?
    a. *No, only the structures indicated in the Dampproofing specification section will require dampproofing.*

34. Will Frisco church road be closed through out the duration of this project?
    a. *No, the road will only be closed to through traffic during the construction of the Fayetteville transmission main road crossing. Road shall remain open to residents during this construction and shall be reopened as soon as the road crossing construction is complete.*

35. Plan sheet 000-S-005 slab to slab connections detail over 12" thick slab. Does this apply to all the construction joints within the clearwell? If so could you adjust the given dimensions on that detail (given measurements are 7 127/8 1/128") Please clarify?
    a. *Dimensions indicated for "SLAB TO SLAB (T<12")" shall be 8" and 8".*



SLAB TO SLAB (T<12")

36. Can the contractor utilize 48" Steel pipe for the Fayetteville Transmission pipe run and the DIP Option for both shutdowns 1 & 3 connections that is shown on sheet 000-C-402?
    a. *The question appears to be asking if steel pipe can be used for the 48" main and then transition to DIP for the two connections to the existing 36" and 42" Fayetteville transmission mains – that would be an acceptable alternative, but there would be an HMC required on 45-FW-VBF-0003 and an insulating flange kit to separate the DIP and steel pipe.*

37. Just confirming the overflow channel on the East side of the Clearwell calls out construction joints every 10' per note 2 on A/000-C-502?
    a. *Correct.*

38. At the pre-bid it was stated the BWD was working on clearing the onsite spoils location and the contractor was to remove all the chips and stumps at that location correct?
    a. *BWD is cutting and chipping the trees. The contractor must remove the stumps, clear, and grub the site prior to placing fill.*

39. Specification 31 23 11 E.1 states to use a material with a LL less than 45 and PI of 18 for structure backfill. Will the material coming from the excavation from the clearwell be suitable for backfill?
    a. *Refer to the geotechnical report attached to the specifications and additional boring logs included in this Addendum for in situ soil information.*

40. Please provide a specification section for the Security Fence and gates.
    a. *A specification will not be provided for security fences and gates since they will be temporary and become the property of the Owner after*

construction. Fence height and material are noted on Note 2 Sheet 000-C-100.

41. Specification section 03 08 13 3.1.E – Are the influent box, basin 4, basin 5, and the effluent channel considered adjacent structures, and will they need to be hydrotested individually?
    a. *Each chamber of the clearwell shall be hydrostatically tested individually including the influent box, Basin 4, Basin 5, and the effluent channel.*

42. Is it acceptable to backfill the clearwell after the clearwell has been placed into service?
    a. *Per specification section 03 08 13 Tightness Testing of Structures, the clearwell shall be pressure tested prior to backfilling. However, the clearwell shall not be put into service until it has been backfilled.*

43. Can one basin of the clearwell be backfilled after successful completion of leak test and drained while the other clearwell basin is being hydrotested?
    a. *Yes.*

44. Specification section 03 08 13 3.1.F – Please clarify the last sentence, is measurement of leakage at slide gates allowed or do they need to be drip tight?
    a. *The overall permissible leakage of the structure includes any openings, i.e., slide gates. There is no separate leakage requirement. The paragraph states,"Where slide gates, sluice gates, or similar devices are located, Contractor shall provide bulkheads or the means to make them drip tight and measure any leakage."*

45. Specification section 33 14 00 3.3 A. – For the buried steel pipe will makeup water in accordance with AWWA C604-17 – 7.2.4 be allowed?
    a. *No.*

46. Detail B/000-C-505 call for the tie bolts at harnessed mechanical couplings to be stainless steel, Specification section 40 05 24 – 3.11.C.1 requires the tie-bolts to be coated with a coal tar epoxy. Will the stainless-steel bolts be required to be coated with a coal tar epoxy?
    a. *This has been changed by addendum herein – the tie rods and bolts shall be wrapped with wax tape.*

47. Specification section 40 05 64.11 requires buried valves to be shop painted with a coal tar epoxy and specification section 40 05 24 3.11.B. & 3.11.A. requires the buried valve flanges to received wax tape then shrink sleeve and remaining portions of the valve to receive wax tape or shrink sleeve, please confirm that this is correct.
    a. *Correct.*

48. Specification section 40 05 24 3.11.D. requires restrained mechanical couplings to receive two coats of coal tar epoxy then shrink wrap. 3.11.D.3. states shrink sleeve shall not be installed over the entire restrained mechanical coupling assembly. Please clarify what portions of the assembly require the shrink sleeve and underlying sleeve, bolts, harness lugs etc.
    a. *This has been changed by addendum herein. The shrink sleeves have been removed and a wax tape system added.*

E. PRE-BID MEETING MINUTES

Minutes and attendance sheet from the Pre-Bid Meeting held on January 9th, 2025 are attached.

F. GEOTECHNICAL BORING LOGS

Additional geotechnical borings provided for reference only are attached.

G. ACKNOWLEDGEMENT BY BIDDER

Each bidder shall acknowledge receipt of all addenda in the space provided on the Bid Form.

Beaver Water District
Plant Expansion Program
Contract 23-3 16 MG Clearwell
Pre-Bid Meeting Minutes
January 9th, 2025, at 1:00 PM
301 N Primrose Rd, Lowell, AR 72745

I. Introductions & Attendance
   a. Refer to attached Attendance Sheet for list of in-person attendees.
   b. Virtual (Teams) attendees include:
      1. Damon Hoops-BWD
      2. Danny Dearing-BWD
      3. Frank Blowers-BWD
      4. Stacy Cheevers-BWD
      5. Tim Malcolm-BV
      6. Andrew Hansen-BV
      7. Benjamin Knoop -BV
      8. Bridget Moore-BV
      9. Lukas Koechner-BV

II. Description of Project:
   The work includes the construction of a new segment of Fayetteville transmission main, 16-million gallon, in-ground, cast-in-place concrete clearwell for storing treated water at the Owner's treatment facility, including a flow meter vault structure, groundwater drainage collection system, associated piping, appurtenances, electrical, instrumentation, mechanical, and sitework to provide a complete and functional system.

III. Availability of Bidding Documents
   Beaver Water District Bidding Website:
   https://qcpi.questcdn.com/cdn/posting/?group=8022661&provider=8022661&projType=all
   Quest Number: 9448359

IV. Bid Submission & Selection
   a. Bids and proposals must be submitted via email to malcolmt@bv.com no later than 12:00 PM (noon) local time on Wednesday January 22nd, 2025
   b. Pre-bid meeting attendance is not mandatory to submit a bid.
   c. All questions should be submitted no later than 12:00 PM (noon) on Wednesday, January 15th, 2025.
   d. Bid Security (5%)
   e. Bidder Qualifications – Respondents submitting a proposal for this RFCSP should clearly demonstrate that water/wastewater facilities and pipeline activities is a primary business focus and service, and such services have been successfully provided for at least ten (10) continuous years.
   f. Bid response and attachments to this bid
      i. Lump Sum Bids
      ii. Proposal required as indicated in the Supplementary Instructions to Bidders
      iii. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids

g. Selected Bidder will be provided written Notice of Award and copies of the contract documents for execution
    i. Bidder is required to execute bonds, insurance, and agreement within 15 days for Notice of Award
    ii. Owner will have the agreement executed within 30 days of receipt of the executed documents.

V. Taxes and Wages
    a. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the State of Arkansas.
    b. Contractor will act as Owners Purchasing Agent in regard to purchase of 24-inch and larger pipe, 24-inch and larger valves, and all slide gates. Only those items will be tax exempt.
    c. Contractor will be required to pay Davis-Bacon Wage Rates. Submission of weekly payroll is not required.

VI. Project Schedule
    a. Pre-construction Scheduling conference: Within 10 days of Effective date of Contract
    b. Anticipated Notice to Proceed – March 21st, 2025
    c. Substantial Completion – March 1st, 2027
    d. Milestone 1 – Fayetteville FW transmission main relocation substantial completion prior to February 26, 2026.
    e. Final Completion – 30 calendar days following the date for Substantial Completion
    f. Liquidated Damages:
        i. Substantial Completion –$7,000 per calendar day
        ii. Final Completion - $1,000 per calendar day
        iii. Milestones - Contractor shall pay Owner $7,000 for each day that expires after the time specified above for achievement of Milestone 1, until Milestone 1 is achieved, or until the time specified for Substantial Completion is reached. Liquidated damages for Milestone 1 and Substantial completion are not additive.

VII. Construction Schedule Requirements
    a. Milestone 1 - the construction of a new segment of Fayetteville transmission main.
        i. New 48-inch ductile iron or steel Fayetteville transmission main will parallel Primrose Road, and then tie into 36-inch DIP and 42-inch PCCP. Tie-in shutdown periods are critical as this is Fayetteville's only water supply. Three (3) separate shutdowns are required are specified in section 01 11 13 and are as follows. All shutdowns must be coordinated with City of Fayetteville.
        ii. Tie-in new 48-inch main to 42-inch PCCP main (November 30 to January 30, 24hrs)
        iii. Tie-in new main to 36-inch DIP main (November 30 to January 30, 24hrs)
        iv. Tie-in new 48-inch main to existing 42-inch DIP main (November 30 to January 30)

1. Linestop and bypass required – 2hr shutdown for linestop installation
2. Tie-in to be complete within 12hrs of successful linestop installation

b. Existing Clearwell will remain in service and cannot be shut down for the for the duration of the project. Treated Water Interconnect tie in to existing Clearwell shall occur between November 1 and March 1.

1. As the existing clearwell is the only way to transfer water to all districts, the tie-in must be made while the existing clearwell is in service. A diver is required to enter wet well to install and remove stop plates. Refer to drawings and specs for exact details including sequencing.

VIII. Permits

a. Owner will obtain and pay for the following permits:
   i. NPDES Permit for Storm Water Discharge associated with Construction Activity. See Appendix B for Draft Permit. Final permit will be provided when available
   ii. Benton County Road Crossing Permit
   iii. Benton County Development Plan Review
   iv. Arkansas Department of Health Drinking Water Plan Review
   v. USACE 404 Permit

b. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all:
   i. Building permits
   ii. Inspection fees necessary for the prosecution of the Work only as specified in Section 01 45 00.

IX. Special Inspections and Testing

a. B&V, Olsson, Grubbs will be handling a variety of inspections. Refer to Section 01 45 00 for specific details on what the Contractor provided testing.

b. Examples include slump & cylinders testing; compaction testing being coved by BV/Grubbs. Contractor to cover testing for concrete mix designs, aggregate testing, other field inspections including shrink wrap sleeves.

X. Coordination with Other Contracts

a. Western Corridor Pipeline (SC 11/7/25, FC 12/7/25)
   i. 60-inch Western Corridor Pipeline and meter vault
   ii. Fluoride line
   iii. Sample line into TWPS
   iv. Electrical/signal conductors back to North Electrical Bldg

b. Contract 23-2 Raw Water Pipeline (Anticipated NTP 3/21/25)

c. Contract 23-4 Starr Water Treatment Plant (Anticipated NTP 12/4/25)

d. CECC 69kV Relocation

e. Use of Site
    i. Spoils area
        1. Compaction requirements and testing, maximum slope (4:1), and other requirements for spoils placement are included in the specification section 31 23 11.
        2. BWD is currently working on a tree clearing contract which will clear trees clear trees and chip. Contractor is responsible for removing stumps, clearing, and grubbing spoils area prior to placing fill.
    ii. Temporary stockpile and laydown areas (select area only available until December 31, 2025 as indicated on drawings)
    iii. Haul route (available until December 31, 2025)
    iv. Utility crossing areas and protection
        1. Exact time for 69kV relocation is not yet known.
        2. Protection for existing Springdale waterline is included in Addendum No. 1.
        3. Western corridor pipeline (60-inch steel pipe), electrical, water quality sample lines, and control signals for Western Corridor pipeline are being constructed in the project vicinity.
        4. The surface electrical duct bank is critical to plant operations, please note location and provide protection where excavations are nearby.
    v. Excavation limits
        1. Existing Clearwell Wetwell tie-in has narrow excavation limits as shown on Addendum No.1. Plans indicate requirements for phasing and construction of concrete wall boss adjacent to existing clearwell wall.

f. Site Office Complex
    i. Site grading and aggregate base
    ii. Water line to site offices
    iii. Power service drop and panelboard skid (120V & 240V) are to be provided by contractor. Electrical connections to future trailers are not within contractor's scope.
    iv. Contractor office trailer – to remain in possession of Contractor after construction is complete.
    v. RPR jobsite trailer (with water, power, and sanitary services)
    vi. Site temporary fencing
    vii. Sanitary services to be provided by Contractor
    viii. Voice and data services to be provided by Contractor
    ix. All water lines, power service drops, and site temporary fencing (chain link) along with the RPR trailer shall become property of BWD at conclusion of work.

XI. Coordination with Owner

a. Site security – Contractor will be required to obtain site access keys/cards and keep daily logs of personnel onsite. Contractor will need to provide daisy chain locks for all of the perimeter gates being added.
b. Anyone who is not authorized to be on the plant site outside of the Contractor's fence will be removed from the project. Any access to BWD plant site outside of the Contractor's fence needs to be coordinated at least 24hrs in advance.
    i. On-site work that will need to be coordinated with BWD site security, is anticipated to include:
        a. Treated water interconnect/Tie in for Wetwell
        b. Metering vault
        c. Routing DC-6 signals for DCS
c. Owner will have trees within site area cut and chipped, but Contractor will have to remove stumps.
d. Owner will integrate signals to DCS system.
e. Tie-in to existing clearwell wetwell (November 1 to March 1)
    1. The contractor may encounter a French drain for the clearwell within the excavation for the concrete wall boss.
    2. The water surface elevation within the existing clearwell wetwell varies.
    3. Refer to sheet 045-S-503 for concrete boss construction sequencing notes and requirements, including provisions for divers to install aluminum plate prior to coring the existing wall.

XII. Miscellaneous

a. The relocated Fayetteville transmission main can be DIP or steel pipe. Alignment shown on drawings is based on steel piping. If ductile iron is selected, slight adjustments to alignment will be needed.
b. All other piping on the project will be spiral welded steel piping.
c. Working hours are 7am-5pm Monday-Friday
    i. BWD may accommodate differing working hours upon request.

XIII. Site Visit and Geotech Info

a. Site visit is scheduled following the pre-bid conference. No other access to the site will be provided outside of the pre-Bid conference.
b. The Bidding Documents contain a Geotechnical Report for reference only.
c. Additional geotechnical borings along the alignment of the relocated Fayetteville transmission main are being conducted this week and will be provided for reference via addendum.

XIV. Document Questions and Clarifications

a. Bidder shall submit all questions through the Bidding Documents Website. An addendum will be posted with the attendance sheet and minutes from this pre-bid meeting.

XV. Questions

1. Is there a hatch in the existing clearwell large enough for the stop plate to be inserted?
    a. Yes. The stop plate will be inserted in pieces and assembled inside the clearwell. The location and size of the opening is shown on revised sheet 000-C-100 in Addendum No. 1.
2. Does the existing clearwell wetwell water surface elevation vary?
    a. Yes.
4. Is cathodic protection required if ductile iron is selected for the Fayetteville transmission main?
    a. Anodes are only required for steel piping.
5. What coordination is required for Fayetteville transmission main?
    a. BWD and Contractor will be required to coordinate work with the City of Fayetteville for all connections to the Fayetteville transmission main.
6. Will accommodations outside normal working hours of M-F 7AM to 5PM be allowed for concrete pours?
    a. Yes, BWD may accommodate differing working hours upon request.
7. Does BWD have a preferred diver?
    a. No, BWD does not have a preferred diver, but their previous diver has been notified of the project and provided the plan holders list.

Meeting: Contract 23-3 16 MG Clearwell Pre-Bid

Date: January 9, 2025

Name	Company	Email	Phone Number
Clint Hayes	Alberici	clint.hayes@alberici.com	314-366.0154
Chad Wirsig	Alberici	Chad.Wirsig@alberici.com	720-241-8029
Frank Trujillo	ALBERICI	Frank.Trujillo@ALBERICI.com	404-314-3423
Matt Standlee	Crossland Heavy	mstandlee@heavycontractors.com	620 249 4105
Stetson Beck	"	SBECK@ " "	417.825.3159
Wade Pierpoint	Garney	Wpierpoint@Garney.com	918-779-8975
Kiowa Whitcomb	MCC	Kwhitcomb@multi-craft.net	479 318 6539
Bill Hagenburger	crossland heavy	bhagenburger@yahoo.com	479 903 0532
Richard Morrison	OCE	rmorrison.oce.us.com	918-625-6638
Dan Thompson	CHC		479-366-1637
Downie Jones	CHC		
Jeffrey Wilson	ESS	jeffrey.wilson@emerysapp.com	479.498-9049
Josh Collins	ESS	joshua.collins@emerysapp.com	(501) 256-3173
Robert Brenna	Thomas Fence	Robert@ThomasFence.Ac.Com	479 458 8001
Eric Hardwick	Carlton	Eric.Hardwick@carlton	479.970-9007
Eric McCoy	MCC	elm@multi-craft.net	479-236-8532

Meeting: Contract 23-3 16 MG Clearwell Pre-Bid

Date: January 9, 2025

Name	Company	Email	Phone Number
Bob Poole	Fleming Elec.	bpoole@flemingelec.com	479-957-2568
Richard Childs	Multi-Craft	rchilds@multi-craft.net	479-422-2657
Barrett Sanders	GTS, Inc.	barrett.sanders@gtscontracting.net	479-879-1307

CERTIFICATIONS

BLACK & VEATCH – GENERAL, CIVIL, MECHANICAL PROCESS

Specifications: Division 01 (except for 01 45 33.5 and 01 67 00.3), Division 02, Division 07, Division 08, Division 09, Division 13, Division 22, Division 31, Division 32, Division 33, Division 40 (except for 40 61 11, 40 71 00, 40 72 00)

THIS DOCUMENT WAS ORIGINALLY ISSUED AND SEALED ON DECEMBER 2, 2024 BY ANDREW J. HANSEN, A LICENSED PROFESSIONAL ENGINEER IN THE STATE OF ARKANSAS, E-14664

_____(SEAL)

BLACK & VEATCH – STRUCTURAL

Specifications: 01 45 33.5, 01 67 00.3, Division 03, Division 05

THIS DOCUMENT WAS ORIGINALLY ISSUED AND SEALED ON DECEMBER 2, 2024 BY DOUGLAS L. DUNCAN, A LICENSED PROFESSIONAL ENGINEER IN THE STATE OF ARKANSAS, E-18748

_____(SEAL

BLACK & VEATCH – MECHANICAL

Specifications: Division 23

THIS DOCUMENT WAS ORIGINALLY ISSUED AND SEALED ON DECEMBER 2, 2024 BY MICHELE FRANCOM ROTH, A LICENSED PROFESSIONAL ENGINEER IN THE STATE OF ARKANSAS, E-17959

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BLACK & VEACTH – ELECTRICAL

Specifications: Division 26

THIS DOCUMENT WAS ORIGINALLY ISSUED AND SEALED ON DECEMBER 2, 2024 BY KELSI R. ENGEL LICENSED PROFESSIONAL ENGINEER IN THE STATE OF ARKANSAS, E-22677

_____(SEAL)

BLACK & VEATCH – INSTRUMENTATION AND CONTROLS

Specifications: 40 61 11, 40 71 00, 40 72 00

THIS DOCUMENT WAS ORIGINALLY ISSUED AND SEALED ON DECEMBER 2, 2024 BY BRIAN L. BUTLER, A LICENSED PROFESSIONAL ENGINEER IN THESTATE OF ARKANSAS, E-11777

_____(SEAL)

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ADVERTISEMENT FOR BIDS

Beaver Water District
Lowell, Arkansas
Contract 23-3 16 MG Clearwell

General Notice

Beaver Water District (Owner) is requesting Bids and proposals for the construction of the following Project:

Contract 23-3 16 MG Clearwell

Bids and proposals for the construction of the Project will be received electronically by Black & Veatch via email to MalcolmT@bv.com, until **Wednesday**, **January 22nd , 2025** at **12:00 PM (noon)** local time. At that time the Bids received will be **privately** opened and read.

The Project includes the following Work:

> **The work includes the construction of a new segment of Fayetteville transmission main, 16-million gallon, in-ground, cast-in-place concrete clearwell for storing treated water at the Owner's treatment facility, including a flow meter vault structure, groundwater drainage collection system, associated piping, appurtenances, electrical, instrumentation, mechanical, and sitework to provide a complete and functional system.**

Bids are requested for the following Contract: **Contract 23-3 16 MG Clearwell.**

Obtaining the Bidding Documents

Information and Bidding Documents for the Project can be found at the following designated website:

https://qcpi.questcdn.com/cdn/posting/?group=8022661&provider=8022661&projType=all

Bidding Documents may be downloaded from the designated website. Prospective Bidders are urged to register with the designated website as a plan holder, even if Bidding Documents are obtained from a plan room or source other than the designated website in either electronic or paper format. The designated website will be updated periodically with addenda, lists of registered plan holders, reports, and other information relevant to submitting a Bid and Proposal for the Project. All official notifications, addenda, and other Bidding Documents will be offered only through the designated website. Neither Owner nor Engineer will be responsible for Bidding Documents, including addenda, if any, obtained from sources other than the designated website.

Pre-bid Conference

A pre-bid conference for the Project will be held on **January 9th, 2025** at **1:00 PM** at **301 N Primrose Rd, Lowell, AR 72745.** Attendance at the pre-bid conference is encouraged but not required.

Instructions to Bidders.

For all further requirements regarding bid submittal, qualifications, procedures, and contract award, refer to the Instructions to Bidders and Supplementary Instructions to Bidders that are included in the Bidding Documents.

This Advertisement is issued by:

Owner: **Beaver Water District**
By: **Lane Crider**
Title: **Chief Executive Officer**
Date: **December 4, 2024**

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INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

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ARTICLE 1—DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Issuing Office*—The office from which the Bidding Documents are to be issued, and which registers plan holders.

ARTICLE 2—BIDDING DOCUMENTS

2.01 Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). See the Agreement for a list of the Contract Documents. It is Bidder's responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.

2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.

2.03 Owner has established a Bidding Documents Website as indicated in the Advertisement or invitation to bid. Owner recommends that Bidder register as a plan holder with the Issuing Office at such website, and obtain a complete set of the Bidding Documents from such website. Bidders may rely that sets of Bidding Documents obtained from the Bidding Documents Website are complete, unless an omission is blatant. Registered plan holders will receive Addenda issued by Owner.

2.04 *Electronic Documents*

A. When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to the Bidders as Electronic Documents in the manner specified.

1. Bidding Documents will be provided in Adobe PDF (Portable Document Format) (.pdf) that is readable by Adobe Acrobat Reader. It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the Owner and Engineer cannot and do not guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner.

B. Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.04.A above. However, Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of Bidding Documents

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and reproductions prepared from those versions and, further, assumes all risks, costs, and responsibility associated with use of the Electronic Documents.

ARTICLE 3—QUALIFICATIONS OF BIDDERS

3.01 Information regarding qualifications shall be submitted as required by the attached Supplementary Instructions to Bidders.

ARTICLE 4—PRE-BID CONFERENCE

4.01 A non-mandatory pre-bid conference will be held at the time and location indicated in the Advertisement or invitation to bid. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference; however, attendance at this conference is not required to submit a Bid.

4.02 Information presented at the pre-Bid conference does not alter the Contract Documents. Owner will issue Addenda to make any changes to the Contract Documents that result from discussions at the pre-Bid conference. Information presented, and statements made at the pre-bid conference will not be binding or legally effective unless incorporated in an Addendum.

ARTICLE 5—SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

5.01 *Site and Other Areas*

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

5.02 *Existing Site Conditions*

A. *Subsurface and Physical Conditions; Hazardous Environmental Conditions*

1. The General Conditions identify the following regarding existing conditions at or adjacent to the Site:

a. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.

b. Those drawings known to Owner of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.

c. Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

d. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely,

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as provided in the General Conditions, has been identified and established in the General Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

3. If the General Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

4. *Geotechnical Report:* The Bidding Documents contain a Geotechnical Report .

   a. As set forth in the General Conditions, the Geotechnical Report describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations ("Baseline Conditions"). The Geotechnical Report is not a Contract Document.

   b. Nothing in the Geotechnical Report is intended to relieve Bidders of the responsibility to make their own determinations regarding construction costs, bidding strategies, and Bid prices, nor of the responsibility to select and be responsible for the means, methods, techniques, sequences, and procedures of construction, and for safety precautions and programs incident thereto.

B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05 of the General Conditions, and not in the drawings referred to in Paragraph 5.02.A of these Instructions to Bidders. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

5.03 *Other Site-related Documents*

A. No other Site-related documents are available.

5.04 *Site Visit and Testing by Bidders*

A. A Site visit is scheduled following the pre-bid conference. Maps to the Site will be available at the pre-Bid conference. No other access to the site will be provided outside of the pre-Bid conference.

B. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

5.05 *Owner's Safety Program*

A. Site visits and work at the Site may be governed by an Owner safety program. If an Owner safety program exists, it will be noted in the General Conditions.

5.06 *Other Work at the Site*

A. Reference is made to Article 8 of the General Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

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ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Express Representations and Certifications in Bid Form, Agreement*

A. The Bid Form that each Bidder will submit contains express representations regarding the Bidder's examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications, and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.

B. If Bidder is awarded the Contract, Bidder (as Contractor) will make similar express representations and certifications when it executes the Agreement.

ARTICLE 7—INTERPRETATIONS AND ADDENDA

7.01 Owner on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.

7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing. Contact information and submittal procedures for such questions are as follows:

A. **Submit all questions through the Bidding Documents Website.**

7.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than seven days prior to the date for opening of Bids may not be answered.

7.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 8—BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of **5%**percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a Bid bond issued by a surety meeting the requirements of Paragraph 6.01 of the General Conditions. Such Bid bond will be issued in the form included in the Bidding Documents.

8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract and furnish the required Contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Owner's damages in the case of a damages-form bond. Such forfeiture will be Owner's exclusive remedy if Bidder defaults.

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the

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Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

ARTICLE 9—CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be (a) substantially completed and (b) ready for final payment, and (c) Milestones (if any) are to be achieved, are set forth in the Agreement.

9.02 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 10—SUBSTITUTE AND "OR EQUAL" ITEMS

10.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or-equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.

10.02 All prices that Bidder sets forth in its Bid will be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 11—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

11.01 See attached Supplementary Instructions to Bidders regarding information on Subcontractors and Suppliers that is required to be submitted with the Bid.

ARTICLE 12—PREPARATION OF BID

12.01 The Bid Form is included with the Bidding Documents.

A. All blanks on the Bid Form must be completed in ink and the Bid Form signed in ink. Erasures or alterations must be initialed in ink by the person signing the Bid Form. A Bid price must be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein. The completed Bid Form shall be scanned to PDF and submitted as indicated herein.

B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words "No Bid" or "Not Applicable."

12.02 If Bidder has obtained the Bidding Documents as Electronic Documents, then Bidder shall prepare its Bid on a paper copy of the Bid Form printed from the Electronic Documents version of the Bidding Documents. The printed copy of the Bid Form must be clearly legible, printed on 8½ inch

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by 11-inch paper and as closely identical in appearance to the Electronic Document version of the Bid Form as may be practical. The Owner reserves the right to accept Bid Forms which nominally vary in appearance from the original paper version of the Bid Form, providing that all required information and submittals are included with the Bid.

12.03 A Bid by a corporation must be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation must be shown.

12.04 A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.

12.05 A Bid by a limited liability company must be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.

12.06 A Bid by an individual must show the Bidder's name and official address.

12.07 A Bid by a joint venture must be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.

12.08 All names must be printed in ink below the signatures.

12.09 The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.

12.10 Postal and e-mail addresses and telephone number for communications regarding the Bid must be shown.

12.11 The Bid must contain evidence of Bidder's authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.

12.12 If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder's licensure, or Bidder must certify in writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder's state contractor license number, if any, must also be shown on the Bid Form.

ARTICLE 13—BASIS OF BID

13.01 *Lump Sum*

A. Bidders must submit a Bid on a lump sum basis as set forth in the Bid Form.

ARTICLE 14—SUBMITTAL OF BID

14.01 The Bidding Documents include a copy of the Bid Form, and the Bid Bond Form. The Bid Form is to be completed and submitted with the Bid security, proposal as indicated in the attached

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Supplementary Instructions to Bidders, and the other documents required to be submitted under the terms of Article 2 of the Bid Form.

14.02 A Bid and proposal must be received no later than the date and time prescribed and at the place indicated in the Advertisement. The Bid and proposal shall be submitted as two PDF files labelled accordingly. The subject line of the email shall include the contract number, contract name, firm name submitting the Bid, and the words "BID ENCLOSED".

14.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted.

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

15.01 An unopened Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the Bid will be discarded.

15.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 15.01 and submit a new Bid prior to the date and time for the opening of Bids.

15.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, the Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, the Bidder may be disqualified from further bidding on the Work.

ARTICLE 16—OPENING OF BIDS

16.01 Bids and proposals will be opened privately.

ARTICLE 17—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

17.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 18—EVALUATION OF BIDS AND AWARD OF CONTRACT

18.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.

18.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.

18.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of

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the Bid, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.

18.04 If Owner awards the contract for the Work, such award will be based on highest score as defined in the attached Supplementary Instructions to Bidders.

18.05 *Evaluation of Bids*

A. See attached Supplementary Instructions to Bidders for Bid and proposal evaluation information.

18.06 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

18.07 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 19—BONDS AND INSURANCE

19.01 Article 6 of the General Conditions sets forth Owner's requirements as to performance and payment bonds, other required bonds (if any), and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by required bonds and insurance documentation.

19.02 Article 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

ARTICLE 20—SIGNING OF AGREEMENT

20.01 When Owner issues a Notice of Award to the Successful Bidder, it will be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder must execute and deliver the required number of counterparts of the Agreement and any bonds and insurance documentation required to be delivered by the Contract Documents to Owner. Within 30 days thereafter, Owner will deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 21—SALES AND USE TAXES

21.01 Refer to Article 9 of the Agreement for purchasing agent and tax information.

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SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

Beaver Water District (BWD) has determined that the Competitive Sealed Proposal (CSP) method of procurement will provide the best value for BWD for this project. This document provides general information about the requirements and evaluation for this Request for Competitive Sealed Proposals (RFCSP).

A. EVALUATION OF PROPOSALS

1. BWD will conduct a comprehensive and impartial evaluation of all CSPs received in response to this request. BWD will evaluate and rank each proposal in relation to the following selection criteria:

Firm Qualifications and Experience	**10%**
Proposed Staff Qualifications and Experience	**20%**
Project Approach	**10%**
Price	**60%**
Total:	**100%**

2. During the evaluation and ranking of Respondents' proposals, BWD reserves the right to consider the following:

   a. Whether the Respondent can perform the contract within the specified time. In making this determination BWD may take into account Respondent's existing commitments and whether in BWD's sole discretion those commitments will adversely impact Respondent's ability to complete the work in the scheduled time.
   b. The quality and punctuality of performance on any current or previous contracts.
   c. BWD may contact references provided by the Respondent, as well as any other references to verify qualifications, experience and performance. In making this determination, BWD may take into account work performed by the Respondent on any project, including but not limited to BWD projects, projects that the Respondent provides as references and any other projects that BWD has knowledge of.
   d. Respondent's financial resources and ability to perform the contract.

3. If Respondent fails to provide a response to each of the Evaluation Criteria identified within this RFCSP, points may be deducted, or the proposal may be considered non-responsive and ineligible for consideration.

B. REQUIRED EXPERIENCE

Respondents submitting a proposal for this RFCSP should clearly demonstrate that water/wastewater facility and pipeline activities is a primary business focus and service, and such services have been successfully provided for at least ten (10) continuous years.

C. DEFINITIONS

1. Personnel for the purpose of this RFCSP is defined as employees of the Prime Contractor, or any subcontractor(s), affiliates, joint venture partners, or team members, and consultants engaged by any of those entities.

2. Proposed Key Personnel shall include at a minimum the Project Manager and the Project Superintendent but other critical staff included in the Respondent's organization chart that are intended to serve on the project. Key Personnel must remain actively involved and be readily available throughout the construction phase of the project. In accordance with the General Conditions, the proposed project Superintendent shall provide full-time on-site supervision over Work ongoing at the site. Respondents shall assign and provide qualified Key Personnel that can effectively fulfill the responsibilities of their role for the duration of the project. Prior to diverting any of the specified individuals to other projects, the Contractor shall notify the Owner reasonably in advance, and shall submit justification (including proposed substitutions) in sufficient detail to permit evaluation of the impact on the project. No diversion of Key Personnel shall be made by the Contractor without written consent of the Owner.

3. Key Subcontractors for the purpose of this RFCSP are defined as subcontractors that are responsible for executing a significant portion of the work, and as such are deemed to be essential to the work being performed under this Contract.

D. RESPONSE FORMAT

1. Firm Qualifications and Experience

a. Organizational Structure and Information of the Prime Contractor

i. Provide current type and business organizational structure.
ii. Indicate the number of years performing contracting/construction work under current legal business name and/or previous legal business name(s).
iii. Provide total number of employees and annual company revenues for each of the last five (5) calendar years.
iv. Provide any litigation, arbitration, subcontractor liens, and claims history for the last three (3) years.
v. Total and current available bonding capacity and any bond claims made in the last five (5) years.

b. Prime Contractor Experience on Similar Projects in the Past Ten (10) Years

i. List and describe three (3) <u>completed</u> projects within the last ten (10) years of similar size, scope, and complexity to the work described in the Contract Documents for this Project. Respondents should provide references with contact information to include a valid, recently verified email and telephone number for

each project listed. Each project should include the following information:

- Project name.
- Utility/Owner name and contact information (phone number and email address) for Utility/Owner's Project Manager.
- Key personnel on the project.
- Original (bid/price) and final construction in place costs.
- Project description and why it is comparable to the size, scope, and complexity of this project.
- Total costs of change orders, as well as explanation regarding the reason for specific change orders.
- Date of Notice to Proceed and Final Completion.
- Identify whether the project was completed by the Substantial Completion date, if liquidated damages or other monetary or labor compensation was provided to compensated for failure to meet the contractual completion dates.

ii. The Respondent shall provide a list of all current projects for all Utility/Owners. Respondent shall provide the following information for each project:

- Project name.
- Utility/Owner name.
- Original Contract Completion Date and Actual Completion Date. If project is not complete at the time of submission, Respondent shall provide the current
  % Complete based on contract time.
- Original (bid/price) and final construction in place costs.

iii. The Respondent shall provide a list of **all** projects currently under construction in which Key Personnel are involved, as identified in the organizational chart provided in the response for this RFCSP, and the expected completion date that demonstrates Respondent's ability to start and complete the work required by the project.

2. Proposed Staff Qualifications and Experience

a. **Proposed Team Structure and Key Personnel Roles and Responsibilities**

i. Provide a 1-page organizational chart that describes the composition of the team for this project. The chart shall include the specific proposed key personnel for the Prime Contractor and any key subcontractor(s). The chart shall also include percent availability (as percentage of total individual's workload) being committed for key personnel (prime and subcontractor(s)) and their proposed role for the duration of the Project.

ii. Provide a clear description of the proposed team identifying key subcontractor(s), their role on the project, and teaming history. If the Prime

Contractor has not worked previously with proposed Key Subcontractor(s), describe the proposed approach for ensuring successful completion of the project in accordance with Contract Documents.

iii. Provide a clear description of the proposed team's Key Personnel roles and responsibilities.

iv. Identify alternative replacement staff. Replacement staff shall not be engaged without the written consent of BWD.

b. **Qualifications and Experience of Key Personnel Proposed for this Project**

i. Provide resumes, one per person and not to exceed one (1) page each, for key personnel for the prime contractor and key subcontractor(s) identified on the organizational chart. Resumes should include the following information:

- Name, job title, education
- Number of years of total professional experience
- Number of years/months with current company
- Number of years/months of experience in proposed role for this project
- Description of professional qualifications (to include degrees, licenses, certifications, and associations)
- Brief overview of professional experience
- Detailed description of capabilities and experience relevant to this project
- List of all other active projects the team member is assigned to for the duration of the Project to include the phase and percentage of time allocated to each of the other projects. For each active project, include current utility contact information. For each project included in each resume, clearly identify whether the project is with current firm or part of the person's past professional experience.

3. Project Approach, Schedule, and Availability

a. **Project Approach**

i. Provide a narrative of the project approach describing how the Respondent will complete this project. Include key milestones, specific critical processes and critical path items, phases and/or sequencing, permits, approvals, coordination with stakeholders, and procurements anticipated to complete the project work. Identify potential risks and describe proposed mitigation measures to ensure on-time completion of the Project.

ii. Provide a detailed description of the proposed shutdown plan and related activities for Fayetteville pipeline and existing clearwell tie-in connection and opportunities for reduced downtime.

iii. Identify specific long lead procurement items and describe the approach to ensure timely delivery.

iv. Provide any innovative ideas for cost savings (construction sequencing, method or construction duration, supply chain management and logistics, procurement

of critical items, and availability of materials and equipment,) for this project. Value engineering alternatives will only be considered after Contract award.

v. Provide a Quality Management Plan (QMP) describing how the Prime Contractor will ensure that the necessary steps, safeguards, subcontractor oversight, QC processes, and document controls will be implemented in a rigorous manner as to ensure the completeness, workmanship, accuracy, and successful completion of the Project.

b. **Project Schedule and Unforeseen Conditions**

i. Provide a project specific critical path method (CPM) schedule in Primavera or Microsoft Project. The schedule shall include milestones, specific critical processes and critical path items, construction phases, permits, approvals, coordination with stakeholders, and procurements anticipated to complete the project work. The anticipated notice to proceed (NTP) for this Project is **March 21, 2025.** Respondent shall use this date for developing the proposed project schedule.

ii. Explain how Respondent will complete the project within the schedule taking into account the existing commitments identified above.

iii. Identify long-lead time items and critical path shop drawing submittals.

iv. Describe the Respondent's approach towards mitigating and managing unforeseen conditions should they be encountered during the construction of this Project.

4. Price

The Proposal with the lowest total price will receive sixty (60) points. Proposals will receive a percentage of the sixty (60) points based on a comparison with the lowest total price proposal as described below.

Computation Steps:

i. Step 1. Determine lowest total price and award 60 points for price.

ii. Step 2. Calculate the ratio between the lowest total price and each proposal. Multiply the ratio by 60 to obtain the points earned.

Example Price Scoring Calculation:

Proposal	Price	Calculation	Points Earned
A	$9,350,000	(7,750,665/9,350,000) x 60	49.74
B	$10,125,800	(7,750,665/10,125,800) x 60	45.93
C	$7,750,665	(7,750,665/7,750,665) x 60	60.00
D	$8,565,450	(7,750,665/8,565,450) x 60	54.29
E	$12,700,000	(7,750,665/12,700,000) x 60	36.62

E. FORMAT OF PROPOSALS

1. Proposals shall be prepared simply and economically, providing a straightforward, concise description of the Respondent's ability to meet the requirements of this RFCSP. Emphasis shall be on the quality, completeness, clarity of content, responsiveness to the requirements, responsiveness to the evaluation criteria, and an understanding of BWD needs.

2. A maximum of **20 pages** shall be included in the Proposal. The Price Proposal (Bid), and any other required documents will not count as printed pages and should be submitted as a standalone and separate file.

3. Proposals shall be submitted in PDF files electronically. Respondents are responsible to ensure all required items are included.

4. Respondents shall carefully read the information contained in this RFCSP and submit a complete response to all requirements and questions as directed. Incomplete Proposals will be considered non-responsive and subject to rejection.

5. Proposals and any other information submitted by Respondents in response to this RFCSP shall become the property of BWD.

6. Proposals shall be prepared using letter-size 8-1/2” x 11” pages. The project schedule and up to one (1) figure may be provided using tabloid-size 11” x 17” paper.

7. Separate and identify each evaluation criteria response of this RFCSP by use of a divider sheet with an integral tab for ready reference in the order indicated herein.

8. BWD reserves the right to conduct interviews if deemed necessary to facilitate final evaluation and scoring.

BID FORM FOR CONSTRUCTION CONTRACT

The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions.

ARTICLE 1—OWNER AND BIDDER

1.01 This Bid is submitted to: **Beaver Water District.**

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2—ATTACHMENTS TO THIS BID

2.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid security;

B. Proposal as indicated in the Supplementary Instructions to Bidders

C. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;

D. Contractor's license number as evidence of Bidder's State Contractor's License or a covenant by Bidder to obtain said license within the time for acceptance of Bids;

ARTICLE 3—BASIS OF BID—LUMP SUM BID PRICES

3.01 *Lump Sum Bids*

A. Bidder will complete the Work in accordance with the Contract Documents for the following lump sum (stipulated) price(s):

1. Lump Sum Price (Single Lump Sum)

Lump Sum Bid Price	$ 40,439,000.00

ARTICLE 4—TIME OF COMPLETION

4.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

4.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

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ARTICLE 5—BIDDER'S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

5.01 *Bid Acceptance Period*

A. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

5.02 *Instructions to Bidders*

A. Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

5.03 *Receipt of Addenda*

A. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date
1	11/8/2025
2	11/16/2025

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Bidder's Representations*

A. In submitting this Bid, Bidder represents the following:

1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.
2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the General Conditions, with respect to the Technical Data in such reports and drawings.
5. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the General Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder's (Contractor's) safety precautions and programs.
6. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data

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are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

7. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

8. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

9. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

10. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

6.02 *Bidder's Certifications*

A. The Bidder certifies the following:

1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.

2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.

3. Bidder has not solicited or induced any individual or entity to refrain from bidding.

4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 8.02.A:

a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.

b. Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.

c. Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.

d. Coercive practice means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

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BIDDER hereby submits this Bid as set forth above:

Bidder: Crossland Heavy Contractors
(typed or printed name of organization)



By: [signature]
(individual's signature)

Name: Daniel A. Thompson
(typed or printed)

Title: President
(typed or printed)

Date: 1/22/2025
(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest: [signature]
(individual's signature)

Name: Amy Harlos
(typed or printed)

Title: Estimating Admin. Assistant
(typed or printed)

Date: 1/22/2025
(typed or printed)

Address for giving notices:
501 S East Avenue
Columbus KS 66725

Bidder's Contact:

Name: Matt Standlee
(typed or printed)

Title: Estimator
(typed or printed)

Phone: 620·429·1410

Email: mstandlee@heavycontractors.com

Address:
501 S East Avenue
Columbus KS 66725

Bidder's Contractor License No.: (if applicable) 0016730125

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BID BOND (PENAL SUM FORM)

Bidder Name: Crossland Heavy Contractors, Inc. Address *(principal place of business)*: PO Box 350 Columbus, KS 66725	**Surety** Federal Insurance Company / Fidelity and Deposit Company of Maryland / Zurich American Insurance Company Name: Address *(principal place of business)*: 202B Hall's Mill Road, Whitehouse Station, NJ 08889 / 1299 Zurich Way, 10th Floor, Schaumburg, IL 60196-1056
Owner Name: **Beaver Water District** Address *(principal place of business)*: **301 N. Primrose Rd, Lowell, AR 72745**	**Bid** Project *(name and location)*: **Contract 23-3 16 MG Clearwell, Lowell, AR** Bid Due Date: January 22, 2025

Bond

Penal Sum: Five Percent of Amount Bid (5%)

Date of Bond: January 22, 2025

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

Bidder	Surety
Crossland Heavy Contractors, Inc. *(Full formal name of Bidder)*	Federal Insurance Company / Fidelity and Deposit Company of Maryland / Zurich American Insurance Company *(Full formal name of Surety) (corporate seal)*
By: *(Signature)*	By: Elizabeth Drone *(Signature) (Attach Power of Attorney)*
Name: Mark Sell *(Printed or typed)*	Name: Elizabeth Drone *(Printed or typed)*
Title: Executive Chairman	Title: Attorney-in-Fact
Attest: Amy Harlos *(Signature)*	Attest: Joshua Eichem *(Signature)*
Name: Amy Harlos *(Printed or typed)*	Name: Joshua Eichem *(Printed or typed)*
Title: Estimating Admin Assistant	Title: Witness

Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.

EJCDC® C-430, Bid Bond (Penal Sum Form).
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1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation will be null and void if:
   3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
   3.2. All Bids are rejected by Owner, or
   3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action will be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond will be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

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CHUBB

Power of Attorney

Federal Insurance Company | Vigilant Insurance Company | Pacific Indemnity Company
Westchester Fire Insurance Company | ACE American Insurance Company

Know All by These Presents, that **FEDERAL INSURANCE COMPANY,** an Indiana corporation, **VIGILANT INSURANCE COMPANY,** a New York corporation, **PACIFIC INDEMNITY COMPANY,** a Delaware corporation, **WESTCHESTER FIRE INSURANCE COMPANY** and **ACE AMERICAN INSURANCE COMPANY** corporations of the Commonwealth of Pennsylvania, do each hereby constitute and appoint appoint Clara R. Navarro Abela, Myriah A. Anderson, Joshua Eichem, Alycia Marie Hoebener, Cassidy D. Palic, Neha Rai, Todd Alan Rambo, Timothy Craig Smith, and Desiree E. Westmoreland of Wichita, Kansas; Monica F. Donatelli, Elizabeth Drone, Charissa D. Wilson, Morgan Wilkerson-Liu, and S. Mark Wilkerson of Overland Park, Kansas

each as their true and lawful Attorney-in-Fact to execute under such designation in their names and to affix their corporate seals to and deliver for and on their behalf as surety thereon or otherwise, bonds and undertakings and other writings obligatory in the nature thereof (other than bail bonds) given or executed in the course of business, and any instruments amending or altering the same, and consents to the modification or alteration of any instrument referred to in said bonds or obligations.

In Witness Whereof, said **FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY** and **ACE AMERICAN INSURANCE COMPANY** have each executed and attested these presents and affixed their corporate seals on this **9th day of October, 2024.**

Rupert HD Swindells, Assistant Secretary

Warren Eichhorn, Vice President

STATE OF NEW JERSEY
County of Hunterdon ss.

On this **9th day of October, 2024** before me, a Notary Public of New Jersey, personally came Rupert HD Swindells and Warren Eichhorn, to me known to be Assistant Secretary and Vice President, respectively, of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY, the companies which executed the foregoing Power of Attorney, and the said Rupert HD Swindells and Warren Eichhorn, being by me duly sworn, severally and each for himself did depose and say that they are Assistant Secretary and Vice President, respectively, of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY and know the corporate seals thereof, that the seals affixed to the foregoing Power of Attorney are such corporate seals and were thereto affixed by authority of said Companies; and that their signatures as such officers were duly affixed and subscribed by like authority.

Notarial Seal

Albert Contursi
NOTARY PUBLIC OF NEW JERSEY
No 50202369
Commission Expires August 22,2027

Notary Public

CERTIFICATION

Resolutions adopted by the Boards of Directors of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY on August 30, 2016; WESTCHESTER FIRE INSURANCE COMPANY on December 11, 2006; and ACE AMERICAN INSURANCE COMPANY on March 20, 2009:

"RESOLVED, that the following authorizations relate to the execution, for and on behalf of the Company, of bonds, undertakings, recognizances, contracts and other written commitments of the Company entered into in the ordinary course of business (each a "Written Commitment"):

(1) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized to execute any Written Commitment for and on behalf of the Company, under the seal of the Company or otherwise.

(2) Each duly appointed attorney-in-fact of the Company is hereby authorized to execute any Written Commitment for and on behalf of the Company, under the seal of the Company or otherwise, to the extent that such action is authorized by the grant of powers provided for in such person's written appointment as such attorney-in-fact.

(3) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized, for and on behalf of the Company, to appoint in writing any person the attorney-in-fact of the Company with full power and authority to execute, for and on behalf of the Company, under the seal of the Company or otherwise, such Written Commitments of the Company as may be specified in such written appointment, which specification may be by general type or class of Written Commitments or by specification of one or more particular Written Commitments.

(4) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized, for and on behalf of the Company, to delegate in writing to any other officer of the Company the authority to execute, for and on behalf of the Company, under the Company's seal or otherwise, such Written Commitments of the Company as are specified in such written delegation, which specification may be by general type or class of Written Commitments or by specification of one or more particular Written Commitments.

(5) The signature of any officer or other person executing any Written Commitment or appointment or delegation pursuant to this Resolution, and the seal of the Company, may be affixed by facsimile on such Written Commitment or written appointment or delegation.

FURTHER RESOLVED, that the foregoing Resolution shall not be deemed to be an exclusive statement of the powers and authority of officers, employees and other persons to act for and on behalf of the Company, and such Resolution shall not limit or otherwise affect the exercise of any such power or authority otherwise validly granted or vested."

I, Rupert HD Swindells, Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY (the "Companies") do hereby certify that

(i) the foregoing Resolutions adopted by the Board of Directors of the Companies are true, correct and in full force and effect,
(ii) the foregoing Power of Attorney is true, correct and in full force and effect.

Given under my hand and seals of said Companies at Whitehouse Station, NJ, this January 22, 2025

Rupert HD Swindells, Assistant Secretary

IN THE EVENT YOU WISH TO VERIFY THE AUTHENTICITY OF THIS BOND OR NOTIFY US OF ANY OTHER MATTER, PLEASE CONTACT US AT:
Telephone (908) 903-3493 Fax (908) 903-3656 e-mail: surety@chubb.com

ZURICH AMERICAN INSURANCE COMPANY
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY
FIDELITY AND DEPOSIT COMPANY OF MARYLAND
POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That the ZURICH AMERICAN INSURANCE COMPANY, a corporation of the State of New York, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, a corporation of the State of Illinois, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND a corporation of the State of Illinois (herein collectively called the "Companies"), by Robert D. Murray, Vice President, in pursuance of authority granted by Article V, Section 8, of the By-Laws of said Companies, which are set forth on the reverse side hereof and are hereby certified to be in full force and effect on the date hereof, do hereby nominate, constitute, and **appoint S. Mark WILKERSON, Morgan WILKERSON-LIU, Morgan DEWEY, Monica F. DONATELLI, Debra L. WALZ, Charissa D. WILSON, Elizabeth DRONE, Neha S. RAI, Joshua EICHEM, Cassidy D. PALIC of Overland Park, Kansas,** its true and lawful agent and Attorney-in-Fact, to make, execute, seal and deliver, for, and on its behalf as surety, and as its act and deed: **any and all bonds and undertakings,** and the execution of such bonds or undertakings in pursuance of these presents, shall be as binding upon said Companies, as fully and amply, to all intents and purposes, as if they had been duly executed and acknowledged by the regularly elected officers of the ZURICH AMERICAN INSURANCE COMPANY at its office in New York, New York., the regularly elected officers of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at its office in Owings Mills, Maryland., and the regularly elected officers of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at its office in Owings Mills, Maryland., in their own proper persons.

The said Vice President does hereby certify that the extract set forth on the reverse side hereof is a true copy of Article V, Section 8, of the By-Laws of said Companies, and is now in force.

IN WITNESS WHEREOF, the said Vice-President has hereunto subscribed his/her names and affixed the Corporate Seals of the said **ZURICH AMERICAN INSURANCE COMPANY, COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and FIDELITY AND DEPOSIT COMPANY OF MARYLAND**, this 08th day of October, A.D. 2024.

ATTEST:
ZURICH AMERICAN INSURANCE COMPANY
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY
FIDELITY AND DEPOSIT COMPANY OF MARYLAND

SEAL SEAL SEAL

By: Thomas O. McClennan
Vice President

By: Dawn E. Brown
Secretary

State of Maryland
County of Baltimore

On this 08th day of October, A.D. 2024, before the subscriber, a Notary Public of the State of Maryland, duly commissioned and qualified, **Thomas O. McClellan, Vice President and Dawn E. Brown, Secretary** of the Companies, to me personally known to be the individuals and officers described in and who executed the preceding instrument, and acknowledged the execution of same, and being by me duly sworn, deposeth and saith, that he/she is the said officer of the Company aforesaid, and that the seals affixed to the preceding instrument are the Corporate Seals of said Companies, and that the said Corporate Seals and the signature as such officer were duly affixed and subscribed to the said instrument by the authority and direction of the said Corporations.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my Official Seal the day and year first above written.

Genevieve M. Maison

GENEVIEVE M. MAISON
NOTARY PUBLIC
BALTIMORE COUNTY, MD
My Commission Expires JANUARY 27, 2025

Authenticity of this bond can be confirmed at bondvalidator.zurichna.com or 410-559-8790

EXTRACT FROM BY-LAWS OF THE COMPANIES

"Article V, Section 8, Attorneys-in-Fact. The Chief Executive Officer, the President, or any Executive Vice President or Vice President may, by written instrument under the attested corporate seal, appoint attorneys-in-fact with authority to execute bonds, policies, recognizances, stipulations, undertakings, or other like instruments on behalf of the Company, and may authorize any officer or any such attorney-in-fact to affix the corporate seal thereto; and may with or without cause modify of revoke any such appointment or authority at any time."

CERTIFICATE

I, the undersigned, Vice President of the ZURICH AMERICAN INSURANCE COMPANY, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing Power of Attorney is still in full force and effect on the date of this certificate; and I do further certify that Article V, Section 8, of the By-Laws of the Companies is still in force.

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the ZURICH AMERICAN INSURANCE COMPANY at a meeting duly called and held on the 15th day of December 1998.

RESOLVED: "That the signature of the President or a Vice President and the attesting signature of a Secretary or an Assistant Secretary and the Seal of the Company may be affixed by facsimile on any Power of Attorney...Any such Power or any certificate thereof bearing such facsimile signature and seal shall be valid and binding on the Company."

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at a meeting duly called and held on the 5th day of May, 1994, and the following resolution of the Board of Directors of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at a meeting duly called and held on the 10th day of May, 1990.

RESOLVED: "That the facsimile or mechanically reproduced seal of the company and facsimile or mechanically reproduced signature of any Vice-President, Secretary, or Assistant Secretary of the Company, whether made heretofore or hereafter, wherever appearing upon a certified copy of any power of attorney issued by the Company, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seals of the said Companies, this 22nd day of January, 2025.



MJ Pethick

Mary Jean Pethick
Vice President

TO REPORT A CLAIM WITH REGARD TO A SURETY BOND, PLEASE SUBMIT A COMPLETE DESCRIPTION OF THE CLAIM INCLUDING THE PRINCIPAL ON THE BOND, THE BOND NUMBER, AND YOUR CONTACT INFORMATION TO:

Zurich Surety Claims
1299 Zurich Way
Schaumburg, IL 60196-1056
reportsfclaims@zurichna.com
800-626-4577

Authenticity of this bond can be confirmed at bondvalidator.zurichna.com or 410-559-8790

License No. 0067301125

ID #8600

State of Arkansas

Commercial Contractors Licensing Board

CROSSLAND HEAVY CONTRACTORS, INC.
501 S EAST AVENUE
COLUMBUS, KS 66725

This is to Certify That CROSSLAND HEAVY CONTRACTORS, INC.

is duly licensed under the provisions of Ark. Code Ann. § 17-25-101 et. seq. as amended and is entitled to practice Contracting in the State of Arkansas within the following classifications/specialties:

HEAVY CONSTRUCTION
MUNICIPAL & UTILITY CONSTRUCTION

This contractor has an unlimited suggested bid limit.

from October 25, 2024 **until** November 30, 2025 **when this Certificate expires.**

Witness our hands of the Board, dated at North Little Rock, Arkansas:

GREAT SEAL OF THE STATE OF ARKANSAS

CHAIRMAN

SECRETARY

October 25, 2024 - dsa

CROSSLAND
HEAVY CONTRACTORS

501 S East Avenue | PO Box 350
Columbus, Kansas 66725
t 620 429 1410
f 620 429 2977

CORPORATE RESOLUTION

BE IT RESOLVED: that at the monthly meeting of the Board of Directors of Crossland Heavy Contractors, Inc., held on the 27th day of October 2023, the Board of Directors did, by unanimous decision, authorize Mark Sell, Chris Walters, Justin Lillie, Dan Thompson, Erick Lowe or Ivan Crossland, Jr. to sign on behalf of said Corporation all documents and papers pertaining to the business of said Corporation.

All documents signed by Mark Sell, Chris Walters, Justin Lillie, Dan Thompson, Erick Lowe or Ivan Crossland, Jr. on behalf of Crossland Heavy Contractors, Inc. shall be legally binding on Crossland Heavy Contractors, Inc. and their successors and assigns.

Dan Thompson, President

ATTEST: _____
Holly Rhodes, Secretary

State of Kansas, County of Cherokee:

Before me, the undersigned Notary Public in and for the County and State aforesaid, personally appeared Dan Thompson, President of Crossland Heavy Contractors, Inc. a corporation duly organized and existing in the State of Kansas, and he acknowledged the same on behalf of said Corporation.

In witness thereof I have set my hand and affixed my seal this 30 day of Nov 2023.

_____
Notary Public

My Commission Expires: 12-21-25

DENISE LUCIAN
Notary Public - State of Kansas
My Appt. Expires 12-21-25

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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.

AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

Prepared By

EJCDC®
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

ACEC
AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

NSPE®
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed By

CSI®
Building Knowledge
Improving Project Delivery

NUCA
We Dig America

EJCDC® C-520, Agreement between Owner and Contractor for Construction Contract (Stipulated Price).
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(202) 347-7474
www.acec.org

American Society of Civil Engineers
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AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

This Agreement is by and between **Beaver Water District** ("Owner") and **Crossland Heavy Contractors, Inc** ("Contractor").

Terms used in this Agreement have the meanings stated in the General Conditions.

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

The work includes the construction of a new segment of Fayetteville transmission main, 16-million gallon, in-ground, cast-in-place concrete clearwell for storing treated water at the Owner's treatment facility, including a flow meter vault structure, groundwater drainage collection system, associated piping, appurtenances, electrical, instrumentation, mechanical, and sitework to provide a complete and functional system.

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows:

Plant Expansion Program Contract 23-3: 16 MG Clearwell

ARTICLE 3—ENGINEER

3.01 The Owner has retained **Black & Veatch Corporation** ("Engineer") 8880 Ward Parkway, Kansas City, Missouri 64114, to act as Owner's representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Contract Times: Dates*

A. The Work will be substantially complete on or before **March 1st, 2027**, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before **April 30th, 2027**.

4.04 *Milestones*

A. Parts of the Work must be substantially completed on or before the following Milestone(s):

1. Milestone 1: Fayetteville FW transmission main relocation substantial completion prior to 2/26/2026.

EJCDC® C-520, Agreement between Owner and Contractor for Construction Contract (Stipulated Price).
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4.05 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. *Substantial Completion:* Contractor shall pay Owner **$7,000** for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.

2. *Completion of Remaining Work:* After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner **$1,000** for each day that expires after such time until the Work is completed and ready for final payment.

3. *Milestones:* Contractor shall pay Owner **$7,000** for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for achievement of Milestone 1, until Milestone 1 is achieved, or until the time specified for Substantial Completion is reached, at which time the rate indicated in Paragraph 4.05.A.1 will apply, rather than the Milestone rate.

4. Liquidated damages for failing to timely attain Milestones, Substantial Completion, and final completion are not additive, and will not be imposed concurrently.

B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

ARTICLE 5—CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents a Lump Sum amount of: forty million four hundred thirty nine thousand dollars ($40,439,000.00) as stated in Contractor's Bid.sss

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about a consistent date each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted

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in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.
    a. **95%** percent of the value of the Work completed (with the balance being retainage).
        1) If 50 percent or more of the Work has been completed, as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and
    b. **95%** percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to **100%** percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less **200%** percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

6.04 *Consent of Surety*

A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

6.05 *Interest*

A. No interest will be paid on late payments.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

A. The Contract Documents consist of all of the following:
    1. This Agreement.
    2. Bonds:
        a. Performance bond (together with power of attorney).
        b. Payment bond (together with power of attorney).
    3. General Conditions.

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4. Specifications as listed in the table of contents of the project manual (copy of list attached).

5. Drawings (not attached but incorporated by reference) consisting of **82** sheets with each sheet bearing the following general title: **Plant Expansion Program Contract 23-3: 16 MG Clearwell**.

7. Exhibits to this Agreement (enumerated as follows):

   a. **Exhibit A – Davis-Bacon Wage Rate Determination**

8. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:

   a. Notice to Proceed.

   b. Work Change Directives.

   c. Change Orders.

   d. Field Orders.

B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.

2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.

4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the General Conditions, with respect to the Technical Data in such reports and drawings.

5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the General Conditions, with respect to Technical Data in such reports and drawings.

6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and

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observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the General Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.03 *Standard General Conditions*

A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published

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by the Engineers Joint Contract Documents Committee, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as "track changes" (redline/strikeout).

ARTICLE 9 – PROCUREMENT

9.01 *Purchasing Agent*

A. Except where otherwise directed by the Owner, the Contractor shall act as the "Purchasing Agent" of the Owner in effecting procurement of all pipe and valves over 24-inches in diameter and all slide gates, and the Owner shall be directly liable to the vendors for the purchase price. The Contractor shall administer all such purchases and shall advance all payments therefor unless the Owner shall otherwise direct, and such advances shall be charged to the Schedule of Value and paid to the Contractor pursuant to **Article 15** of the General Conditions. All other equipment and materials not listed above to be procured by the Purchasing Agent and behalf of the Owner are subject to 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.

B. Title to all equipment and materials as noted above that are procured by the Contractor as Purchasing Agent for the Owner shall pass directly from the Supplier or vendor to the Owner without vesting in the Contractor, and such title (except as to property to which the Owner has obtained title at an earlier date) shall vest in the Owner at the time payment is made therefor by the Owner or the Contractor, or upon delivery thereof to the Owner or the Contractor, whichever of said events shall first occur. This provision for passage of title shall not relieve the Contractor of any of its duties or obligations under this Agreement including, without limitation, the warranties provided in **Article 8** of this Agreement, nor shall this provision constitute any waiver of the right of the Owner to absolute fulfillment of all the terms of the Agreement.

C. Each contract with a Contractor and each contract or subcontract entered into by Contractor, or a subcontractor or sub-subcontractor of Contractor shall, unless otherwise directed by the Owner, provide that (i) the Contractor, subcontractor, and any sub-subcontractors shall act as the Purchasing Agent of the Owner to the extent and with the same authority granted to Contractor in **Section 9.01(A)** in regard to such action by the Contractor; and (ii) title to purchases for which the Contractor, subcontractor and sub-subcontractor are entitled to reimbursement shall pass to the Owner in the same manner as that specified in **Section 9.01(B)** in regard to purchases for the cost of which the Contractor is entitled to reimbursement.

D. Except where directed otherwise by the Owner, the Contractor, subcontractor or sub-subcontractor shall sign each purchase order as agent for the Owner, which shall be issued under the Owner's letterhead in one of the following formats:

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Beaver Water District
By its Agent, [Contractor]
By: _____
Title: _____

or

Beaver Water District
By its agent, [Contractor]
And its agent, [Subcontractor]
By: _____
Title: _____

Or

Beaver Water District
By its agent, [Contractor]
And its agent, [Subcontractor]
And its agent, [Sub-Subcontractor]
By: _____
Title: _____

E. No purchase in excess of $250,000.00 shall be made by Purchasing Agent as agent for the Owner without the prior written approval of the Owner, which shall not be unreasonably delayed or withheld by the Owner. Notwithstanding the foregoing, the Owner may, in its discretion, either reduce the limitation on the amount of any purchase which may be made without such prior approval or authorize the Contractor to make purchases in amounts not in excess of $250,000.00 for any one purchase without obtaining such prior approval.

F. No purchase order in excess of the limitations in **Section 9.01(E)** shall be entered into by the Contractor, a subcontractor or a sub-subcontractor without prior written approval of the Owner; provided that approval by the Owner of a technical submittal shall meet the approval requirements contained above.

G. The Owner shall submit the language contained in this **Article 9** to the Arkansas Department of Finance and Administration (the "Department") and request an opinion from the Department (the "Opinion") substantiating that purchases of materials and equipment for the Project as noted above made by the Contractor, subcontractors and sub-subcontractors as Purchasing Agent of Owner will be exempt from any gross receipts tax or use tax. Subject to the provisions of the Opinion and this **Article 9**, the purchase of equipment and materials for the Project will be exempt from Arkansas gross receipts and use taxes. The Contractor agrees that it will pay on behalf of the Owner any gross receipts or use taxes that may be due on equipment and materials purchased

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by Contractor, its subcontractors and its sub-subcontractors, and that it will indemnify and hold the Owner harmless from any liability for gross receipts or use tax liability and related interest and penalties that are assessed against the Owner as a result of the failure of Contractor or any subcontractor or sub-subcontractor to comply with all of the provisions of the Opinion and this **Article 9**.

H. The authority granted to the Contractor, any subcontractor or sub-subcontractor to act as Purchasing Agent is limited to the authority expressly granted herein, and no additional authority to act on behalf of the Owner shall be implied from the authority to act as Purchasing Agent.

I. To the extent that any provision of this **Article 9** conflicts with any provision of the General Conditions or any other Contract Document, the provisions of this **Article 9** shall control.

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IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on _____ (which is the Effective Date of the Contract).

Owner:	Contractor:
_____ *(typed or printed name of organization)*	_____ *(typed or printed name of organization)*
By: _____ *(individual's signature)*	By: _____ *(individual's signature)*
Date: _____ *(date signed)*	Date: _____ *(date signed)*
Name: _____ *(typed or printed)*	Name: _____ *(typed or printed)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)*
	(If entity is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)
Attest: _____ *(individual's signature)*	Attest: _____ *(individual's signature)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)*
Address for giving notices:	Address for giving notices:
_____	_____
_____	_____
_____	_____
Designated Representative:	Designated Representative:
Name: _____ *(typed or printed)*	Name: _____ *(typed or printed)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)*
Address:	Address:
_____	_____
_____	_____
_____	_____
Phone: _____	Phone: _____
Email: _____	Email: _____
(If entity is a corporation, attach evidence of authority to sign. If entity is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)	License No.: _____ *(where applicable)*
	State: _____

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"General Decision Number: AR20240049 01/05/2024

Superseded General Decision Number: AR20230049

State: Arkansas

Construction Type: Heavy
HEAVY CONSTRUCTION PROJECTS (Including Water and Sewer Lines)

County: Benton County in Arkansas.

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 $17.20 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 2024.
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 $12.90 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 2024.

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	01/05/2024

SUAR2015-046 01/09/2017

	Rates	Fringes
CARPENTER, Includes Form Work	$ 17.50	0.00
CEMENT MASON/CONCRETE FINISHER	$ 17.72	0.00
ELECTRICIAN	$ 22.88	7.19

LABORER: Common or General.....$ 13.12 **   0.63

LABORER: Pipelayer.............$ 14.14 **   0.00

OPERATOR:
Backhoe/Excavator/Trackhoe.....$ 17.07 **   1.47

OPERATOR: Bulldozer............$ 17.00 **   1.92

OPERATOR: Crane................$ 24.21   6.79

OPERATOR: Loader...............$ 15.45 **   0.00

PAINTER (Brush and Roller).....$ 18.00   0.00

TRUCK DRIVER: Dump Truck.......$ 14.02 **   2.18

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.

==========

** Workers in this classification may be entitled to a higher
minimum wage under Executive Order 14026 ($17.20) or 13658
($12.90). 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 classification
and wage rates that have been found to be prevailing for the
cited type(s) of construction in the area covered by the wage
determination. The classifications are listed in alphabetical
order of ""identifiers"" that indicate whether the particular
rate is a union rate (current union negotiated rate for local),
a survey rate (weighted average rate) or a union average rate
(weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which 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. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of 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. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write 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 the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write 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 by 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

4.) All decisions by the Administrative Review Board are final.

===

END OF GENERAL DECISION"

PERFORMANCE BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: **Beaver Water District**	Description *(name and location)*:
Mailing address *(principal place of business)*:	**Contract 23-3 16 MG Clearwell, Lowell, AR**
301 N Primrose Rd, Lowell, AR 72745	Contract Price: **$40,439,000.00**
	Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☒ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
(Full formal name of Contractor)	*(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title:	Title:
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title:	Title:

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

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1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:

    3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;

    3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

    3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

    5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

    5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

    5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

    5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

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5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

   7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

   7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

   7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.

12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such

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statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

    14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

    14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

    14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

    14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

    14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

16. Modifications to this Bond are as follows: **None**

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PAYMENT BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: **Beaver Water District**	Description *(name and location)*: **Contract 23-3 16 MG Clearwell, Lowell, Arkansas**
Mailing address *(principal place of business)*: **301 N. Primrose Rd, Lowell, AR 72745**	Contract Price: **$40,439,000.00**
	Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☒ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____	_____
(Full formal name of Contractor)	*(Full formal name of Surety) (corporate seal)*
By: _____	By: _____
(Signature)	*(Signature)(Attach Power of Attorney)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____
Attest: _____	Attest: _____
(Signature)	*(Signature)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

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1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond will arise after the following:

    5.1. Claimants who do not have a direct contract with the Contractor

        5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

        5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).

    5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

    7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

    7.2. Pay or arrange for payment of any undisputed amounts.

    7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

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8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

    16.1. *Claim*—A written statement by the Claimant including at a minimum:

        16.1.1. The name of the Claimant;

        16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;

        16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;

        16.1.4. A brief description of the labor, materials, or equipment furnished;

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16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

16.1.7. The total amount of previous payments received by the Claimant; and

16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

18. Modifications to this Bond are as follows: **None.**

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. 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, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document 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, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

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requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. ~~*Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.~~ *Constituent of Concern*- Asbestos; petroleum; radioactive materials; polychlorinated biphenyls (PCBs); hazardous waste; Contaminated Environmental Media; Metal Bearing Protective Coatings, Paints, and Liners; metals such as but not limited to arsenic, cadmium, chrome, cobalt, lead, and mercury; and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. ("CERCLA"); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5101 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. ("RCRA"); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. ~~*Contractor*—The individual or entity with which Owner has contracted for performance of the Work.~~ *Contractor*- The individual or entity with which Owner has contracted for the performance of the Work. The terms Contractor, CONTRACTOR, and Construction

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Manager are interchangeable and shall have the same meaning in the Contract Documents.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. ~~*Engineer*—The individual or entity named as such in the Agreement.~~ *Engineer*- The individual or entity named as such in the Agreement. The terms Engineer and ENGINEER are interchangeable and shall have the same meaning in the Contract Documents.

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. ~~*Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.~~

    a. ~~The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.~~

    b. ~~The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.~~

    c. ~~The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.~~

    Hazardous Environmental Condition- The presence at the Site of Constituents of Concern, including, but not limited to, Contaminated Environmental Media, asbestos, Metal Bearing Protective Coatings, Paints, and Liners, polychlorinated biphenyls (PCBs), petroleum, Hazardous Waste, radioactive material, metals such as but not limited to arsenic, cadmium, chrome, cobalt, lead, and mercury, and other Hazardous Substances; in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto or cause them to come under the application

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of a federal, state, or local regulation. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Materials Testing Agency*- An individual or agency having a contract with the Owner to furnish services associated with ongoing materials testing with respect to the Project.

28. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

29. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

30. *Notice to Proceed*—A written notice 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.

31. ~~*Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.~~ *Owner*- The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract. The terms Owner and OWNER are interchangeable and shall have the same meaning in the Contract Documents.

32. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

33. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

34. ~~*Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.~~ *Resident Project Representative*- The Resident Project Representative shall be the authorized representative of Owner, who may be assigned to the site or any part thereof. As used herein, the term Resident Project Representative or "RPR" includes any assistants or field staff of Resident Project Representative.

35. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

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36. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

37. *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.

38. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

39. *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, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

40. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

41. *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.

42. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

43. *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 of such Work.

44. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

45. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

46. *Supplier*—A manufacturer, fabricator, supplier, distributor, 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 a Subcontractor.

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47. *Technical Data*

    a. Those items expressly identified as Technical Data in the ~~Supplementary~~ General Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

48. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

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; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

51. ~~*Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.~~ *Work Change Directive*- A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner ordering an addition, deletion or revision in the Work.

52. *Float*- The amount of time between the early start date and the late start date, or the early finish date and the late finish date, of any of the activities in the Progress Schedule.

53. *Hazardous Substance*- The term Hazardous Substance shall have the meaning provided in 29 CRF 1910.120 titled "Hazardous Waste Operations and Emergency Response," as amended from time to time.

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54. *Hazardous Waste*- The term Hazardous Waste shall have the meaning provided in 40 CFR 261 titled "Identification and Listing of Hazardous Waste," as amended from time to time.

55. *Metal Bearing Protective Coatings, Paints, and Liners*- Protective coatings, paints, and liners that contain measurable amounts of metals such as but not limited to arsenic, cadmium, chrome, cobalt, lead, or mercury. The terms liners and linings are interchangeable and shall have the same meanings in the contract documents.

56. *Subconsultant*- An individual or entity having a contract with Engineer to furnish services as Engineer's independent professional associate or consultant with respect to the Project and who is identified as follows: "Olsson, Inc 302 E Millsap Road, Fayetteville, Arkansas 72703" and "Grubbs, Hoskyn, Barton & Wyatt, LLC, dba UES, 341 W County Line Road, Springdale, AR 72764".

1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: 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 Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. 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 15.03 or Paragraph 15.04).

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E. *Furnish, Install, Perform, Provide*

1. The word “furnish,” when used in connection with services, materials, or equipment, means 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, means 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, means to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. *Contract Price or Contract Times*: References to a change in “Contract Price or Contract Times” or “Contract Times or Contract Price” or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term “or both” is not expressed.

G. 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.

H. *Without Exception.*

1. The term "without exception", when used in the Contract Documents following the name of a Supplier or a proprietary item of equipment, product, or material, shall mean that the sources of the product are limited to the listed Suppliers or products and that no like, equivalent, or "or-equal" item and no substitution will be permitted.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor’s Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the ~~Supplementary~~ General Conditions expressly establish other dates for delivery of specific insurance policies.

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C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. ~~Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF).~~

~~Additional printed copies will be furnished upon request at the cost of reproduction.~~ The Contractor to whom a contract is awarded will be furnished one fully executed copy of the Agreement and one copy of the Project Manual and one set of the Drawings, together with all Addenda as an electronic portable document format (PDF). Additional copies of the Project Manual and Drawings will be furnished on request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), 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;

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.

2.04 *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 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, 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 and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

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2.05 *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 the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will 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 the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

A. ~~Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.~~ See Section 01 33 00 Submittal Procedures for electronic submittal requirements.

B. ~~*Electronic Documents Protocol:* The parties shall conform to the following provisions in Paragraphs 2.06.B and 2.06.C, together referred to as the Electronic Documents Protocol ("EDP" or "Protocol") for exchange of electronic transmittals.~~

~~1. *Basic Requirements*~~

~~a. To the fullest extent practical, the parties agree to and will transmit and accept Electronic Documents in an electronic or digital format using the procedures described in this Protocol. Use of the Electronic Documents and any information contained therein is subject to the requirements of this Protocol and other provisions of the Contract.~~

~~b. The contents of the information in any Electronic Document will be the responsibility of the transmitting party.~~

~~c. Electronic Documents as exchanged by this Protocol may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.~~

~~d. Except as otherwise explicitly stated herein, the terms of this Protocol will be incorporated into any other agreement or subcontract between a party and any third party for any portion of the Work on the Project, or any Project-related services, where that third party is, either directly or indirectly, required to exchange Electronic Documents with a party or with Engineer. Nothing herein will modify the~~

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requirements of the Contract regarding communications between and among the parties and their subcontractors and consultants.

e. When transmitting Electronic Documents, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the receiving party's use of software application packages, operating systems, or computer hardware differing from those established in this Protocol.

f. Nothing herein negates any obligation 1) in the Contract to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations; 2) to comply with any applicable Law or Regulation governing the signing and sealing of design documents or the signing and electronic transmission of any other documents; or 3) to comply with the notice requirements of Paragraph 18.01 of the General Conditions.

2. *System Infrastructure for Electronic Document Exchange*

a. Each party will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions ("System Infrastructure") at its own cost and sufficient for complying with the EDP requirements. With the exception of minimum standards set forth in this EDP, and any explicit system requirements specified by attachment to this EDP, it is the obligation of each party to determine, for itself, its own System Infrastructure.

1) The maximum size of an email attachment for exchange of Electronic Documents under this EDP is **[number]** MB. Attachments larger than that may be exchanged using large file transfer functions or physical media.

2) Each Party assumes full and complete responsibility for any and all of its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, or otherwise enabling its System Infrastructure, including operating systems and software, for use with respect to this EDP.

b. Each party is responsible for its own system operations, security, back-up, archiving, audits, printing resources, and other Information Technology ("IT") for maintaining operations of its System Infrastructure during the Project, including coordination with the party's individual(s) or entity responsible for managing its System Infrastructure and capable of addressing routine communications and other IT issues affecting the exchange of Electronic Documents.

c. Each party will operate and maintain industry-standard, industry-accepted, ISO-standard, commercial-grade security software and systems that are intended to protect the other party from: software viruses and other malicious software like worms, trojans, adware; data breaches; loss of confidentiality; and other threats in the transmission to or storage of information from the other parties, including transmission of Electronic Documents by physical media such as CD/DVD/flash drive/hard drive. To the extent that a party maintains and operates such security software and systems, it shall not be liable to the other party for any breach of system security.

d. In the case of disputes, conflicts, or modifications to the EDP required to address issues affecting System Infrastructure, the parties shall cooperatively resolve the

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issues; but, failing resolution, the Owner is authorized to make and require reasonable and necessary changes to the EDP to effectuate its original intent. If the changes cause additional cost or time to Contractor, not reasonably anticipated under the original EDP, Contractor may seek an adjustment in price or time under the appropriate process in the Contract.

e. Each party is responsible for its own back-up and archive of documents sent and received during the term of the contract under this EDP, unless this EDP establishes a Project document archive, either as part of a mandatory Project website or other communications protocol, upon which the parties may rely for document archiving during the specified term of operation of such Project document archive. Further, each party remains solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract, or after termination of the Project document archive, if one is established, for as long as required by the Contract and as each party deems necessary for its own purposes.

f. If a receiving party receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission.

g. The parties will bring any non-conforming Electronic Documents into compliance with the EDP. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.

h. The Owner will operate a Project information management system (also referred to in this EDP as "Project Website") for use of Owner, Engineer and Contractor during the Project for exchange and storage of Project related communications and information. Except as otherwise provided in this EDP or the General Conditions, use of the Project Website by the parties as described in this Paragraph will be mandatory for exchange of Project documents, communications, submittals, and other Project related information. The following conditions and standards will govern use of the Project Website:

1) Describe the period of time during which the Project Website will be operated and be available for reliance by the parties;

2) Provide any minimum system infrastructure, software licensing and security standards for access to and use of the Project Website;

3) Describe the types and extent of services to be provided at the Project Website (such as large file transfer, email, communication and document archives, etc.); and

4) Include any other Project Website attributes that may be pertinent to Contractor's use of the facility and pricing of such use.

C. *Software Requirements for Electronic Document Exchange; Limitations*

1. Each party will acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received

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from the other party (and if relevant from third parties), using the software formats required in this section of the EDP.

a. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or adjust its transmission to comply with this EDP.

2. The parties agree not to intentionally edit, reverse engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a software data format, including Portable Document Format (PDF), intended by sender not to be modified, unless the receiving party obtains the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.

3. Software and data formats for exchange of Electronic Documents will conform to the requirements set forth in Exhibit A to this EDP, including software versions, if listed.

D. *Requests by Contractor for Electronic Documents in Other Formats*

1. Release of any Electronic Document versions of the Project documents in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be at the sole discretion of the Owner.

2. To extent determined by Owner, in its sole discretion, to be prudent and necessary, release of Electronic Documents versions of Project documents and other Project information requested by Contractor ("Request") in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be subject to the provisions of the Owner's response to the Request, and to the following conditions to which Contractor agrees:

a. The content included in the Electronic Documents created by Engineer and covered by the Request was prepared by Engineer as an internal working document for Engineer's purposes solely, and is being provided to Contractor on an "AS IS" basis without any warranties of any kind, including, but not limited to any implied warranties of fitness for any purpose. As such, Contractor is advised and acknowledges that the content may not be suitable for Contractor's application, or may require substantial modification and independent verification by Contractor. The content may include limited resolution of models, not-to-scale schematic representations and symbols, use of notes to convey design concepts in lieu of accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other devices that may affect subsequent reuse.

b. Electronic Documents containing text, graphics, metadata, or other types of data that are provided by Engineer to Contractor under the request are only for convenience of Contractor. Any conclusion or information obtained or derived from such data will be at the Contractor's sole risk and the Contractor waives any claims against Engineer or Owner arising from use of data in Electronic Documents covered by the Request.

c. Contractor shall indemnify and hold harmless Owner and Engineer and their subconsultants from all claims, damages, losses, and expenses, including attorneys'

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~~fees and defense costs arising out of or resulting from Contractor's use, adaptation, or distribution of any Electronic Documents provided under the Request.~~

~~d. Contractor agrees not to sell, copy, transfer, forward, give away or otherwise distribute this information (in source or modified file format) to any third party without the direct written authorization of Engineer, unless such distribution is specifically identified in the Request and is limited to Contractor's subcontractors. Contractor warrants that subsequent use by Contractor's subcontractors complies with all terms of the Contract Documents and Owner's response to Request.~~

~~3. In the event that Owner elects to provide or directs the Engineer to provide to Contractor any Contractor-requested Electronic Document versions of Project information that is not explicitly identified in the Contract Documents as being available to Contractor, the Owner shall be reimbursed by Contractor on an hourly basis (at $**[number]** per hour) for any engineering costs necessary to create or otherwise prepare the data in a manner deemed appropriate by Engineer.~~

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one Contract Document 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.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

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2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract 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, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer 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 part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or 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) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) 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 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

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.

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B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

   a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); 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 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers 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 versions, or 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; or~~ have or acquire any title 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 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

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Engineer or its consultants and specific written verification or adaptation by entity responsible for those documents.

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract 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 Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

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

4.03 *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.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 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 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any

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disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, 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 Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions as defined by the technical specifications;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.

~~5.~~

D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

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E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;

2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor in writing 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.

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 permanent improvements are to be made 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.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other

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materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, 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 any such claim, and against all 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 directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will 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 and adjacent areas 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 of 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 structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

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

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

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4. The following report of explorations and tests of subsurface conditions at or adjacent to the Site are known to Owner:

    a. Results of Geotechnical Investigation Proposed Clearwell – Phase II Report dated September 5, 2024.

    The report shall be considered Technical Data upon which Contractor may rely.

5. The following drawings of physical conditions relating to existing surface or subsurface structures at the Site are known to Owner:

    a. Western Corridor Treated Water Pipeline project Conformed to Bid plans dated December 2022.

    b. Phase I Expansion to the Joe M. Steele Water Treatment Plant Record Drawings dated September 1990.

    c. Contract Sections I & II Water Transmission Line: Beaver Water Treatment Plant to Fayetteville dated January 1992.

6. d. Beaver 36" Transmission Line and Distribution Mains project dated February 1969.Contractor may examine copies of reports identified herein that were not included with the Contract Documents at Owner's facility during regular business hours and upon 48 hours' notice to Owner.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the ~~Supplementary~~ General Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on 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;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

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5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;

2. is of such a nature as to require a change in the Drawings or Specifications;

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 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in

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Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

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 Paragraph 13.03; and,

c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a 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 otherwise;

b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the ~~Supplementary~~ General Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

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3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then 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 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

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or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. 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 Paragraph 13.03;

b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

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

~~1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;~~

~~2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and~~

~~3. Technical Data contained in such reports and drawings.~~

B. ~~*Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of~~

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~~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;~~

~~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.~~ Not used.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) 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 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. 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, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a

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Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. 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, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. 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, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. 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 failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the ~~Supplementary~~ General Conditions, or other provisions of the Contract.

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1. *Required Performance Bond Form:* The performance bond that Contractor furnishes will be in the form of EJCDC® C-610, Performance Bond (2018 edition).

2. *Required Payment Bond Form:* The payment bond that Contractor furnishes will be in the form of EJCDC® C-615, Payment Bond (2018 edition).

B. Contractor shall also furnish such other bonds (if any) as are required by the General Supplementary Conditions or other provisions of the Contract.

1. The correction period specified as one year after the date of Substantial Completion in Paragraph 15.08.A of the General Conditions is hereby revised to be **2** years after Substantial Completion.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond 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 must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the ~~Supplementary~~ General Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the ~~Supplementary~~

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General Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

1. Contractor may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the Project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the ~~Supplementary~~ General Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

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H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the ~~Supplementary~~ General Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, 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.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the ~~Supplementary~~ General Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

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2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is 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; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner (Beaver Water District) and Engineer (Black & Veatch), and any individuals or entities identified as additional insureds in the ~~Supplementary~~ General Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

E. *Workers' Compensation and Employer's Liability:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions). The workers' compensation and employer's liability insurance policy shall include an "all states" or "other states" endorsement.

Workers' Compensation and Related Policies	**Policy limits of not less than:**
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
~~**Jones Act (if applicable)**~~	

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Workers' Compensation and Related Policies	Policy limits of not less than:
~~Bodily injury by accident—each accident~~	~~$~~
~~Bodily injury by disease—aggregate~~	~~$~~
Employer's Liability	
Each accident	$1,000,000
Each employee	$1,000,000
Policy limit	$1,000,000
~~**Stop-gap Liability Coverage**~~	
~~For work performed in monopolistic states, stop-gap liability coverage must be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of:~~	~~$~~

F. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
2. damages insured by reasonably available personal injury liability coverage, and
3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.
    a. Such insurance must be maintained for three years after final payment.
    b. Contractor shall furnish Owner and each other additional insured (as identified in the ~~Supplementary~~ General Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
4. Underground, explosion, and collapse coverage.
5. Personal injury coverage.
6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.

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7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

8. A per project aggregate endorsement.

H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).

2. Any exclusion for water intrusion or water damage.

3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.

4. Any exclusion of coverage relating to earth subsidence or movement.

5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).

6. Any limitation or exclusion based on the nature of Contractor's work.

7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	**Policy limits of not less than:**
General Aggregate	$2,000,000
Products—Completed Operations Aggregate	$1,000,000
Personal and Advertising Injury	$1,000,000
Bodily Injury and Property Damage—Each Occurrence	$2,000,000

J. *Automobile Liability:* Contractor shall purchase and maintain automobile liability insurance 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. The automobile liability policy must be written on an occurrence basis.

Automobile Liability	**Policy limits of not less than:**
Bodily Injury	
Each Person	$1,500,000
Each Accident	$3,000,000
Property Damage	
Each Accident	$600,000
[or]	
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	$2,000,000

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K. *Umbrella or Excess Liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	$5,000,000
General Aggregate	$5,000,000

L. *Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements:* Contractor may meet the policy limits specified for employer's liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy's policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy was required under this Contract, at a specified minimum policy limit, such umbrella or excess policy must retain a minimum limit of $**1,000,000** after accounting for partial attribution of its limits to underlying policies, as allowed above.

M. *Contractor's Pollution Liability Insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance must be maintained for no less than three years after final completion.

Contractor's Pollution Liability	Policy limits of not less than:
Each Occurrence/Claim	$1,000,000
General Aggregate	$1,000,000

N. *Contractor's Professional Liability Insurance:* If Contractor will provide or furnish professional services under this *Contract*, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance must cover negligent acts, errors, or omissions in the performance of professional design or related services by the insured or others for whom the insured is legally liable. The insurance must be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. The retroactive date on the policy must pre-date the commencement of furnishing services on the Project.

Contractor's Professional Liability	Policy limits of not less than:
Each Claim	$3,000,000
Annual Aggregate	$3,000,000

P. *Unmanned Aerial Vehicle Liability Insurance:* If Contractor uses unmanned aerial vehicles (UAV—commonly *referred* to as drones) at the Site or in support of any aspect of the Work, Contractor shall obtain UAV liability insurance in the amounts stated; name Owner, Engineer,

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and all individuals and entities identified in the herein as additional insureds; and provide a certificate to Owner confirming Contractor's compliance with this requirement. Such insurance will provide coverage for property damage, bodily injury or death, and invasion of privacy.

Unmanned Aerial Vehicle Liability Insurance	Policy limits of not less than:
Each Claim	$1,000,000
General Aggregate	$1,000,000

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the ~~Supplementary~~ General Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the ~~Supplementary~~ General Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth ~~in the Supplementary Conditions~~ herein.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

F. Builder's Risk Requirements: The builder's risk insurance must:

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1. be written on a builder's risk "all risk" policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).

    a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.

    b. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake, volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance will be provided through other insurance policies acceptable to Owner and Contractor.

2. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).

4. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier). This is replacement cost and not the contract price.

5. extend to cover damage or loss to insured property while in transit. This is replacement cost and not the contract price.

6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.

7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.

8. include performance/hot testing and start-up, if applicable.

9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of Owner's procurement of property insurance following Substantial Completion, whichever occurs first.

10 include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder's risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and

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this and all other corresponding ~~Supplementary~~ General Conditions, the parties required to be insured will be referred to collectively as "insureds." In addition to Owner, Contractor, and Subcontractors of every tier, include as insureds the following:

a. **Black & Veatch**

11. include, in addition to the Contract Price amount, the value of the following equipment and materials to be installed by the Contractor but furnished by the Owner or third parties:

a. **Not applicable.**

G. *Coverage for Completion Delays:* The builder's risk policy will include, for the benefit of Owner, loss of revenue and soft cost coverage for losses arising from delays in completion that result from covered physical losses or damage. Such coverage will include, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, compensation for loss of net revenues, rental costs, and attorneys' fees and engineering or other consultants' fees, if not otherwise covered.

I. Waiver of Subrogation. With respect to workers' compensation and employers' liability, comprehensive automobile liability, commercial general liability, and umbrella liability insurance, and all other liability insurance specified herein to be provided by Contractor, Contractor shall require its insurance carriers to waive all rights of subrogation against Owner, Engineer, and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the ~~Supplementary~~ General Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the 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, risks, 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 Engineer, its consultants, all individuals or entities identified in the ~~Supplementary~~ General Conditions as builder's risk or installation floater insureds, 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. The perils or causes of loss insured against shall also include damage caused by frost and freezing.

2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of

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the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. 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 all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights 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 insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the ~~Supplementary~~ General Conditions as insureds, the Engineer and its consultants, 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 fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

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ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *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.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *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 maintain good discipline and order at the Site.

B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. 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 will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

1. Regular working hours will be **7 am to 5pm.**

7.04 *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

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performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will 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 must 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.

D. Until final completion of the Work is acknowledged by Owner, Contractor shall have responsible charge and care of the Work and of all equipment and materials to be used therein, including equipment and materials which have been furnished by Owner and shall bear the risk of injury, loss, or damage to any part thereof by action of the elements or from any other cause.

E. Contractor shall rebuild, repair, restore, and make good all injuries, losses, or damage to any portion of the Work or the equipment or materials occasioned by any cause before completion and acceptance of the Work and shall bear the expense therefore. Contractor shall, at no additional cost to Owner, provide suitable drainage and suitable structures as necessary to protect the Work or any portion thereof from damage.

F. Suspension of the Work or the granting of an extension of time for any cause whatever shall not relieve Contractor of its responsibilities for the Work as specified herein.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item 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 is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that the proposed item:

1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

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2) 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;

3) has a proven record of performance and availability of responsive service; and

4) is not objectionable to Owner.

b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an accepted Shop Drawing or other written communication.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

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2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

    a. will certify that the proposed substitute item will:

        1) perform adequately the functions and achieve the results called for by the general design;

        2) be similar in substance to the item specified; and

        3) be suited to the same use as the item specified.

    b. will state:

        1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

        2) 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

        3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

    c. will identify:

        1) all variations of the proposed substitute item from the item specified; and

        2) available engineering, sales, maintenance, repair, and replacement services.

    d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the

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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.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

1. Particular consideration will be given to the qualifications of each Subcontractor proposed on the List of Subcontractors. The use of Subcontractors proposed by Bidder and accepted by Owner prior to the Notice of Award will be required in the performance of the Work unless otherwise permitted or directed by Owner.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in

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Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *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 an 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 will be disclosed 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,

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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.

D. Contractor shall furnish to Owner at the time of initial submittal, satisfactory evidence that Suppliers of proprietary materials, equipment, devices, or processes to be furnished or used in the performance of the Work do indemnify, keep, and save harmless Contractor from all liabilities, judgments, costs, damages, and expenses which may arise from the use of such proprietary materials, equipment, devices, or processes, furnished to Contractor for incorporation in or use in performance of the Work and their operation by Owner after acceptance of the Work. Such satisfactory evidence shall consist of patent licenses or patent releases covering proprietary materials, equipment, devices, or processes.

7.09 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. 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 the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

B. Owner will obtain and pay for the following permits:

1. NPDES Permit for Storm Water Discharge associated with Construction Activity. See Appendix B for Draft Permit. Final permit will be provided when available.

2. Benton County Site Plan Review Permit

3. Benton County Road Crossing Permit

4. Arkansas Department of Health Drinking Water Plan Review

5. USACE 404 Permit

7.10 *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.~~

B. Refer to Article 9 of the Agreement for tax requirements.

7.11 *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. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

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B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and 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 such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

The provisions of this Paragraph 7.11.C shall not apply to any changes to prevailing wage rates. Changes to wage rates during the life of the Contract shall be the responsibility of Contractor, and shall not be eligible for Claims for changes to the Contract Price.

D. Safety and Health Regulations. OSHA "Safety and Health Regulations for Construction", Chapter XVII of Title 29, CFR Part 1926, shall apply to Work under this Contract. The U.S. Department of Labor will be responsible for compliance review and enforcement of the regulations.

E. Employment Requirements. Employment requirements shall be as specified herein and in the attachments at the end of the General Conditions.

F. Work in Confined Spaces. Owner has established a confined-space entry program for its own use, and will be responsible for enforcement of the program for Owner's personnel only.

Contractor is hereby notified that manholes and other structures included under the confined-space definition of 29 CFR 1910.146, shall be considered as hazardous locations with hazardous atmospheric conditions. The structures may contain methane, hydrogen sulfide, carbon dioxide, and other gases which are dangerous to life or health. Contractor shall allow its personnel or Subcontractors to enter these confined spaces only through compliance with an entry permit program as specified herein.

Contractor shall establish and maintain a confined-space entry program appropriate to the structures and conditions encountered. The program shall meet the requirements of 29 CFR 1910.146 and shall specifically address the provisions of Paragraph (d) therein. Contractor shall enforce the requirements of Paragraphs € and (f), shall establish and conduct a training program in accordance with Paragraph (g), and shall comply with all other applicable requirements of the referenced regulation.

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Contractor shall prepare a complete written program covering the requirements of this paragraph and the referenced regulation. The written program shall be submitted through Engineer for review and approval by Owner, and shall be modified and resubmitted if required. No Work shall be done by Contractor or any of Contractor's personnel or Subcontractors in any confined spaces until Contractor's program has been approved by Owner and Owner is satisfied that the program provisions are in place.

G. Contractor shall cooperate with Owner for coordination of activities whenever Contractor's personnel and Owner's personnel will both be working in or near the confined spaces at the same time.

H. NSF Requirements. The following materials which will be in contact with treated water, shall have been tested and certified to meet the requirements of NSF 372, ANSI/NSF 60, ANSI/NSF 61, or NSF 600. The materials shall be guaranteed by the manufacturer or by a site mix evaluation to have the required certification and to be suitable for the intended service. Evidence of the certification shall be submitted to Engineer with the appropriate drawings and data. Any materials which cannot be so guaranteed, whether or not specified by manufacturer and product designation, shall not be used.

- Pipes and related products (including coated and uncoated pipes, fittings, small storage devices, tubing, and screens)
- Protective (barrier) materials (including paints, coatings, linings, and diaphragms)
- Joining and sealing materials (including gaskets, sealing materials, and lubricants)
- Mechanical devices (including pumps, valves, and other water treatment process devices)
- Mechanical plumbing products

7.12 *Record Documents*

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

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7.13 *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.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. 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, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.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 at its expense (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).

E. 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.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the ~~Supplementary~~ General Conditions or Specifications.

H. 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.

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I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as 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.

7.15 *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 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 by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. Shop Drawing and Sample Requirements. Requirements for shop drawings, samples, and submittal procedures shall be as specified in Submittals Procedures section. Fabrication that proceeds prior to acceptance of submittals by Engineer shall be at Contractor's risk.

1. ~~Before submitting a Shop Drawing or Sample, Contractor shall:~~

~~a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;~~

~~b. determine and verify:~~

~~1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;~~

~~2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and~~

~~3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;~~

~~c. confirm that the Submittal is complete with respect to all related data included in the Submittal.~~

~~2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with~~

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respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must 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 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall 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 7.16.C.

3. 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. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. 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, comply with the requirements of 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, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and

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Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

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.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

   a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

   b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

   c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

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~~d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.~~

~~2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.~~

~~F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.~~

7.17 *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 is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, 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.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

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~~ acceptance of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

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9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, 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 losses, damages, costs, and judgments (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 from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage 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 7.18.A will 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.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

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D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. ~~Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:~~

~~1. Checking for conformance with the requirements of this Paragraph 7.19;~~

~~2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and~~

~~3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.~~

Pursuant to this Paragraph 7.19, Engineer's review and acceptance 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 acceptance of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Submittals Procedures section.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

H. When professional design services are required by the Contract Documents, Contractor shall provide certification that the associated construction conforms to the design provided by the design professional.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is

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performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. 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.

E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, 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.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the ~~Supplementary~~ General Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

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

C. Owner intends to contract with others for the performance of other work at or adjacent to the Site.

1. **Owner** shall have authority and responsibility for coordination of the various contractors and work forces at the Site;

2. The following specific matters are to be covered by such authority and responsibility: **Western Corridor Pipeline, Intake Expansion (Contract 23-1), Raw Water Pipeline (Contract 23-2), and Starr Water Treatment Plant (Contract 23-4)**;

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8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

    1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

    2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) 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 any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or

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arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. ~~Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.~~ Except as otherwise provided in these General Conditions, if Owner issues communications to Contractor, a copy shall be provided to Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

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

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *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

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be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *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 (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

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.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

9.13 *Owners Site Representative*. Owner will furnish an "Owner's Site Representative" to represent Owner at the Site and assist Owner in observing the progress and quality of the Work. Owner's Site Representative is not Engineer's consultant, agent, or employee. Owner's Site Representative will be designated after award.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *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.

The action of Engineer in performance of these duties shall not be construed to make Engineer the Agent for the Owner with respect to changes in the cost of the work or changes in the Contract Documents.

10.02 *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 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise,

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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.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer ~~will~~ may furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided ~~in the Supplementary Conditions~~ herein, and limitations on the responsibilities thereof will be as provided ~~in the Supplementary Conditions~~ herein and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the ~~Supplementary~~ General Conditions.

C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:

1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.

3. *Liaison*

   a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

   b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

   c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.

4. *Review of Work; Defective Work*

   a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.

   b. Observe whether any Work in place appears to be defective.

   c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.

5. *Inspections and Tests*

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a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.

b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.

6. *Payment Requests:* Review Applications for Payment with Contractor.

7. *Completion*

a. Participate in Engineer's visits regarding Substantial Completion.

b. Assist in the preparation of a punch list of items to be completed or corrected.

c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.

d. Observe whether items on the final punch list have been completed or corrected.

D. The RPR will not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.

5 Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Authorize Owner to occupy the Project in whole or in part.

10.04 *Engineer's Authority*

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

E. Engineer's authority as to Applications for Payment is set forth in Article 15.

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10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

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

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work insofar as the subject matter of any pertinent claim, dispute, or other matter falls within the realm of the technical expertise of Engineer. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith. Engineer shall not render any decision on any matters the subject matter of which, at the Engineer's sole discretion, requires legal, rather than technical, interpretation.

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, 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, will 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 Contractor under Paragraph 15.06.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 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

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ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in 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;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

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B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes 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. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-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. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *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, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

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1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);
2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or
3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will 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 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;
      b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 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 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;
      d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
      e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and
      f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

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11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

C. A Change Proposal for an adjustment of the Contract Times (or Milestones), otherwise allowable under the Contract Documents, shall be granted only to the extent the time lost exceeds the Float for the delayed activity at the time of the event giving rise to the claim. Float, whether expressly disclosed or implied in any manner, is jointly owned by the project participants.

D. Contractor shall not use Float suppression techniques (including, but not limited to, preferential sequencing caused by late starts of follow-up trades, unreasonably small crews, extended durations, or imposed dates) in information provided to Engineer.

11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its

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discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *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.

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

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4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

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ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will 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 in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will 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 accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will 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, which 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 will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

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4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of 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, 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.

        1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

    c. *Construction Equipment Rental*

        1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

        2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the ~~Supplementary~~ General Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs. The equipment rental rate book that governs the included costs for the rental of machinery and equipment owned by Contractor (or a related entity) under the Cost of the Work provisions of this Contract is the most current edition of **RSMeans.**

            a. For purposes of this paragraph, "small tools and hand tools" means any tool or equipment whose current price if it were purchased new at retail would be less than $500.

        3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

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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 builder's risk or other property insurance established in accordance with Paragraph 6.04), 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 include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will 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 communication 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 that Contractor is required by the Contract Documents to purchase and maintain.

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

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, project managers, engineers, architects, surveyors, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, information technology, 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 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. 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.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

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D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 *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*: Contractor agrees that:

1. 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

2. 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 for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's 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 for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

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13.03 *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. Payments to Contractor for Unit Price Work will be based on actual quantities.

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. 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, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction 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 with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

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.

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D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. 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. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

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losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages 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. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then 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, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages 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 pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. 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, 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, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *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, then Owner may order Contractor to stop the Work,

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or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will 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.

14.07 *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 defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, 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, 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 incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. 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 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *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.

2. 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 must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

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establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

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

5. Materials and Equipment. Payments for stored materials and equipment shall be based only upon the actual cost to Contractor of the materials and equipment and shall not include any overhead or profit to Contractor. Payments for stored materials shall be as indicated in Section 01 29 76.

   Partial payments will not be made for undelivered materials or equipment.

6. Schedules and Data. During the progress of the Work, each application for Payment shall be accompanied by Contractor's updated Progress Schedule, schedule of operations, or progress report, with such shop drawings schedules, procurement schedules, values of materials and equipment on hand included in application, and other data specified or reasonably required by Engineer.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, 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 13.03, and any other qualifications stated in the recommendation); and

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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; 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;

   b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

   c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

   d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; 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 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

   a. the Work is defective, requiring correction or replacement;

   b. the Contract Price has been reduced by Change Orders;

   c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

   d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

   e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

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D. *Payment Becomes Due*

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

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

    a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

    b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

    c. Contractor has failed to provide and maintain required bonds or insurance;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

    e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

    f. The Work is defective, requiring correction or replacement;

    g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

    h. The Contract Price has been reduced by Change Orders;

    i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

    j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

    k. 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; or

    l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, 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, if

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Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

F. For contracts in which the Contract Price is based on the Cost of Work, if Owner determines that progress payments made to date substantially exceed the actual progress of the Work (as measured by reference to the Schedule of Values), or present a potential conflict with the Guaranteed Maximum Price, then Owner may require that Contractor prepare and submit a plan for the remaining anticipated Applications for Payment that will bring payments and progress into closer alignment and take into account the Guaranteed Maximum Price (if any), through reductions in billings, increases in retainage, or other equitable measures. Owner will review the plan, discuss any necessary modifications, and implement the plan as modified for all remaining Applications for Payment.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *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 and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

1. "Substantial Completion" means that the facilities are completed to the point that water can be treated continuously through the clearwell, without interuption, in addition to the items specified herein. All equipment shall be installed, tested, and commissioned for operation. All performance and operational testing shall have been completed prior to the date of Substantial Completion. Final Operations & Maintenance manuals shall have been provided to the Owner and all training must be complete.

2. To be considered Substantially Complete, the following portions of the Work must be operational and ready for Owner's continuous use as intended:

16 MG Clearwell, Flow Meter Vault, and Fayetteville Transmission Main, including but not limited to:

Structures.

Process and mechanical equipment.

Mechanical work including all piping, valves, and appurtenances.

Electrical and instrumentation work.

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Network and communications to existing Water Treatment Plant.

Completion of all startup requirements including operational and functional testing as specific in Section 01 91 00.

Clearwell.

Flow Meter Vault.

Tightness testing, leakage testing, pressure testing, cleaning, and disinfection work for all structures and pipes specified shall be complete.

3. Portions of the Work not essential to plant operation, which can be completed without interruption of plant operation, may be completed after the Work is accepted as substantially complete, and may include the following items:

Permanant seeding

Removal of erosion control

Touch-up painting

As-built documents

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 preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

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E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. 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 punch list.

15.04 *Partial Use or Occupancy*

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. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be 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 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work 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 15.03 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 6.04 regarding builder's risk or other property insurance.

15.05 *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, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

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15.06 *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, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. ~~consent of the surety, if any, to final payment;~~ consent of the surety, signed by an agent and accompanied by a certified copy of such agent's authority to act for the surety;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

   d. a list of all duly pending Change Proposals and Claims; and

   e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) 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, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: 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 have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. 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.

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C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim, appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within ~~one~~ two years after the date of Substantial Completion (or such longer period of time as may be prescribed by ~~the Supplementary Conditions or~~ the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;

2. correct such defective Work;

3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an

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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. Contractor shall pay all 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). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. 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.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, 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.

F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *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 written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and 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);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

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B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, 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 complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.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 the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds 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.

F. 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, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 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

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connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 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 16.03.

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, 7 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 are not intended to preclude Contractor from submitting a Change Proposal 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 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. ~~elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;~~ request mediation of any Claim submitted to Engineer for a decision under Paragraph 12.01 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. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of

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filling of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above. If the Claim is not resolved by mediation, Engineer's actions regarding denial shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner and Contractor either agrees with the other party to submit the Claim to another dispute resolution process, or gives written notice to the other party of their intent to submit the Claim to a court of competent jurisdiction.

~~2. agree with the other party to submit the dispute to another dispute resolution process; or~~

~~3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.~~

17.03 *Attorneys' Fees*

A. For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys' fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other arbiter of the matter subject to final resolution, taking into account the parties' initial demand or defense positions in comparison with the final result.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;
2. by registered or certified mail, postage prepaid, to the recipient's place of business; or
3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract 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.

18.03 *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. The provisions of this paragraph will be as effective as if

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repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

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

E. Contractor shall obtain from all Suppliers and manufacturers any and all warranties and guarantees of such Suppliers and manufacturers, whether or not specifically required by the Specifications, and shall assign such warranties and guarantees to Owner. With respect thereto, Contractor shall render reasonable assistance to Owner when requested, in order to enable Owner to enforce such warranties and guarantees. The assignment of any warranties or guarantees shall not affect the correction period or any other provisions of these Contract Documents.

18.07 *Controlling Law*

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

18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is 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.

18.09 *Successors and Assigns*

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

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

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Section 01 11 13 - WORK COVERED BY CONTRACT DOCUMENTS

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION OF WORK

A. The Work to be performed under these Contract Documents is generally described as follows:

1. Construction of a new segment of Fayetteville transmission main, 16-million gallon, in-ground, cast-in-place concrete clearwell for storing treated water at the Owner’s treatment facility, including a flow meter vault structure, groundwater drainage collection system, associated piping, appurtenances, electrical, instrumentation, mechanical, and sitework to provide a complete and functional system.

1.2 OTHER CONSTRUCTION CONTRACTS

A. Work at the site performed by others under separate contracts includes the following:

1. Intake Expansion (Contract 23-1)

2. Raw Water Pipeline (Contract 23-2)

3. Starr Water Treatment Plant (Contract 23-4)

4. Western Corridor Pipeline

1.3 COORDINATION

A. Contractor shall plan, schedule, and coordinate its operations in a manner which will facilitate the simultaneous progress of the work included under other contracts outside the scope of these Contract Documents, including coordination with the Owner.

1.4 WORK BY PUBLIC UTILITIES

A. The Contractor shall coordinate all details and scheduling for relocation of utilities with the respective utility owners. The cost for relocation of utilities, the establishment of electrical service, and the establishment of temporary electrical service shall be included in the Contract Price.

B. The establishment of temporary electrical service required to perform the work shall be the responsibility of the Contractor. The Contractor shall determine the power

requirements based on the equipment used. The Contractor shall coordinate with the Owner, Engineer, and utility provider (Carroll Electric Cooperative Corporation) to establish required temporary electrical service.

1.5 WORK BY OWNER

A. Owner shall perform certain activities in connection with the Project with its own personnel as follows:

1. Integration of new signals to the existing Distributed Control System (DCS).

1.6 RESPONSIBILITY FOR MATERIALS AND EQUIPMENT

A. Items Furnished by Contractor

1. Contractor shall be fully responsible for all materials and equipment which it has furnished.

1.7 OFFSITE STORAGE

A. Offsite storage arrangements shall be approved by Owner for all materials and equipment not incorporated into the Work but included in Applications for Payment. Such offsite storage arrangements shall be presented in writing and shall afford adequate and satisfactory security and protection. Offsite storage facilities shall be bonded and insured for the value of the equipment or materials with Owner named as an additional insured. Offsite storage facilities shall be accessible to Owner and Engineer.

1.8 SUBSTITUTES AND "OR-EQUAL" ITEMS

A. Provisions for evaluation of proposed "or-equal" items of materials or equipment are covered in Paragraph 7.05 of the General Conditions. Provisions for evaluation of proposed substitute items of materials or equipment are covered in Paragraph 7.05 of the General Conditions. Requests for review of equivalency will not be accepted by Engineer from anyone except Contractor, and such requests will not be considered until after the Effective Date of the Agreement.

1.9 PREPARATION FOR SHIPMENT

A. All materials shall be suitably packaged to facilitate handling and protect against damage during transit and storage. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

B. Each item, package, or bundle of material shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

1.10 SALVAGE OF MATERIALS AND EQUIPMENT

A. Existing materials and equipment removed and not reused as a part of the Work shall become Contractor's property.

B. Existing materials and equipment removed by Contractor shall not be reused in the Work.

1.11 LAND FOR CONSTRUCTION PURPOSES

A. Contractor will be permitted to use available land belonging to Owner, on or near the Site, for construction purposes and for storage of materials and equipment.

B. The locations and extent of the areas so used shall be as indicated on the Drawings.

C. Contractor shall immediately move stored materials or equipment if any occasion arises, as determined by Owner, requiring access to the storage area. Materials or equipment shall not be placed on the property of Owner until Owner has agreed to the location to be used for storage.

1.12 EASEMENTS AND RIGHTS-OF-WAY

A. The easements and rights-of-way for the pipelines are shown on the Drawings. Contractor shall confine its construction operations within the limits indicated on the Drawings. Contractor shall use due care in placing construction tools, equipment, excavated materials, and pipeline materials and supplies in order to avoid damage to property and interference with traffic.

B. On Private Property

1. Easements across private property are indicated on the Drawings.

2. Contractor shall set stakes to mark the boundaries of construction easements across private property.

3. The stakes shall be protected and maintained until completion of construction and cleanup.

C. Contractor shall not enter any private property outside the designated construction easement boundaries without written permission from the owner of the property.

D. Where the line crosses fields which are leveled for irrigation or terraced, Contractor shall relevel irrigated fields and replace all terraces to their original or better condition, and to the satisfaction of the owner.

E. Work Within Highway Rights-of-Way

1. Permits shall be obtained by Owner.

2. All Work performed and all operations of Contractor, its employees, or Subcontractors within the limits of highway rights-of-way shall be in conformity with the requirements and be under the control through Owner of the highway authority owning, or having jurisdiction over and control of, the right-of-way in each case.

1.13 OPERATION OF EXISTING FACILITIES

A. The existing treatment plant facilities must be kept in continuous operation throughout the construction period. No interruption will be permitted which adversely affects the degree of service provided. Provided permission is obtained from Owner in advance, portions of the existing facilities may be taken out of service for short periods corresponding with the low demand season.

B. Contractor shall provide temporary facilities and make temporary modifications as necessary to keep the existing facilities in operation during the construction period.

1.14 NOTICES TO OWNERS AND AUTHORITIES

A. Contractor shall, as provided in the General Conditions, notify owners of adjacent property and utilities when execution of the Work may affect them.

B. When it is necessary to temporarily deny access to property, or when any utility service connection must be interrupted, Contractor shall give notices sufficiently in advance to enable the affected persons to provide for their needs. Notices shall conform to any applicable local ordinance and, whether delivered orally or in writing, shall include appropriate information concerning the interruption and instructions on how to limit inconvenience caused thereby.

C. Utilities and other concerned agencies shall be notified at least 24 hours prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines.

1.15 LINES AND GRADES

A. All Work shall be done to the lines, grades, and elevations indicated on the Drawings.

B. Basic horizontal and vertical control points will be established or designated by Engineer to be used as datums for the Work. All additional survey, layout, and measurement work shall be performed by Contractor as a part of the Work.

C. Contractor shall provide an experienced instrument person, competent assistants, and such instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement work. In addition, Contractor shall furnish, without charge, competent persons and such tools, stakes, and other materials as Engineer may require in establishing or designating control points, in establishing construction easement boundaries, or in checking survey, layout, and measurement work performed by Contractor.

D. Contractor shall keep Engineer informed, a reasonable time in advance, of the times and places at which it wishes to do Work, so that horizontal and vertical control points may be established and any checking deemed necessary by Engineer may be done with minimum inconvenience to Engineer and minimum delay to Contractor.

E. Contractor shall remove and reconstruct work which is improperly located.

1.16 CONNECTIONS TO EXISTING FACILITIES

A. Unless otherwise specified or indicated, Contractor shall make all necessary connections to existing facilities, including structures, drain lines, and utilities such as water, sewer, gas, telephone, and electric. In each case, Contractor shall receive permission from Owner or the owning utility prior to undertaking connections. Contractor shall protect facilities against deleterious substances and damage.

B. Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

C. Tie-ins to existing facilities shall only be performed during the “low demand season” between November 1 and March 1 unless specified otherwise. A tie-in plan for each tie-in shall be submitted 90 days prior to the tie-in. Tie-in work shall proceed a minimum of 21 days after the tie-in plan is accepted. Tie-in plans shall include listing of materials and equipment required to complete the tie-in, inventory of materials and equipment onsite available for the tie-in, estimated manpower required, an organization chart detailing all parties involved and their representatives that have authority, detailed schedule for the tie-in work on an hour-by-hour basis, and contingency plans.

D. Contractor shall perform tie-ins in the following order: Shutdown Period 1, Shutdown Period 3, and Shutdown Period 2. The shutdowns shall include all requirements as detailed on the Drawings and as specified herein.

1. Shutdown Period 1: Fayetteville Transmission Tie-In to 42” Fayetteville Transmission Main (Downstream Tie-In)

    a. Outage period limited to a single consecutive 24-hr period between November 30 and January 30. Work shall proceed around the clock until the tie-in is complete.

    b. Prior to shutdown, contractor shall complete the following:

        1) Construct new 48-inch Steel or DIP finished water pipeline from 45-FW-VBF-0001 to 45-FW-VBF-0002.

        2) Ensure all required materials to perform the connection shall be on-site, the existing pipe fully excavated, and crews ready to begin shutdown work activities.

        3) Field locate nearest usable 42-inch PCCP joints and identify piping lay direction.

        4) Disinfect and assemble fittings and valves to greatest extent feasible in order to minimize shutdown duration. This includes 42-inch cross, 42- and 36-inch butterfly valves (45-FW-VBF-0002, 45-FW-VBF-0003, 45-FW-VBF-0004, and 45-FW-VBF-0005), reducer, spool pieces, and mechanical joint restraint.

    c. Coordinate with BWD to isolate all necessary valves to perform the Work. BWD to close existing valve north of downstream tie-in (WSV-10300 per Fayetteville GIS), and Fayetteville to close downstream transmission valve (WSV-9 per Fayetteville GIS). Existing 42-inch PCCP to WSV-10300 and 36-inch DIP transmission main to remain in service throughout duration of shutdown.
    d. Contractor to drain existing transmission line between closed valves.
    e. Contractor shall demolish existing pipe section and perform tie-in of downstream 42-inch tie-in as detailed on the Drawings.
    f. PCCP bell and spigot adaptor pieces shall be welded to nearest usable PCCP joints on either side of connection. Contractor shall install piping, sleeves or HMCs, fittings listed above, and thrust collars on 36-inch and 42-inch Fayetteville lines. Thrust collars do not need to be fully cured when 42-inch PCCP transmission main is reinstated. However, it must be fully cured to 28-day compressive strength prior to Shutdown 3 for the 36-inch DIP tie-in.
    g. After installation is complete, close valves 45-FW-VBF-0003 and 45-FW-VBF-0005 and open valves 45-FW-VBF-0002 and 45-FW-VBF-0004. To reinstate 42-inch main, BWD and Fayetteville to reopen valves indicated in notes above.
    h. Tie-in must be in operation for 24 hours with no issues before Contractor can initiate next shutdown. Immediately following 24 hour wait period begin preparation for Shutdown Period No. 3.

2. Shutdown Period 2: Fayetteville Transmission Tie-In to 42” BWD Transmission Main to Fayetteville (Upstream Tie-In)

   a. Outage period is limited to a single consecutive 2-hour period between November 30 and January 30. Work prior to shutdown and after shutdown to install line stop is not included in the 2-hour duration. All tie-in work shall be completed within 12 hours of the line stop installation.

   b. Prior to shutdown, contractor shall complete the following:

      1) Ensure all required materials to perform the connection shall be on-site, the existing pipe fully excavated, and crews ready to begin shutdown work activities.

      2) Expose existing 42-inch 45 degree bends, disinfect, and assemble new fittings and pipe to greatest extent feasible in order to minimize shutdown duration. New 48-inch FW main shall be tested and disinfected up to 42-inch butterfly valve 45-FW-VBF-0001. Thrust blocks on the 48-inch line must be cured to 28-day compressive strength prior to pressure testing.

      3) Expose and clean exterior of existing 42-inch DIP where insertable stop and temporary bypass tapping sleeve will be installed.

      4) Disinfect and install temporary bypass tapping sleeves and temporary bypass line.

   c. Coordinate with BWD to isolate all necessary valves to perform the Work. BWD to shut off Fayetteville finished water pumps and close valve north of downstream tie-in (WSV-10229 per Fayetteville GIS).

   d. Contractor to install insertable stop. Coordinate with BWD to reinstate Fayetteville finished water pumps once insertable line stop is installed and bypass line is operational.

   e. After shutdown to install insertable line stop, contractor shall complete the following:

      1) Drain existing 42-inch transmission line between closed valves.

      2) Cut existing DIP pipe, demolish 45 degree bend and piping to next downstream 45 degree bend, and perform tie-in of upstream 42-inch BWD transmission main to Fayetteville as detailed on the Drawings. Install 42-inch pipe and solid sleeve.

      3) Complete 42-inch tie-in and remove insertable line stop.

      4) Remove temporary bypass line.

3. Shutdown Period 3: Fayetteville Transmission Tie-In to 36” Fayetteville Transmission Main

    a. Tie-in is limited to a single consecutive 24-hr period between November 30 and January 30. Work shall proceed around the clock until the tie-in is complete.
    b. Prior to shutdown, contractor shall complete the following:

        1) Ensure all required materials to perform the connection shall be on-site, the existing pipe fully excavated, and crews ready to begin shutdown work activities.

        2) Ensure all required materials to perform the connection shall be on-site, the existing pipe fully excavated, and crews ready to begin shutdown work activities.

        3) Ensure the thrust block on the existing 36-inch DIP is cured to full compressive strength.

    c. Disinfect and assemble fittings and valves to greatest extent feasible in order to minimize shutdown duration. This includes 36-inch tee, spool pieces, solid sleeves, and mechanical joint restraint.
    d. Coordinate with BWD to isolate all necessary valves to perform the Work. BWD to close existing valve north of tie-in (WSV-10296 per Fayetteville GIS). BWD to coordinate with Fayetteville regarding upstream shutoff location.
    e. Contractor to drain existing transmission line between closed valves.
    f. Contractor shall cut existing DIP pipe, demolish piping, and perform tie-in of downstream 36-inch tie-in as detailed on the Drawings. Install 36-inch tee, spool pieces, solid sleeves, and mechanical joint restraint. Connect piping to closed 36” butterfly valve 45-TW-VBF-0005. Cut and cap existing 36” DIP north of tie-in to abandon in place.

4. TW Tie-In to Clearwell

    a. Existing Clearwell shall remain in service for the duration of the project and will not shut down.

1.17 UNFAVORABLE CONSTRUCTION CONDITIONS

A. During unfavorable weather, wet ground, or other unsuitable construction conditions, Contractor shall confine its operations to work which will not be affected adversely by such conditions. No portion of the Work shall be constructed under conditions which would affect adversely the quality or efficiency thereof, unless special means or precautions are taken by Contractor to perform the Work in a proper and satisfactory manner.

1.18 CUTTING AND PATCHING

A. As provided in General Conditions, Contractor shall perform all cutting and patching required for the Work and as may be necessary in connection with uncovering Work for inspection or for the correction of defective Work.

B. Contractor shall perform all cutting and patching required for and in connection with the Work, including but not limited to the following:

1. Removal of improperly timed Work.

2. Removal of samples of installed materials for testing.

3. Alteration of existing facilities.

4. Installation of new Work in existing facilities.

C. Contractor shall provide all shoring, bracing, supports, and protective devices necessary to safeguard all Work and existing facilities during cutting and patching operations. Contractor shall not undertake any cutting or demolition which may affect the structural stability of the Work or existing facilities without Engineer's concurrence.

D. Materials shall be cut and removed to the extent indicated on the Drawings or as required to complete the Work. Materials shall be removed in a careful manner, with no damage to adjacent facilities or materials. Materials which are not salvable shall be removed from the site by Contractor.

E. All Work and existing facilities affected by cutting operations shall be restored with new materials, or with salvaged materials acceptable to Engineer, to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, entire surfaces shall be patched and refinished.

1.19 HAZARDOUS ENVIRONMENTAL CONDITIONS AT SITE

A. No Hazardous Environmental Conditions at the Site in areas that will be affected by the Work are known to the Owner.

1.20 CLEANING UP

A. Contractor shall keep the premises free at all times from accumulations of waste materials and rubbish. Contractor shall provide adequate trash receptacles about the Site and shall promptly empty the containers when filled.

B. Construction materials, such as concrete forms and scaffolding, shall be neatly stacked by Contractor when not in use. Contractor shall promptly remove splattered concrete,

asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.

C. Volatile wastes shall be properly stored in covered metal containers and removed daily.

D. Wastes shall not be buried or burned on the Site or disposed of into storm drains, sanitary sewers, streams, or waterways. All wastes shall be removed from the Site and disposed of in a manner complying with local ordinances and antipollution laws.

E. Adequate cleanup will be a condition for recommendation of progress payment applications.

1.21 APPLICABLE CODES

A. References in the Contract Documents to local codes mean the following:

1. 2021 International Building Code
2. 2020 National Electric Code
3. 2021 Arkansas Mechanical Code
4. 2018 Arkansas Plumbing Code
5. Occupational Safety and Health Act (OSHA) Standards Manual
6. Ten States Recommendations for Drinking Water

B. Other standard codes which apply to the Work are designated in the Specifications.

1.22 PRECONSTRUCTION CONFERENCE

A. Prior to the commencement of Work at the Site, a preconstruction conference will be held at a mutually agreed time and place. The conference shall be attended by:

1. Contractor and its superintendent.
2. Contractor’s waste management coordinator.
3. Principal Subcontractors.
4. Representatives of principal Suppliers and manufacturers as appropriate.
5. Engineer and its Resident Project Representative.
6. Representatives of Owner.

7. Others as requested by Contractor, Owner, or Engineer.

B. Unless previously submitted to Engineer, Contractor shall bring to the conference a preliminary schedule for each of the following:

1. Progress Schedule.

2. Procurement schedule.

3. Schedule of Values for progress payment purposes.

4. Schedule of Shop Drawings and other submittals.

C. The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda will include:

1. Contractor's preliminary schedules.

2. Transmittal, review, and distribution of Contractor's submittals.

3. Processing Applications for Payment.

4. Maintaining record documents.

5. Critical Work sequencing.

6. Field decisions and Change Orders.

7. Use of premises, office and storage areas, security, housekeeping, and Owner's needs.

8. Major equipment deliveries and priorities.

9. Contractor's assignments for safety and first aid.

D. Engineer will preside at the conference and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

1.23 PROGRESS MEETINGS

A. Engineer shall schedule and hold regular progress meetings at least monthly and at other times as required by progress of the Work. Contractor, Engineer, and all Subcontractors active on the Site shall be represented at each meeting. Contractor may at its discretion request attendance by representatives of its Suppliers, manufacturers, and other Subcontractors.

B. Engineer shall preside at the meetings. Contractor will be expected to participate in the meetings and cover topics as directed by Engineer or as required for the project. Meeting minutes shall be prepared and distributed by Engineer. The purpose of the meetings will be to review the progress of the Work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop.

1.24 SITE ADMINISTRATION

A. Contractor shall be responsible for all areas of the Site used by it and by all Subcontractors in the performance of the Work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to Owner or others.

B. Contractor shall have the right to exclude from the Site all persons who have no purpose related to the Work or its inspection, and may require all persons on the Site (except Owner's employees) to observe the same regulations as Contractor requires of its employees.

C. Smoking and Controlled Substance Restrictions

1. Use of tobacco products, alcoholic beverages, marijuana, and other controlled substances is not permitted at the Site.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

Section 01 29 76 - PROGRESS PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers methods of measurement and payment for items of Work under this Contract.

1.2 GENERAL

A. The Contract Price shall cover all Work required by the Contract Documents. All costs in connection with the proper and successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction plant, equipment, and tools; and performing all necessary labor and supervision to fully complete the Work, shall be included in the unit and lump sum prices bid. All Work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of Contractor and all costs in connection therewith shall be included in the prices bid.

1.3 ESTIMATED QUANTITIES

A. All estimated quantities stipulated in the Bid or other Contract Documents are approximate and are to be used only (a) as a basis for estimating the probable cost of the Work and (b) for the purpose of comparing the Bids submitted for the Work. The actual amounts of work done and materials furnished under unit price items may differ from the estimated quantities. The basis of payment for work and materials will be the actual amount of work done and materials furnished. Contractor agrees that it will make no claim for damages, anticipated profits, or otherwise on account of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts therefor.

1.4 EXCAVATION AND TRENCHING

A. Except where otherwise specified, the unit or lump sum price bid for each item of Work which involves excavation or trenching shall include all costs for such Work. No separate payment shall be made for excavation or trenching. All trenching shall be unclassified as to materials which may be encountered, and trenches shall be unclassified as to depth. All excavation work required for structures shall be unclassified as to materials which may be encountered; such excavation work shall be considered to be a subsidiary obligation of Contractor and the cost of such excavation shall be included in the prices bid for the structures.

PART 1 - PRODUCTS (NOT USED)

PART 2 - EXECUTION (NOT USED)

End of Section

Section 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SCHEDULE OF VALUES

A. After review of the preliminary schedule at the preconstruction conference, and before submission of the first Application for Payment, Contractor shall prepare and submit to Engineer a Schedule of Values covering each lump sum item. The Schedule of Values, showing the value of each kind of work, shall be acceptable to Engineer before any Application for Payment is prepared.

B. The sum of the items listed in the Schedule of Values shall equal the Contract Price. Such items as Bond premium, temporary construction facilities, and plant may be listed separately in the Schedule of Values, provided the amounts can be substantiated. Overhead and profit shall not be listed as separate items.

C. The Schedule of Values shall have sufficient detail such that partial completion of separable items of work can easily be calculated. The Schedule of Values shall have separate lines for manufacturer's field services, O&M manuals, and performance testing for each item of equipment requiring such services. The value for O&M manuals shall be no less than 10% of the installed equipment cost and will be withheld until receipt and acceptance of the Final O&M manual.

D. An unbalanced Schedule of Values providing for overpayment of Contractor on items of Work which would be performed first will not be accepted. The Schedule of Values shall be revised and resubmitted until acceptable to Engineer. Final acceptance by Engineer shall indicate only consent to the Schedule of Values as a basis for preparation of applications for progress payments, and shall not constitute an agreement as to the value of each indicated item.

1.2 SCHEDULE OF PAYMENTS

A. Within 30 days after award of contract, Contractor shall furnish to Engineer a schedule of estimated monthly payments. The schedule shall be revised and resubmitted each time an Application for Payment varies more than 10 percent from the estimated payment schedule.

1.3 SURVEY DATA

A. All field books, notes, and other data developed by Contractor in performing surveys required as part of the Work shall be available to Engineer for examination throughout

the construction period. All such data shall be submitted to Engineer with the other documentation required for final acceptance of the Work.

B. GPS Information. In addition to the record drawings, the Contractor shall provide GPS information for all buried infrastructure including, but not limited to, pipe, culverts, conduit, and ductbanks.

The GPS information shall be obtained before backfilling the trench to obtain ties for the installed location of the pipeline center line at approximately 500 feet (5+/- feet) intervals along the pipeline. Other GPS points shall be taken at the following locations:

a. At beginning and ending of curves
b. All VPIs and HPIs
c. All bends, tees, valves, connections
d. Plugged ends of lines, and other fittings and specials or other facilities
e. Both ends of all tunnel crossings and encasements
f. All corrosion protection materials, including anodes, test lead stations, and insulating flanges, if any.

If trench needs to be backfilled before GPS points are taken, install a temporary PVC pipe or tube or similar marker at the GPS points to obtain the GPS information. All temporary markers shall be removed and any holes shall be filled.

The GPS information shall include, but not be restricted to the x, y, and z coordinates of each item. GPS information shall also include as applicable, pipe size, type of fitting, type of valve, encasement size and material, number of turns to open/close each valve, and length of valve extension stem.

The GPS information shall meet the following requirements:

a. Horizontal Accuracy: <0.75 inch
b. Vertical Accuracy: <1.50 inches
c. Coordinate System and Vertical Datum: As indicated on Drawings.
d. File Collection System: Export to individual shapefile for ESRI Geodatabases feature classes.
e. Items must be captured in individual shapefile based upon the individual feature classes.

The Contractor shall generate field generated unique identification numbers for all Items. The field generated number shall be indicated on the record drawings.

The type of fitting can be described as, but not limited to:

VERTICAL BEND, TEE, REDUCER, PLUG, OFFSET, END OF MAIN, CROSS, 22-1/2 BEND, 90 BEND, 45 BEND, 11-1/4 BEND.

The type of valve can be described as, but not limited to:

TSV (tapping sleeve and valve), PRV (pressure reducing valve), LV (line valve), VRV (vacuum relief valve), BOV (blow off valve), BOA (blow off assembly), SVC (service valve), etc.

The rod placement for obtaining GPS data shall be on the top center of the pipe for the pipeline, the top center of the fitting for the fittings, top of the operating nut and top center of valve for valves, top center of manhole covers and access pits, top of the vault for test lead stations, top center of the pipe for the pipeline at both ends of the encasement pipe, and at other locations as required and acceptable to the Owner.

C. Submittals. The engineering and field ties, GPS information, including the electronic Geodatabases shapefile, and other record data shall be made and annotated on the record drawings and on a paper form of the GPS electronic Geodatabases shapefile acceptable to Owner as the Work progresses. Contractor shall bring his marked-up record drawings and GPS electronic Geodatabases shapefile form to each progress meeting for review. Contractor shall identify all new markups that have been made since the preceding progress meeting to assist Owner's review of the current markups. Satisfactory, complete, and current record drawings and GPS electronic Geodatabases shapefile form will be a condition for recommendation of progress payment applications and for final payment.

1.4 LAYOUT DATA

A. Contractor shall keep neat and legible notes of measurements and calculations made in connection with the layout of the Work. Copies of such data shall be furnished to the Resident Project Representative for use in checking Contractor's layout as provided in the project requirements section. All such data considered of value to Owner will be transmitted to Owner by Engineer with other records upon completion of the Work.

End of Section

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Section 01 32 16 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 GENERAL OVERVIEW

A. A Progress Schedule shall be used to control the Work and to provide a definitive basis for determining project progress. The Progress Schedule shall be prepared, maintained and updated by Contractor and historical dates agreed monthly with Engineer. Contractor shall submit a preliminary Progress Schedule and a Progress Schedule for acceptance by Engineer. These schedules shall be Contractor's working schedules and shall be used to plan, organize and execute the Work, record and report actual performance and progress, and show how Contractor plans to complete all remaining Work as of the end of each progress report period.

B. The Progress Schedule shall comprise all the detailed construction-related activities using the critical path method (CPM). The Progress Schedule shall provide sufficient detail and clarity to reflect the intricacies and interdependencies of activities so Contractor can plan, schedule, monitor, control and report on the progress of his work. In addition, it shall provide Engineer and Owner a tool to monitor and follow the progress for all phases of the Work.

1.2 PRE-CONSTRUCTION SCHEDULING CONFERENCE

A. Engineer will conduct a pre-construction scheduling conference with Contractor to review requirements for the schedules including Schedule of Values and schedule configuration. The conference shall be conducted sufficiently early to allow Contractor to submit the preliminary Progress Schedule within ten days of the Effective Date of the Contract.

B. At this meeting, Contractor shall explain in detail the procedure to be used to develop the schedule activity cost-loading or Schedule of Values and cash flow. This procedure is subject to the review and acceptance of Engineer.

1.3 PRELIMINARY PROGRESS SCHEDULE

A. Following the pre-construction scheduling conference but within ten calendar days after the Effective Date of the Contract, Contractor shall submit a preliminary Progress Schedule for review by Engineer. The preliminary Progress Schedule shall show detailed construction-related activities for the first 60 days of the project. The remainder of the Contract activities shall be shown as summary bars within the milestones of the Work. If Engineer has comments on the preliminary Progress Schedule, Contractor shall make the necessary changes and resubmit it within ten

calendar days. No progress payments will be made during the period specified above for the preliminary Progress Schedule until the preliminary Progress Schedule has been accepted by Engineer.

B. The preliminary Progress Schedule shall:

1. Illustrate a feasible schedule for completion of the Work within the Contract Times and Milestones specified.

2. Provide an elementary example of the schedule in the format to be used for the Progress Schedule.

C. Preliminary Progress Schedule Submittal Format:

1. Contractor shall submit an electronic copy of the preliminary Progress Schedule.

2. A brief narrative shall accompany the submittal, describing Contractor's scheduling approach to the project. The narrative shall include a description of the Contract milestones, approach for construction activities during the period of the preliminary Progress Schedule, description of the general approach of the activities for the work beyond the preliminary Progress Schedule period, a description of the project's critical path, identification of critical long-lead submittals, and planned outages.

3. The narrative shall also incorporate activity codes, calendars, weather days, milestone constraints, and work breakdown structure in accordance with the requirements specified herein.

1.4 PROGRESS SCHEDULE

A. The Progress Schedule comprises all the construction-related activities for the Work and shall show the order in which Contractor proposes to carry out the work. Contractor shall include milestones, coordination necessitated by limited access and available work areas, and the availability and use of manpower, material and equipment. Contractor shall use the Progress Schedule to plan, schedule and coordinate the Work including activities of subcontractors, equipment vendors, and suppliers.

B. The Progress Schedule shall be to the level of detail acceptable to Engineer, and shall include the following:

1. Organization and structural breakdown of the Project;

2. Milestones and completion dates;

3. Type of work to be performed and the labor trades involved;

4. Purchase, manufacture and delivery activities for major materials and equipment;

5. Preparation, submittal, and acceptance of shop drawings and material samples;

6. Deliveries of owner-furnished equipment and/or materials;

7. Acceptances required by regulatory agencies and/or other third parties;

8. Assignment of responsibility for each activity;

9. Access requirements to work areas;

10. Identification of interfaces and dependencies with preceding, concurrent and follow-on contractors;

11. Tests, submittal of test reports and acceptance of test results;

12. Planning for phased or total acceptance by Owner; including start up and commissioning;

13. Identification of any manpower, material and equipment restrictions.

14. Sequence of construction to maintain plant operations;

15. Planned outages.

C. The activities included in the Progress Schedule shall be defined in work days. Durations shall be based on the labor (crafts), equipment, and materials required to perform each activity on a normal workday basis. Activity durations shall be 20 working days or less except in the case of non-construction activities such as procurement of materials, delivery of equipment, and concrete curing. All durations shall be the result of definitive manpower and resource planning by Contractor to perform the Work, in consideration of contractually defined on-site work conditions and Contractor's planned means and methods.

D. When the Progress Schedule is accepted by Engineer, Engineer will save a copy of the Progress Schedule as the baseline schedule, and will use it for analysis of Contractor's progress.

E. Contractor shall update the Progress Schedule monthly.

1.5 COORDINATING PROGRESS SCHEDULE WITH OTHER CONTRACT SCHEDULES

A. Where work is to be performed under this Contract concurrently with or contingent upon work performed on the same facilities or area under other contracts, the Progress Schedule shall be coordinated with the schedules of the other contracts. Owner will provide the schedules of other contracts for preparation and updating of the Progress

Schedule. Contractor shall revise the Progress Schedule as required by changes in schedules of other contracts.

B. In case of interference between the operations of different contractors, Owner will determine the work priority of each contractor and the sequence of work necessary to expedite the completion of the entire project. In all such cases, the decision of Owner shall be accepted as final.

1.6 SUBMITTALS

A. Progress Schedule Submittals

1. The Progress Schedule and associated reports shall be submitted to Engineer for acceptance within the period of the preliminary Progress Schedule specified herein. If the Progress Schedule is not submitted, no progress payments will be made after the due date until the Progress Schedule has been submitted.

2. Printouts and electronic layouts required as part of the Progress Schedule submittal and monthly updates are as follows:

   a. Critical Path Schedule: sorted based on the total Float, early-start, early-finish;
   b. 60-Day Look Ahead Schedule: sorted by total Float, early-start, early-finish;
   c. Activities in Progress: organized by WBS or area of work; sorted by total Float, early-start, early-finish;

1.7 MONTHLY SCHEDULE UPDATES

A. Monthly Progress Schedule updates shall be submitted for the duration of the Contract on a date agreed to by Owner, Engineer, and Contractor. If monthly Progress Schedule updates are not submitted by the due date, progress payments will be withheld until the required information is submitted.

B. The updated schedule shall be reviewed each month in a meeting with Engineer to verify:

1. Actual start dates,

2. Actual completion dates,

3. Activity percent completion,

4. Revised logic (as-built and projected) and changes in activity durations, cost assigned,

5. Cost influence of change orders, if any,

6. Revisions due to extension of time.

C. Prior to each meeting, Contractor shall prepare a complete and accurate report of current procurement and construction progress through the end of the update period, and a depiction of how Contractor plans to continue the Work to meet all contract completion dates. All network changes and status data agreed to during each update meeting shall be considered as accepted by both parties unless written notice of any exceptions is given within five calendar days after the meeting.

D. For major network changes that cannot be agreed to during an updating meeting, Contractor shall submit the proposed changes for Engineer's acceptance prior to inserting such changes into the network. Submittals may be in the form of marked-up networks, fragnets, or schedule abstracts, provided they are submitted with a letter of transmittal. A fragnet is defined as a sequence of new activities and/or activity revisions that are proposed to be added to the existing schedule to demonstrate how project events have an impact on the schedule.

1.8 REVIEW PROCESS

A. Engineer will review Contractor's preliminary Progress Schedule and full Progress Schedule submittals within 15 calendar days after receipt of all required information.

B. If any of the required submittals are returned to Contractor for corrections or revisions, they shall be resubmitted within ten calendar days after the return mailing date. Resubmittals shall include all information and media included in the first submittal. Review and response by Engineer will be given within 10 calendar days after receipt of each resubmittal.

C. Schedules shall show contract completion of the Work on the Contract completion date and with zero or positive total Float even if Contractor plans to finish early. In no event shall acceptance of the Progress Schedule be a basis for a claim for delay against Owner or Engineer by Contractor for an early finish. A Progress Schedule containing activities with negative Float or that extend beyond the date that the Work is completed and ready for final payment will not be acceptable.

D. Acceptance of the Progress Schedule by Engineer does not relieve Contractor of responsibility for accomplishing the Work by the Contract completion date. Omissions and errors in the accepted Progress Schedule shall not relieve Contractor of obligations under the Contract. Acceptance by Engineer in no way makes Engineer or Owner an ensurer of the Progress Schedule's success or liable for time or cost overruns. Engineer and Owner hereby disclaim any obligation or liability by reason of acceptance of the Progress Schedule by Engineer.

1.9 RESPONSIBILITY FOR SCHEDULE COMPLIANCE

A. Whenever it becomes apparent from the current Progress Schedule that the critical path is delayed and the contract completion date will not be met, Contractor shall mitigate the delay by taking some or all of the following actions at no additional cost to Owner.

1. Increase construction manpower in such quantities and crafts as will bring the project back on schedule within the completion dates and milestones.

2. Increase the number of working hours per shift, shifts per day, working days per week, and the amount of construction equipment, or any combination of the foregoing, to substantially eliminate the backlog of work.

3. Re-schedule activities to achieve maximum practical concurrence of activities and to comply with the schedule date(s).

B. Within ten calendar days of Engineer's request, Contractor shall submit a recovery schedule and written statement of the steps intended to remove or arrest the delay to the critical path in the schedule. If Contractor fails to submit the required information or should fail to take measures acceptable to Engineer, Engineer with Owner concurrence may direct Contractor to increase man-power, equipment and scheduled work hours to remove or arrest the delay to the critical path and Contractor shall promptly provide such level of effort at no additional cost to Owner.

C. In the event Contractor fails to follow the updated or revised recovery schedule, Owner may elect to withhold progress payments until Contractor complies with the revised schedule.

D. Should Contractor's efforts not remove or arrest the delay to the critical path of the accepted schedule, then Owner shall be entitled to supplement Contractor's work-force and equipment to remove and arrest any delay, and shall be entitled to deduct all costs and expenses associated therewith from payments due to Contractor. If insufficient Contract funds remain, Owner may recover such funds from Contractor and its Surety.

1.10 CHANGES IN THE WORK, DELAYS, AND EXTENSIONS OF TIME

A. When changes in the Work or delays are experienced by Contractor and Contractor requests an extension of time, Contractor shall submit a written time impact analysis to Engineer illustrating the influence of each change or delay to the current Contract Times. Each time impact analysis shall include a fragnet incorporating the change or delay into the Progress Schedule to demonstrate how Contractor was delayed.

B. Each time impact analysis shall demonstrate the estimated time impact based on the events of the change or the delay; the date the change was given to Contractor or the delay incurred, the status of construction at that point in time, and the event time computation of all activities affected by the change or delay. The event times used in the

analysis shall be those included in the latest update of the Progress Schedule or as adjusted for the events of delay.

C. Three copies of the time impact analysis and an electronic copy on compact disk shall be submitted within seven calendar days of delay occurrence or direction to proceed with a change is given to Contractor. No time extensions will be considered if the time impact analysis is not submitted within the specified time.

D. Engineer will review Contractor's time impact analysis. Contractor shall furnish such justification and supporting evidence as Engineer deems necessary to determine whether Contractor is entitled to an extension of time. Engineer's review of each time impact analysis will be made within five working days of receipt of the time impact analysis and additional information as required by Engineer, unless subsequent meetings and negotiations are necessary.

E. The Contract Times will be adjusted only for causes specified in paragraph 15. Time extensions will be granted only to the extent that equitable time adjustments for the activity or activities affected exceed the total or remaining Float along the critical path at the time of actual delay. Delays in activities which are not on the critical path and do not affect Contract Times, will not be considered for an extension of time.

1.11 CAUSES FOR EXTENSIONS OF TIME

A. Additional positive total Float in the Progress Schedule generated by efficiencies of Owner or Contractor is a shared commodity to be reasonably used by either party, and belongs exclusively to the Project. Contractor is not entitled to any additional compensation for completion of the project prior to expiration of the Contract Times.

B. Owner-Initiated Changes. Owner initiated changes to the Work that absorb Float time will not be considered for an extension of time. Owner-initiated changes that affect the critical path of the Progress Schedule shall be grounds for extending or shortening completion dates. Use of Float time for Contractor initiated changes will require Owner's concurrence. Contractor's changes, however, shall give way to Owner-initiated changes competing for the same Float time.

C. Outside Contractor's Control. Events outside of Contractor's control that affect the critical path of the Progress Schedule will be considered for an extension or reduction of the Contract Times.

D. Weather Delays. Engineer will obtain weather data during construction from a reputable source, and will maintain weather records.

1. Engineer will determine Contractor's entitlement to an extension of the Contract Times as a result of weather delays.. For any claim, Contractor shall provide justification that the weather delay impacted critical path activities. An extension of Contract Time of no more than one day will be granted for one day of lost work, regardless of the number of allowable reasons for lost time. Any weather related

extension of Contract Times shall be non-compensable. Efficiencies gained as a result of favorable weather within a calendar month, where the number of days of normally anticipated weather days is less than expected, shall contribute to the project Float and shall not affect the Contact Times. Application for a weather related extension of time shall be submitted to Engineer, and shall state the extension requested and be supported by the relevant weather data. Entitlement for weather delays will be based on the following criteria:

a. For rain events, an extension of Contract Time will be given for the number of calendar days in a given month in which the daily precipitation exceeds 0.10 inches, less the monthly average as indicated in Table 1.
b. For mud events, an extension of Contract Time of one calendar day will be given for the day following each 1 inch precipitation event.
c. For snow events, an extension of Contract Time will be given for the number of days in which the daily snowfall exceeds 3 inches.
d. For temperature events, an extension of Contract Time will be given for the number of calendar days in which the daily high temperature exceeds 105°F, or is below 10°F.

Table 1

Average Number of Calendar Days

with Precipitation of 0.10 Inches

or More in a Single 24-hour Period

10 year average **2014-2024**

NOAA National Centers for Environmental Information,

Annual Climatological Summaries

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4	5	7	6	8	7	6	5	5	3	5	5

1.12 MANDATORY MILESTONES

A. The Contract duration shall be equal to the time period between the Notice to Proceed and the completion of the Work in readiness for final payment. The following milestones are mandatory.

1. Notice to Proceed

2. Milestones, if any, as indicated in Contractor's Bid

3. Substantial Completion as indicated in Contractor's Bid

4. Completion and readiness for final payment, as indicated in Contractor's Bid

B. The following additional milestones are to be considered and incorporated into the Progress Schedule in accordance with the Contract, if applicable.

1. Permit constraints

2. Facility shut down or outage milestone requirements

3. Applicable phasing milestones

4. Other milestones deemed appropriate by Engineer

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

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Section 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 CONSTRUCTION PHOTOGRAPHS BY CONTRACTOR

A. Contractor shall be responsible for the production of construction photographs as provided herein. Engineer shall designate the subject of each photograph.

B. For plant projects, at least fifty (50) photographs of the entire site, or pertinent features thereof, shall be taken before the commencement of Work and promptly submitted to Engineer. The same views shall be rephotographed upon completion of all construction activities and submitted with Contractor's application for final payment. At least twelve (12) aerial photographs and fifteen (15) additional photographs shall be made each month throughout the progress of the Work at such times as requested by Engineer, and submitted with Contractor's application for progress payment.

C. For the Fayettevile transmission pipeline work, drone video footage shall be taken along the route of the pipeline before the commencement of Work, and promptly submitted to Engineer. The same route shall be captured with drone video footage upon completion of construction activities on the pipeline, and submitted with Contractor's Application for Payment for Work on that section.

D. All photographs and videos shall be color digital, produced by a competent professional photographer or drone videographer. Contractor shall submit the photographs and videos electronically. Digital images shall be compiled on a USB drive and provided with a descriptive index of the images or videos.

E. Engineer will transmit the digital files to Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

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Section 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SHOP DRAWINGS AND ENGINEERING DATA

A. General

1. The Project has been designed by Engineer and Engineer will perform design-intent reviews of submittals. Owner, Engineer, Engineer, and Contractor may develop a protocol for the transmittal of shop drawings, samples, and other submittals.

2. Shop Drawings and engineering data (submittals) covering all equipment and all fabricated components and building materials which will become a permanent part of the Work under this Contract shall be submitted to Engineer for review, as required. Submittals shall verify compliance with the Contract Documents, and shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, and the operation of component materials and devices; the external connections, anchorages, and supports required; the performance characteristics; and dimensions needed for installation and correlation with other materials and equipment.

3. Each submittal shall cover items from only one section of the specification unless the item consists of components from several sources. Contractor shall submit a complete initial submittal including all components. When an item consists of components from several sources, Contractor's initial submittal shall be complete including all components.

4. All submittals, regardless of origin, shall be approved by Contractor and clearly identified with the name and number of this Contract, Contractor's name, and references to applicable specification paragraphs and Contract Drawings. Each copy of all submittals, regardless of origin, shall be stamped or affixed with an approval statement of Contractor. Each submittal shall indicate the intended use of the item in the Work. When catalog pages are submitted, applicable items shall be clearly identified and inapplicable data crossed out. The current revision, issue number, and date shall be indicated on all drawings and other descriptive data.

5. Contractor shall be solely responsible for the completeness of each submittal. Contractor's stamp or affixed approval statement of a submittal, per Figure 1-01 33 00, is a representation to Owner and Engineer that Contractor accepts sole responsibility for determining and verifying all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto, and that

Contractor has reviewed and coordinated each submittal with other Shop Drawings and with the requirements of the Work and the Contract Documents.

6. All deviations from the requirements of the Contract Documents shall be identified as deviations on each submittal and shall be tabulated in Contractor's letter of transmittal using Figure 2-01 33 00. Such submittals shall, as pertinent to the deviation, indicate essential details of all changes proposed by Contractor (including modifications to other facilities that may be a result of the deviation) and all required piping and wiring diagrams.

7. For electronic submittals, drawings and the necessary data shall be submitted electronically to Engineer as specified below. Submittal documents shall be in color to facilitate use of red line markups.

   a. All electronic files shall be in Portable Document Format (PDF) as generated by Adobe Acrobat Professional Version 7.0 or higher.
   b. The PDF file(s) shall be fully indexed using the Table of Contents, searchable with thumbnails generated. PDF images must be at a readable resolution.
   c. For most documents, they should be scanned or generated at 300 dots per inch (dpi). Use of higher resolution is acceptable with Owner and Engineer approval.
   d. Optical Character Recognition (OCR) capture must be performed on these images so that text can be searched, selected and copied from the generated PDF file.
   e. The PDF documents shall have a bookmark created in the navigation frame for each major entry (“Section” or “Chapter”) in the Table of Contents.
   f. Thumbnails shall be generated for each page or graphic in the PDF file.
   g. The opening view for each PDF document shall be as follows:

      1) Initial View: Bookmarks and Page

      2) Magnification: Fit In Window

      3) The file shall open to Contractor’s transmittal letter, with bookmarks to the left. The first bookmark shall be linked to the Table of Contents.

   h. PDF document properties shall include the submittal number for the document title and Contractor’s name for the author.
   i. Electronic submittal file sizes shall be limited to 10 MB. When multiple files are required for a submittal the least number of files possible shall be created.

8. Contractor shall post submittals and retrieve Engineer's submittal review comments through the Project website accessible through the Internet.

Instruction on procedures for posting and retrieving submittals will be provided after award of the Contract.

9. Facsimiles (fax) will not be acceptable. Submittals will not be accepted from anyone but Contractor. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.

B. Engineer's Review of Submittals

1. Engineer's review of submittals covers only general conformity to the Drawings and Specifications, external connections, and dimensions that affect the layout; it does not indicate thorough review of all dimensions, quantities, and details of the material, equipment, device, or item covered. Engineer's review shall not relieve Contractor of sole responsibility for errors, omissions, or deviations in the drawings and data, nor of Contractor's sole responsibility for compliance with the Contract Documents.

2. Engineer's submittal review period shall be 14 consecutive calendar days and shall commence on the first calendar day following receipt of the submittal or resubmittal in Engineer's office.

3. When the drawings and data are returned with review status "NOT ACCEPTABLE" or "RETURNED FOR CORRECTION", the corrections shall be made as instructed by Engineer.

   a. If submittals are made electronically, the corrected drawings and data shall be resubmitted through the Project website.
   b. Resubmittals by facsimile or e-mail will not be accepted. When the drawings and data are returned with review status "EXCEPTIONS NOTED", "NO EXCEPTIONS NOTED", or "RECORD COPY", no additional copies need be furnished unless specifically requested by Engineer.

C. Resubmittal of Shop Drawings and Data

1. Contractor shall accept full responsibility for the completeness of each resubmittal. Contractor shall verify that all corrected data and additional information previously requested by Engineer are provided on the resubmittal. Resubmittals shall be in an organized and consistent format.

2. When corrected copies are resubmitted, Contractor shall direct specific attention to all revisions in writing and shall list separately any revisions made other than those called for by Engineer on previous submittals. Requirements specified for initial submittals shall also apply to resubmittals. Resubmittals shall bear the number of the first submittal followed by a letter (A, B, etc.) or a unique

identification that indicates the initial submittal and correct sequence of each resubmittal.

3. If more than one resubmittal is required because of failure of Contractor to provide all previously requested corrected data or additional information, Contractor shall reimburse Owner for the charges of Engineer for review of the additional resubmittals. This does not include initial submittal data such as shop tests and field tests that are submitted after initial submittal.

4. Resubmittals shall be made within 30 days of the date of the letter returning the material to be modified or corrected, unless within 14 days Contractor submits an acceptable request for an extension of the stipulated time period, listing the reasons the resubmittal cannot be completed within that time.

5. The need for more than one resubmittal, or any other delay in obtaining Engineer's review of submittals, will not entitle Contractor to extension of the Contract Times unless delay of the Work is the direct result of a change in the Work authorized by a Change Order or failure of Engineer to review and return any submittal to Contractor within the specified review period.

D. Color Selection

1. Contractor shall submit samples of colors and finishes for all accepted products before Engineer will coordinate the selection of colors and finishes with Owner. Engineer will prepare a schedule of finishes that includes the colors and finishes selected for both manufactured products and for surfaces to be field painted or finished and will furnish this schedule to Contractor within 60 days after the date of acceptance of the last color or finish sample.

1.2 OPERATION AND MAINTENANCE DATA AND MANUALS

A. Adequate operation and maintenance information shall be supplied for all equipment requiring maintenance or other attention. The equipment Supplier shall prepare a Project specific operation and maintenance manual for each type of equipment indicated in the individual equipment sections or the equipment schedule.

B. Unless otherwise agreed by Engineer, the operation and maintenance manual for each type of equipment shall only be submitted for review following completion of review of all shop drawings and engineering data pertaining to that equipment.

C. Parts lists and operating and maintenance instructions shall be furnished for other equipment not listed in the individual equipment sections or the equipment schedule.

D. Operation and maintenance manuals shall include the following:

1. Equipment function, normal operating characteristics, and limiting conditions.

2. Assembly, installation, alignment, adjustment, and checking instructions.

3. Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.

4. Lubrication and maintenance instructions.

5. Guide to troubleshooting.

6. Parts lists and predicted life of parts subject to wear.

7. Outline, cross section, and assembly drawings; engineering data; and wiring diagrams.

8. Test data and performance curves, where applicable.

E. The operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered, or which may be required by Contractor.

F. Hard copy and Electronic Manuals

1. Each electronic manual shall be submitted to Engineer for review prior to the date of shipment of the equipment.

2. The electronic copy shall be submitted through the Project website, and will be reviewed for content and organization and assigned a review status by Engineer. When corrections are required, a corrected version of the electronic copy shall be resubmitted.

3. When the O&M manuals are returned with the review status "RETURNED FOR CORRECTION", the corrections shall be made as instructed by Engineer.

4. After review by Engineer is complete, four hard copies and one electronic copy of each operation and maintenance manual shall be prepared and delivered to Ownernot later than 30 days prior to placing the equipment in operation.

5. Procedures for submission of the electronic copy will be provided after award of the Contract.

6. The completed O&M manual shall also be filed to the Project website.

G. All material shall be marked with Project identification, and inapplicable information shall be marked out or deleted.

H. Shipment of equipment will not be considered complete until all required manuals and data have been received.

I. Hard Copy Operation and Maintenance Manual Requirements

1. The final hard copy of each manual shall be prepared and delivered in substantial, permanent, three-ring or three-post binders with a table of contents and suitable index tabs. Drawings 11”x17” shall be included with the documents. Larger drawings shall be folded separately and placed in separately identified envelopes, which are bound into the manuals.

J. Electronic Operation and Maintenance Manual Requirements

1. Electronic manuals shall be in Adobe Acrobat’s Portable Document Format (PDF), and shall be prepared at a resolution between 300 and 600 dots per inch (dpi), depending on document type.

2. Optical Character Recognition (OCR) capture shall be performed on these documents. OCR settings shall be performed with the “original image with hidden text” option in Adobe Acrobat Exchange.

3. File names shall be in the format OMXXXXX-YYYZ-V.pdf, where XXXXX is the five digit number corresponding to the specification section, YYY is a three digit O&M manual number, e.g. 001, Z is the letter signifying a resubmittal, A, B, C, etc., and V is a number used only when more than one 10 MB file is required for an O&M manual.

4. Documents prepared in PDF format shall be processed as follows:

   a. Pages shall be searchable (processed for optical character recognition) and indexed when multiple files are required.
   b. Pages shall be rotated for viewing in proper orientation.
   c. A bookmark shall be provided in the navigation frame for each entry in the Table of Contents.
   d. Embedded thumbnails shall be generated for each completed PDF file.
   e. The opening view for PDF files shall be as follows:

      1) Initial View: Bookmarks and Page

      2) Page Number: Title Page (usually Page 1)

      3) Magnification: Set to Fit in Window

      4) Page: Single Page

   f. Where the bookmark structure is longer than one page the bookmarks shall be collapsed to show the chapter headings only.
   g. When multiple files are required the first file of the series (the parent file) shall list every major topic in the Table of Contents. The parent file shall also include minor headings bookmarked based on the Table of Contents. Major headings, whose content is contained in subsequent files (children) shall be linked to be called from the parent to the specific location in the

child file. The child file shall contain bookmark entries for both major and minor headings contained in the child file. The first bookmark of any child file shall link back to the parent file and shall read as follows "Return to the *Equipment Name* Table of Contents", e.g. Return to the Polymer Feed System Table of Contents.

h. Drawings shall be bookmarked individually.

i. Files shall be delivered without security settings to permit editing, insertion and deletion of material to update the manual provided by the manufacturer.

K. Labeling

1. As a minimum, the following information shall be included on all final O&M manual materials, including thumb drives and hard copy manuals:

   a. Equipment name and/or O&M title spelled out in complete words.
   b. Project Name.
   c. Owner Project/Contract Number.
   d. Specification Section Number. Example: “Section 40 05 59”
   e. Manufacturer’s name.
   f. File Name and Date.

2. Label example:

   Metal Slide Gates Operation and Maintenance Manual

   Beaver Water District Plant Expansion Program

   Contract 23-3 16 MG Clearwell

   Specification Section 40 05 59

   Manufacturer

   OM400559-001.pdf, 5/05/25

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

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SUBMITTAL No. _____
SECTION _____
Do not combine multiple sections together unless required by specifications.

(Contractor's Letterhead)

SUBMITTAL IDENTIFICATION & CONTRACTOR'S APPROVAL STATEMENT

DATE: _____ COPIES _____ DRAWING SHEET NO._____

Description submittal contents: _____
Location: _____
Manufacturer_____
Subcontractor or Supplier (Optional) _____

REMARKS: _____
_____
_____
_____

CONTRACTOR'S APPROVAL

(Construction Company) has reviewed and coordinated the submitted documentation and verifies that the equipment and material meet the requirements of the Work and the Contract Documents. We accept sole responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data contained in the submittal as required by the Contract Documents.

Deviations: □ None □ Yes (See attached Figure 2- 01 33 00for written description)

Approved By: _____ Date: _____

This approval does not release subcontractor / vendor from the contractual responsibilities.

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SUBMITTAL No. _____

SECTION _____

Do not combine multiple sections together unless required by specifications.

(Contractor's Letterhead)

SUBMITTAL IDENTIFICATION & CONTRACTOR'S APPROVAL STATEMENT

DATE: _____ COPIES _____ DRAWING SHEET NO._____

Description submittal contents: _____
Location: _____
Manufacturer_____
Subcontractor or Supplier (Optional) _____

DEVIATIONS

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SECTION 01 42 13 - ABBREVIATIONS AND ACRONYMS

PART 1 - GENERAL

1.1 LIST OF ABBREVIATIONS

A. Abbreviations for standards and organizations used in the Contract Documents are defined as follows:

AA	Aluminum Association
AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
ABMA	American Bearing Manufacturers Association
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
ADH	Arkansas Department of Health
ADEQ	Arkansas Department of Environmental Quality
AEIC	Association of Edison Illuminating Companies
AFBMA	Antifriction Bearing Manufacturers Association now recognized as the ABMA
AFPA	American Forest & Paper Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHA	American Hardboard Association
AHRI	Air-Conditioning, Heating and Refrigeration Institute
AISC	American Institute of Steel Construction

AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Movement and Control Association International
ANSI	American National Standards Institute
APA	Engineered Wood Association (formerly American Plywood Association)
API	American Petroleum Institute
AREMA	American Railway Engineers and Maintenance-of-Way Association
ASAHC	American Society of Architectural Hardware Consultants
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	ASTM International
AWG	American Wire Gauge
AWI	Architectural Woodwork Institute
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Institute of America (formerly SCPI)
BWD	Beaver Water District

CDA	Copper Development Association
CISPI	Cast Iron Soil Pipe Institute
CMAA	Crane Manufacturers Association of America
CRA	California Redwood Association
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard (U.S. Department of Commerce)
DHI	Door and Hardware Institute
DIPRA	Ductile Iron Pipe Research Association
EEI	Edison Electric Institute
EJCDC	Engineers' Joint Contract Documents Committee
EPA	Environmental Protection Agency
FCC	Federal Communications Commission
FCI	Fluid Controls Institute
Fed Spec	Federal Specification
FGMA	Flat Glass Marketing Association
FHWA	Federal Highway Administration
FIA	Factory Insurance Association
FM	Factory Mutual
FSA	Fluid Sealing Association
HEI	Heat Exchange Institute

HMI	Hoist Manufacturers Institute
HPMA	Hardwood Plywood Manufacturers Association
HTI	Hand Tools Institute
I-B-R	Institute of Boiler and Radiator Manufacturers
IEEE	Institute of Electrical and Electronics Engineers
IBC	International Building Code
IES	Illuminating Engineering Society
IFI	Industrial Fasteners Institute
IPCEA	Insulated Power Cable Engineers Association
IRI	Industrial Risk Insurers
ISA	International Society of Automation
LEED	Leadership in Energy and Environmental Design
MHI	Materials Handling Institute
MIL	Military Specification
MMA	Monorail Manufacturers Association
MSS	Manufacturers Standardization Society of Valve and Fitting Industry
NAAMM	National Association of Architectural Metals Manufacturers
NACE	NACE International
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors

NBS	See NIST
NCSPA	National Corrugated Steel Pipe Association
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NEII	National Elevator Industry, Inc.
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology (formerly NBS)
NLA	National Lime Association
NPC	National Plumbing Code
NPT	National Pipe Thread
NRMCA	National Ready Mixed Concrete Association
NSC	National Safety Council
NSF	NSF International (formerly National Sanitation Foundation)
NTMA	National Terrazzo and Mosaic Association
NWMA	National Woodwork Manufacturers Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Precast/Prestressed Concrete Institute
PS	Product Standard

RIS	Redwood Inspection Service
SAE	SAE International
SDI	Steel Door Institute
SFPA	Southern Forest Products Association
SI	Systéme International des Unités (International System of Units)
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SPFA	Steel Plate Fabricators Association
SPI	Society of the Plastics Industry
SPTA	Southern Pressure Treaters Association
SSFI	Scaffolding, Shoring & Forming Institute, Inc
SSPC	SSPC: The Society for Protective Coatings
TABB	Testing, Adjusting, and Balancing Bureau
UL	Underwriters' Laboratories
USBR	U.S. Bureau of Reclamation
USGBC	U.S. Green Building Council
WEF	Water Environment Federation

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

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SECTION 01 45 00 - QUALITY CONTROL

PART 1 - GENERAL

1.1 TESTING SERVICES

A. Testing services shall be provided in accordance with Paragraph 14.02 of the General Conditions. All tests to determine compliance with the Contract Documents shall be performed by an independent commercial testing firm acceptable to Engineer and/or Authority Having Jurisdiction excluding testing as specified to be conducted directly by Contractor. The testing firm's laboratory shall be staffed with experienced technicians, properly equipped and fully qualified to perform the tests in accordance with the specified standards.

B. Testing services provided by Owner are for the sole benefit of Owner and/or as required by the governing building code; however, test results shall be available to Contractor. Testing necessary to satisfy Contractor's internal quality control procedures shall be the sole responsibility of Contractor.

C. Testing Services Provided by Contractor.

1. Unless otherwise specified, Contractor shall provide all testing services in connection with the following:

a. Any Work or part thereof specifically to be inspected, tested or approved by an employee or representative of an Authority Having Jurisdiction. Contractor shall assume full responsibility for arranging and obtaining such inspections, tests or approvals. Contractor shall pay all costs associated for these activities and shall provide the required certificates of inspection or approval.

b. Any inspections, tests or approvals required for Owner or Engineer acceptance of materials or equipment to be incorporated in the Work. This includes any items required for acceptance of materials, concrete mix designs or equipment submitted for approval prior to Contractor’s purchase for incorporation in the Work.

c. Testing, adjusting and balancing of mechanical, electrical and other equipment and systems as specified to be incorporated into the Work. This includes services required by manufacturers of equipment or other products such as concrete repair products, pipe, coatings, linings and roof membranes furnished under the Contract Documents.

d. Tightness testing of containment structures and pressure or leakage testing of piping as specified.

e. Any Work (or part thereof) required by the Contract Documents to be approved by Owner, Engineer or other designated individual or entity. Contractor shall assume full responsibility for arranging and obtaining such approvals, pay all costs in connection therewith and submit to Engineer the required certificates of approval.

2. Excluding those conducted directly by an Authority Having Jurisdiction or expressly specified to be conducted directly by Contractor, inspections and tests shall be performed by independent inspectors, approved agencies or other qualified individuals or entities acceptable to Owner and Engineer .

D. Testing Services and Special Inspections Provided by Owner.

1. Unless otherwise specified, Owner shall employ and pay for the services of an independent testing laboratory, approved agency or other qualified individual or entities for inspections, tests or approvals required by the Contract Documents for field quality control. These include items indicated as Owner provided in the following specifications:

a. Structural Tests and Special Inspections
b. Excavation and Fill for Structures
c. Trenching and Backfilling
d. Cleaning and Disinfection of Water Pipelines
e. Concrete
f. Anchorage in Concrete and Masonry
g. Structural and Miscellaneous Metals
h. Steel Pipe
i. Other materials and equipment at the discretion of Owner.

E. Contractor shall provide access to the site and Work in accordance with 14.01 and 14.02 of the General Conditions. Contractor shall give timely notice of the readiness of the Work for inspection, tests or approvals and shall cooperate with the inspection and testing personnel to facilitate the required tests and inspections. Contractor shall furnish all sample materials and cooperate in the testing activities, including sampling. Contractor shall interrupt the Work when necessary to allow testing, including sampling, to be performed. Contractor shall have no Claim for an increase in Contract Price or Contract Times due to such interruption. When testing activities, including sampling, are performed in the field by Engineer or Agency personnel, Contractor shall furnish personnel and facilities to assist in the activities as required.

F. Transmittal of Test Reports.

1. Written reports of tests and engineering data furnished by Contractor for Engineer's review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings.

2. The Approved Agency retained by Owner will furnish one digital copy of the report of each test.

1.2 OFFSITE INSPECTION

A. Inspection of materials or equipment during the production, manufacturing, or fabricating process, or before shipment, will be performed by Engineer or an independent testing firm or Approved Agency acceptable to Engineer and Authority

Having Jurisdiction as specified in the materials and equipment sections or Code Required Special Instructions and Procedures (IBC 2021) section.

B. Except as otherwise specified in other sections, Contractor shall give appropriate written notice to Engineer not less than 21 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.

C. The inspection organization will submit a written report to Engineer , with a copy to Contractor, at least once each week or as directed by the Statement of Special Inspections as applicable.

1.3 MANUFACTURER'S FIELD SERVICES

A. Manufacturer’s field services shall be as specified herein except as specifically specified in the respective equipment sections.

B. Services Furnished Under This Contract. An experienced, competent, and authorized representative of the manufacturer of each item of equipment for which field services are indicated in the respective equipment section or in the equipment schedule section shall visit the Site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer's representative shall be present when the equipment is placed in operation. The manufacturer's representative shall revisit the jobsite as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Engineer .

C. Each manufacturer's representative shall furnish to Owner, through Engineer , a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.

D. All costs for these services shall be included in the Contract Price.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

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SECTION 01 45 33 - CODE REQUIRED SPECIAL INSPECTIONS AND PROCEDURES (IBC 2021)

PART 1 - GENERAL

1.1 SCOPE

A. Owner, or Registered Design Professional in Responsible Charge of construction acting as Owner's Agent, will engage one or more Approved Agencies to conduct tests and special inspections specified in this section and other related sections.

B. The Approved Agency shall not be employed by Contractor or a supplier materially participating in the project.

1.2 GENERAL

A. This section includes administrative and procedural requirements indicated in the governing building code.

B. Structural testing and special inspection services are required to verify compliance with the construction documents and standards referenced herein. These services do not relieve Contractor of responsibility for compliance with the construction documents.

C. Specific quality-assurance and quality-control requirements for individual construction activities are also referenced in other sections. Requirements in those sections may also cover production of standard products.

D. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the construction documents.

E. Requirements for Contractor to provide quality-assurance and quality-control services required by Engineer, Owner, or Authority Having Jurisdiction (AHJ) are not limited by provisions of this section.

1.3 DEFINITIONS.

A. Approved Agency: An established and recognized agency regularly engaged in conducting tests, furnishing inspection services, or furnishing product certification when such agency has been approved by the Authority Having Jurisdiction.

B. Approved Fabricator: An established and qualified person, firm or corporation approved by the Authority Having Jurisdiction to perform work without Special Inspection.

C. Authority Having Jurisdiction (AHJ): The officer or other designated authority charged with the administration and enforcement of the building code, or a duly authorized representative. Also commonly known as the Building Official.

D. Construction Documents: Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction documents include all supplemental instructions, sketches, addenda, and revisions to the drawings and specifications issued by the Registered Design Professional beyond those issued for a building permit.

E. Pre-Engineered Structural Elements: Structural elements specified by the Registered Design Professional but which may be designed by another Registered Design Professional. (Examples are items such as open web steel joists and joist girders, metal joists, pre-cast concrete elements, pre-fabricated metal buildings, pre-stressed wire wrapped tanks, tilt-up concrete panel reinforcement and lifting hardware.)

F. Registered Design Professional (RDP): An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

G. Registered Design Professional in Responsible Charge (RDPRC): A Registered Design Professional engaged by Owner to review and coordinate certain aspects of the project, as determined by the AHJ and Construction Documents, for compatibility with the design of the buildings or structure, including submittal documents prepared by others, deferred submittal documents and phased submittal documents.

H. Shop Drawings / Submittal Data: Written, graphic and pictorial documents prepared and / or assembled by Contractor or Supplier based on the Construction Documents.

I. Special Inspection: Inspection and/or testing required by the governing building code, as amended by the AHJ, of the materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved Construction Documents and referenced standards.

J. Special Inspection, Continuous: The full-time observation or testing of work requiring special inspection by an approved Special Inspector who is present in the area where the work is being performed.

K. Special Inspection, Periodic: The part-time or intermittent observation or testing of work requiring Special Inspection by an approved Special Inspector who is present in the area where the work has been or is being performed and at the completion of the work.

L. Special Inspector: A qualified person demonstrating competence, to the satisfaction of the AHJ and RDPRC, for inspection of the particular type of construction or operation requiring special inspection. The Special Inspector will be qualified as specified herein.

M. Testing Agency: A qualified materials testing laboratory under the responsible charge of a Registered Design Professional, approved by the AHJ and the RDPRC, to measure, examine, test, calibrate, or otherwise determine the characteristics or performance of construction materials and verify confirmation with construction documents.

1.4 INSPECTION AND TESTING AGENCY QUALIFICATIONS.

A. Special Inspectors and testing agencies will be employed or retained by Owner, and will have the minimum qualifications as described in this section. The qualifications of all personnel performing special inspection and testing activities are subject to the approval of the AHJ and RDPRC.

B. Minimum qualifications of inspection and testing agencies and their personnel will comply with ASTM E329 "Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection," or IAS AC 291 "Accreditation Criteria for Special Inspection Agencies."

C. Inspectors and individuals performing tests will be certified for the work being performed as listed below and in Table 1 of IAS AC291, or by alternate certifications when acceptable to the AHJ. The AHJ may have additional requirements.

Abbreviation used in this Section	Description
AIA	Architect licensed in the state of the project, specializing in the design of building structures.
Licensed Engineers	
PE/SE	Structural Engineer (SE) or Professional Engineer (PE) licensed in the state of the project, specializing in the design of building structures.
PE/GE	Geotechnical Engineer (GE) or Professional Engineer (PE) licensed in the state of the project, specializing in soil mechanics and foundations.
PE/EE	Electrical Engineer (EE) or Professional Engineer (PE) licensed in the state of the project, specializing in electrical systems.
PE/ME	Mechanical Engineer (ME) or Professional Engineer (PE) licensed in the state of the project, specializing in mechanical systems.
EI/EIT	Engineering Intern or Engineer-in-Training: a graduate engineer who has passed the Fundamentals of Engineering examination working under the direct supervision of a Professional Engineer licensed in the state of the project and with a minimum of one year of experience performing inspections.
American Concrete Institute (ACI) Certification	

Abbreviation used in this Section	Description
ACI-CFTT	Concrete Field Testing Technician – Grade 1.
ACI-CCI	Concrete Construction Inspector.
ACI-LTT	Laboratory Testing Technician – Grade 1 or 2.
ACI-STT	Strength Testing Technician.
American Welding Society (AWS) Certification	
AWS-CWI	Certified Welding Inspector.
AWS/AISC-SSI	Certified Structural Steel Inspector.
American Society of Non-Destructive Testing (ASNT) Certification	
ASNT	Non-Destructive Testing Technician. For Ultrasonic Testing (UT) and Radiographic Testing (RT) Certified as Level III through examination by ASNT or certified as Level II by their employer for flaw detection. For Magnetic Particle Testing (MT) and Liquid Penetrant Testing (PT) certified as Level II by their employer or certified as Level III through examination by ASNT and certified by their employer.
International Code Council (ICC) Certification	
ICC-SMSI	Structural Masonry Special Inspector.
ICC-SWSI	Structural Steel and Welding Special Inspector.
ICC-SFSI	Spray-Applied Fire-proofing Special Inspector.
ICC-PCSI	Prestressed Concrete Special Inspector.
ICC-RCSI	Reinforced Concrete Special Inspector.
ICC-SBSI	Structural Steel and Bolting Special Inspector.
ICC-WSI	Structural Welding Special Inspector.
National Concrete Masonry Association	

Abbreviation used in this Section	Description
NCMA	Concrete Masonry Testing Technician.
National Institute for Certification in Engineering Technologies (NICET)	
NICET-CT	Concrete Technician – Levels II, III & IV.
NICET-ST	Soils Technician - Levels II, III & IV.
NICET-GET	Geotechnical Engineering Technician - Levels II, III & IV.
Exterior Design Institute (EDI) Certification	
EDI-EIFS	EIFS Third Party Inspector.

Inspection or Testing Item	Qualification Standards
Fabricators	Varies by product as listed below.
Steel Construction – Welding Inspection	ICC-SWSI, ICC-WSI, AWS-CWI or AWS/AISC-SSI.
Steel Construction – Non-Destructive Weld Testing	ASNT.
Steel Construction – Details	PE/SE, ICC-SWSI, ICC-SBSI or AWS/AISC-SSI.
Steel Construction – High Strength Bolts	PE/SE or ICC-SBSI.
Concrete Construction - Field Tests	ACI-CFTT or NICET-CT.
Concrete Construction - Field Inspection	PE/SE, ICC-RCSI, ACI-CCI or NICET-CT.
Concrete Construction - Laboratory Testing	ACI-LTT, ACI-STT or NICET-CT.
Prestressed Concrete Construction	ICC-PCSI.
Masonry Construction - Field Inspection	PE/SE or ICC-SMSI.
Masonry Construction - Laboratory Testing	NCMA.
Soils (special grading, excavation and filling)	PE/GE, NICET-ST or NICET-GET under the direct supervision of Registered Civil (geotechnical) Engineer.

Inspection or Testing Item	Qualification Standards
Pile Foundations	PE/GE, Appropriate structural material inspection and NICET-ST or NICET-GET under the direct supervision of Registered Civil (geotechnical) Engineer.
Pier Foundations	PE/GE, Appropriate structural material inspection and NICET-ST or NICET-GET under the direct supervision of Registered Civil (geotechnical) Engineer.
Wall Panels and Veneers	ICC-SMSI.
Sprayed Fire-Resistant Materials	ICC-SFSI.
Exterior Insulation and Finish Systems (EIFS)	ICC Building Inspector or EDI-EIFS.
Post Installed Anchors in Concrete	ICC Building Inspector, ICC-RCSI, or PE/SE.
Post Installed Anchors in Masonry	ICC Building Inspector, ICC-SMSI, or PE/SE.
Smoke Control Systems	IBC 1705.18.2.
Other Architectural Systems	ICC Building Inspector, AIA, or PE/SE.
Mechanical Systems	ICC Building Inspector or PE/ME.
Electrical Systems	See NFPA 70.

1.5 CONFLICTING REQUIREMENTS, REPORTS AND TEST RESULTS

A. General

1. If compliance with two or more standards is specified and the standards establish different requirements for minimum quantities or quality levels, comply with the more stringent requirement. Refer uncertainties to the RDPRC for a decision before proceeding.

B. Minimum Quantity or Quality Levels.

1. The quantity or quality level indicated in the Construction Documents shall be the minimum provided or performed. The actual installation shall comply exactly with the minimum quantity or quality specified, or exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to the RDPRC for a decision before proceeding.

C. Precedence.

1. The Approved Agency reports and testing results shall have precedence over reports and test results provided by Contractor.

D. Conflict.

1. Where a conflict exists between the construction documents and approved shop drawings/submittal data, the construction documents shall govern unless the shop drawings/submittal data are more restrictive. All conflicts shall be brought to the attention of the RDPRC.

1.6 TECHNICAL ATTACHMENTS

A. The following forms are required as part of the comprehensive administrative, testing and inspection requirements. The AHJ may have similar documents that can be used in lieu of these forms at the time of building permit application.

Form Title	Notes
Statement of Special Inspections (SSI)	To be completed jointly by the RDPRC and the Approved Agency, and sealed by the RDPRC after completion. Contractor or Owner shall submit the form to the AHJ as part of the building permit application process.
Request for Approval of Individual Inspector or Technician	To be completed by Approved Agency. Approved Agency will submit the form to the AHJ and RDPRC for their approval of individual inspectors and testing technicians.
Contractor's Statement of Responsibility	To completed by Contractor and his relevant suppliers and submitted to Owner and AHJ.
Fabricator's Certificate of Compliance	To be completed by Contractor's Approved Fabricators who perform work without special inspections, and submitted to AHJ and RDPRC prior to placement of the fabricated items in the work.
Final Report of Special Inspections	To be completed and sealed by Approved Agency. Approved Agency or Owner will submit to AHJ at the completion of construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CONTRACTOR AND FABRICATOR RESPONSIBILITIES.

A. Each Fabricator or Contractor responsible for the construction of a seismic-force-resisting system, designated seismic system, seismic resisting component, main wind force-resisting system, or a wind-resisting component listed in the SSI shall submit a "Contractor's Statement of Responsibility" to the AHJ and to Owner prior to the commencement of work.

B. To be considered an Approved Fabricator that may perform work without Special Inspection, the Fabricator shall submit copies of certifications from the International Accreditation Service (IAS) or other recognized and acceptable accreditation organization a minimum of 30 days prior to the start of fabrication. Acceptance as an Approved Fabricator is subject to approval by the AHJ. If the project specifications required an Approved Fabricator, and the AHJ does not accept the Fabricator as an Approved Fabricator, special inspection may become necessary in the Fabricator's shop. Such inspections will be performed by Approved Agency and Contractor shall reimburse Owner for the cost for the inspections.

C. Contractor shall provide, from each Approved Fabricator, a "Fabricator's Certificate of Compliance" indicating that the work was performed in accordance with the approved Construction Documents. The certificate(s) shall be submitted to the AHJ and the RDPRC prior to placement of the fabricated items into the work.

D. Contractor shall assist in coordination of the inspection and testing services with the progress of the work. Contractor shall provide sufficient notice to allow proper scheduling of all inspection and testing personnel. Contractor shall provide safe access to inspection and testing personnel and shall ensure that all work requiring special inspection is not concealed prior to the completion of the inspection and/or testing.

E. Contractor shall submit schedules to Owner, RDPRC and testing and inspecting agencies. Schedules will note milestones and durations of time for materials requiring tests and special inspections.

F. Contractor shall provide the Special Inspector access to approved plans at the job site or fabrication shop as applicable.

G. Contractor shall retain at the job site or fabrication shop, as applicable, all special inspection records submitted by an Approved Agency or Special Inspector and shall provide these records for review by the AHJ's inspector upon request.

H. Contractor shall repair and/or replace work that does not meet the requirements of the construction documents.

I. Contractor shall engage an engineer to prepare repair and/or replacement procedures for any deficiencies identified. Contractor's engineer shall be registered in the state in which the project is located. Contractor's engineer shall be acceptable to the RDPRC, AHJ, and Owner.

Procedures shall be submitted for review and acceptance by the RDPRC, AHJ, and Owner before proceeding with corrective action.

J. Contractor shall be responsible for costs of:

1. Re-testing and re-inspection of materials, work, and/or products that do not meet the requirements of the Contract Documents or shop drawing/submittal data.

2. Review of proposed repair and/or replacement procedures by the RDPRC and the inspectors and testing agencies.

3. Repair or replacement of work that does not meet the requirements of the Construction Documents.

3.2 APPROVED AGENCY AND SPECIAL INSPECTOR RESPONSIBILITIES.

A. Preliminary Approval of Special Inspectors and Testing Technicians

1. The Approved Agency will submit a "Request for Approval of Individual Inspector or Technician" form to the AHJ and RDPRC for each proposed Special Inspector or testing technician. The form will include the individual's credentials, which as a minimum will meet the requirements indicated in this section. Inspector and technician certifications by organizations other than those listed herein will not be acceptable without approval of the AHJ and RDPRC. The AHJ may have additional requirements to those specified herein. It is the responsibility of the testing and inspection agencies to meet local requirements and comply with local procedures.

2. When fabrication will take place away from the local proximity of the project, Approved Agency will submit a "Request for Approval to Provide Special Inspection of Non-Local Fabrication" form for review and approval by Owner, the RDPRC, and the AHJ prior to subcontracting with an inspection/testing agency in the locale of the fabricating plant.

B. Perform Inspections and Tests

1. Be present for and perform continuous or periodic inspections and tests as listed in the SSI for conformance of the work to the AHJ approved Construction Documents. Notify Contractor personnel of their presence and responsibilities. When the SSI column titled "Other Code, Standard or Reference" indicates "Manufacturer's research reports", inspector will obtain the most current ICBO-ES Report, ICC-ES Legacy Report, ICC-ES Report, or IAPMO UES Evaluation Report (as applicable) prior to the applicable inspection, for inspection requirements related to the type and brand of products or materials being inspected.

2. Provide additional inspections and testing as necessary to determine compliance with the Construction Documents. Perform special inspections in a timely manner to avoid delay of work.

3. The Approved Agency shall be responsible to insure that all inspection or testing activity, whether performed locally or at off-site fabrication facilities, fully complies with this section and the SSI.

C. Defective Work

1. Immediately notify Contractor of the need for corrective action when work does not conform to Construction Documents.

D. Uncorrected Defective Work

1. Notify the AHJ and RDPRC when deficiencies have not been corrected. Notice will be made prior to the completion of that phase of the work.

E. Interim Inspection Reports

1. Furnish interim inspection reports to the AHJ, the RDPRC, Contractor, Engineer, and Owner during the progress of the work. Frequency of reports will be as established in the SSI. Reports will indicate that work inspected was done in conformance to the approved Construction Documents, or that the work was defective, as applicable.

2. Special inspection reports and test results will include, but not be limited to, the following:

   a. Project name and address.
   b. Permit number.
   c. Special Inspection Agency name, address, and phone number.
   d. Unique identification of the report and of each page.
   e. Date and time of inspection.
   f. Description of inspections or tests performed, including item description and location (reference grid lines, floors, elevations, etc.). Identify approved agencies employed to carry out tests.
   g. Identification of test/inspection equipment used.
   h. Statement noting that the work, material, and/or product conforms or does not conform to the construction document requirements. Describe defective items.
   i. Name and signature of Contractor's representative who was notified of work, material, and/or products that do not meet the construction document requirements.
   j. Name and signature of Special Inspector and/or testing agency representative performing the work.

F. Report of Defective Work

1. Each agent will maintain a log that identifies work that does not meet the requirements of the construction documents. Include:

   a. Description and exact location.
   b. Reference to applicable drawings and specifications.
   c. Reference to original inspection/test report and subsequent dates of re-inspection/retesting.
   d. Name and title of each individual notified and method of notification.
   e. How defective items were resolved or unresolved, as applicable.
   f. Itemized changes authorized by the RDPRC and AHJ if not included in a defective item.

G. Submittal Schedule.

1. Documentation of reports, test results, and non-compliant work will be submitted at the frequency indicated in the SSI.

H. Final Report of Special Inspections.

1. Each agent listed in the SSI shall submit a final report to the Approved Agency documenting the performed special inspections and the correction of any discrepancies noted. The Approved Agency shall cumulate the reports and submit a comprehensive final report at a point in time as agreed upon by the permit applicant and the AHJ prior to the start of work.

End of Section

Statement of Special Inspections

Project:
Project Address:
Permit Applicant:
Applicant Address:
Owner:
Owner Address:

Registered Design Professional in Responsible Charge (RDPRC) :

Discipline	Name	License Number	Expiration Date
Structural Engineer			
Geotechnical Engineer			
Mechanical Engineer			
Electrical Engineer			
Architect			

This Statement of Special Inspections includes a *Schedule of Special Inspections* applicable to the above referenced project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections.

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the Authority Having Jurisdiction (AHJ) and to the Registered Design Professional in Responsible Charge (RDPRC). Discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the AHJ and the RDPRC prior to completion of that phase of work. A *Final Report of Special Inspections* documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted by each agent.

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Inspection work shall be performed in accordance with the following codes and standards. Unless otherwise indicated within the Statement of Special Inspections, the applicable edition for all codes and standards shall be as follows.

Work	In Accordance With
Building Code	Arkansas Fire Prevention Code Volume II, 2020, based on 2021 International Building Code (IBC)
Seismic Criteria for Nonstructural Components	ASCE 7-16
Standard Tests and Practices	American Society for Testing and Materials (ASTM) International specifications
Concrete	ACI 318-19 and ACI 350-20
Masonry	TMS 402-16 and TMS 602-16
Structural Steel	AISC 360-16 and AISC 341-16
Structural steel welding	AWS D1.1 Structural Welding Code - Steel
Aluminum welding	AWS D1.2 Structural Welding Code – Aluminum

Work	**In Accordance With**
Sheet steel welding	AWS D1.3 Structural Welding Code – Sheet Steel
Structural steel bolting	Research Council on Structural Connections Specification for Structural Joints Using High Strength Bolts, August 1, 2014
Intumescent Fire-Resistive Coating	Association of the Wall and Ceiling Industry (AWCI) Technical Manual 12-B, Second Edition; Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials; an Annotated Guide

RDPRC - Structural	RDPRC - Civil/Geotechnical	RDPRC - Mechanical
RDPRC – Electrical	RDPRC - Architect	

Owner's Acknowledgement:

Signature Date

Acceptance by Authority Having Jurisdiction:

Signature Date

Permit No.

Frequency of interim report submittals to AHJ:

□ 1 week □ 2 weeks □ Monthly □ Bi-Monthly □ At Completion □ Per attached Schedule

Statement of Special Inspections
(Schedule of Inspections)

The attached tables as listed below define the applicable Special Inspections and Procedures.

Table 1 of 9	Geotechnical Special Inspections
Table 2 of 9	Structural Special Inspections
Table 3 of 9	Not Used
Table 4 of 9	Not Used
Table 5 of 9	Testing for Special Inspections
Table 6 of 9	Not Used
Table 7 of 9	Testing for Seismic Resistance
Table 8 of 9	Not Used
Table 9 of 9	Individual Inspection and Testing Agents

The Seismic Design Category for the project is B.

Schedule of Special Inspections - Table 1 of 9 (Geotechnical Special Inspections)						
	Inspection					
	Building Code Reference	Other Code, Standard or Reference	Frequency		Remarks	Inspection Agent No. (see Table 9)
System or Material			**Continuous**	**Periodic**		
Soils						
Perform classification and testing of compacted fill material.	1705.6	Geotechnical Report		**X** (during placement of fill)		
Verify materials, densities, and lift thicknesses during placement and compaction of controlled fill for foundations.	1705.6	Geotechnical Report	**X**		Note the exception of Article 1705.6.	
Driven Deep Foundation Elements						

Schedule of Special Inspections - Table 2 of 9 (Structural Special Inspections)						
System or Material	**Inspection**				**Remarks**	**Inspection Agent No.** (see Table 9)
	Building Code Reference	**Other Code, Standard or Reference**	**Frequency**			
			Continuous	**Periodic**		
Concrete (inspections not required for nonstructural concrete slabs supported directly on the ground)						
Reinforcing steel and prestressing tendon condition (free of oil, dirt and loose rust and that properly coated and/or sheathed) and placement. Verify size, spacing, bar clearances, cover, and adequate support to prevent displacement during concrete placement. Verify lap splices, mechanical splices, and embedment lengths. Verify dowels for work above are properly aligned and spaced to match other work.	1705.3	ACI 318 (Ch. 20) ACI 318 (25.2-25.3) ACI 318 (26.6.1-26.6.3		**X** (prior to closing of forms or delivery of concrete, for each placement)		
Verify use of approved mix design(s).	1705.3	ACI 318 (26.4.3-26.4.4)		**X**	RDPRC to approve contractor's proposed mix design prior to construction. Inspector to verify from concrete delivery ticket that the appropriate mix has been provided prior to placement.	
Formwork shape, location, and dimensions of the concrete member being formed, construction joints properly prepared.	1705.3	ACI 318 (26.11.1.2(b))		**X** (prior to delivery of concrete for each placement)		
Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	1705.3	ASTM C31 ASTM C172 ACI 318 (26.12)		**X**	Sampling and testing frequency shall be as indicated in the cast-in-place concrete specification.	

Schedule of Special Inspections - Table 2 of 9 (Structural Special Inspections)						
System or Material	**Inspection**				**Remarks**	**Inspection Agent No.** (see Table 9)
	Building Code Reference	**Other Code, Standard or Reference**	**Frequency**			
			Continuous	**Periodic**		
Concrete placement.	1705.3	ACI 318 (26.5.2)	**X**		Verify that water added at the site does not exceed that allowed by the mix design. Verify conveying, depositing, and consolidation of concrete. Observe placement procedures for evidence of segregation, possible cold joints, displacement of reinforcing or forms, and proper support of embedded items, anchor bolts, etc.	
Concrete curing – maintain temperature and techniques.	1705.3	ACI 318 (26.5.3-26.5.5)		**X** (during hot, cold, and windy conditions)	For wet-curing, check at the beginning of each day during 7 day curing period	
Structural Steel						
Main structural steel elements: review material test reports.	1705.2.1	AISC 360 (A3.1) AISC 360 (N5.2)		**X**	3 pieces from each lot; verify at fabricator's shop prior to cutting.	
Anchor rods and threaded rods: review material test reports.	1705.2.1	AISC 360 (A3.4) AISC 360 (N5.2)		**X**	Each lot.	
Galvanized steel members: inspect exposed cut surfaces of galvanized main members and rectangular HSS for cracks after galvanizing.	1705.2.1	AISC 360 (N5.7)		**X**	Each main member and HSS shape. Inspect at jobsite.	
Verify the following prior to welding:						
Welding consumables: review manufacturer's certifications.	1705.2.1	AISC 360 (A3.5) AISC 360 (N5.2) AISC 360 (N5.4)		**X**	3 rods from each lot; verified at fabricator's shop and at jobsite.	

Schedule of Special Inspections - Table 2 of 9 (Structural Special Inspections)							
System or Material		**Inspection**				**Remarks**	**Inspection Agent No**. (see Table 9)
		Building Code Reference	**Other Code, Standard or Reference**	**Frequency**			
				Continuous	**Periodic**		
	Welding filler metals and fluxes: review manufacturer's product data sheets or catalog data.	1705.2.1	AISC 360 (N5.2)		**X**	Each lot. Review products, limitations of use, recommended or typical welding parameters, and storage and exposure requirements, includng baking, if applicable.	
	Welding procedures specifications (WPS's): review procedures.	1705.2.1	AISC 360 (N5.2) AISC 360 (N5.4)		**X**	For each welded joint or member.	
	Welding procedures not prequalified per AWS D1.1 or D1.3: review procedure qualification records (PQR's).	1705.2.1	AISC 360 (N5.2)		**X**		
	Welding personnel qualification records (WPQR's) and continuity records: review welder qualifications.	1705.2.1	AISC 360 (N5.2) AISC 360 (N5.4)		**X**	Perform for each welder.	
	Welder identification system: review system of marking joints for purpose of identifying welders.	1705.2.1	AISC 360 (N5.4)		**X**		
	Fit up of groove welds: observe joint preparations, dimensions, cleanliness, tacking, and backing.	1705.2.1	AISC 360 (N5.4)		**X**		

Schedule of Special Inspections - Table 2 of 9 (Structural Special Inspections)							
System or Material		**Inspection**				**Remarks**	**Inspection Agent No.** (see Table 9)
		Building Code Reference	**Other Code, Standard or Reference**	**Frequency**			
				Continuous	**Periodic**		
	Fit up of CJP groove welds of HSS T-, Y-, and K- joints without backing: observe joint preparations, dimensions, cleanliness, and tacking.	1705.2.1	AISC 360 (N5.4)		**X**		
	Access holes: configuration and finish.	1705.2.1	AISC 360 (N5.4)		**X**		
	Fit up of fillet welds: observe dimensions, cleanliness, and tacking.	1705.2.1	AISC 360 (N5.4)		**X**		
Verity the following during welding:							
	Welding consumables: packaging and appropriate exposure control.	1705.2.1	AISC 360 (N5.4)		**X**		
	No welding over cracked tack welds.	1705.2.1	AISC 360 (N5.4)		**X**		
	Environmental conditions: wind speed, precipitation, and ambient temperature limits are observed.	1705.2.1	AISC 360 (N5.4)		**X**		
	Welding procedure specifications (WPS's): settings on welding equipment, travel speed, selected welding materials, shielding gas type/flow rate, preheat applied, interpass temperature maintained (min/max), proper position.	1705.2.1	AISC 360 (N5.4)		**X**		

Schedule of Special Inspections - Table 2 of 9 (Structural Special Inspections)							
System or Material		**Inspection**				**Remarks**	**Inspection Agent No.** (see Table 9)
		Building Code Reference	**Other Code, Standard or Reference**	**Frequency**			
				Continuous	**Periodic**		
	Welding techniques: interpass and final cleaning, each pass is within profile limitations, each pass meets quality requirements.	1705.2.1	AISC 360 (N5.4)		**X**		
	Headed stud anchors: placement and installation of anchors.	1705.2.1	AISC 360 (N5.4)		**X**	Observe once daily for each welder and visually inspect all anchors at the completion of their welding.	
Verify the following after welding:							
	Welds cleaned.	1705.2.1	AISC 360 (N5.4)		**X**		
	Weld size, length and location.	1705.2.1	AISC 360 (N5.4)	**X**			
	Welds meet visual inspection criteria (crack prohibition, weld/base metal fusion, crater cross section, weld profiles, weld size, undercut, porosity).	1705.2.1	AISC 360 (N5.4)	**X**			
	Arc strikes.	1705.2.1	AISC 360 (N5.4)	**X**			
	K-area.	1705.2.1	AISC 360 (N5.4)	**X**		When welding doubler, continuity, or stiffener plates in the k-area of a web, visually inspect the web k-area for cracks within 3 inches of the weld.	
	Weld access holes in rolled heavy shapes and bult-up heavy shapes.	1705.2.1	AISC 360 (N5.4)	**X**		Visually inspect the weld access holes for cracks after welding.	
	Backing removed and weld tabs removed.	1705.2.1	AISC 360 (N5.4)	**X**			

Schedule of Special Inspections - Table 2 of 9 (Structural Special Inspections)							
System or Material		**Inspection**				**Remarks**	**Inspection Agent No.** (see Table 9)
		Building Code Reference	**Other Code, Standard or Reference**	**Frequency**			
				Continuous	**Periodic**		
	Repair activities.	1705.2.1	AISC 360 (N5.4)	**X**			
	Document acceptance or rejection of welded joint or member.	1705.2.1	AISC 360 (N5.4)	**X**			
	No prohibited welds have been added without approval of EOR.	1705.2.1	AISC 360 (N5.4)		**X**		
Verify the following prior to bolting:							
	Fasteners: review manufacturer's certifications.	1705.2.1	AISC 360 (A3.3) AISC 360 (N5.2) AISC 360 (N5.6)		**X** (3 bolts from each lot)	Verified at jobsite.	
	Fasterners: review markings per ASTM requirements.	1705.2.1	AISC 360 (N5.6)		**X**		
	Correct fasteners selected for the joint detail (grade, type, bolt length).	1705.2.1	AISC 360 (N5.6)		**X**		
	Correct bolting procedure selected for joint detail.	1705.2.1	AISC 360 (N5.6)		**X**		
	Connecting elements, including the appropriate faying surface condition (for slip-criitcal joints) and hole preparation.	1705.2.1	AISC 360 (N5.6) RCSC Specification for Structural Joints Using High-Strength Bolts (Section 9.3)		**X**		

Schedule of Special Inspections - Table 2 of 9 (Structural Special Inspections)							
System or Material		**Inspection**				**Remarks**	**Inspection Agent No.** (see Table 9)
		Building Code Reference	**Other Code, Standard or Reference**	**Frequency**			
				Continuous	**Periodic**		
	Pre-installation verification testing by installing personnel.	1705.2.1	AISC 360 (N5.6) RCSC Specification for Structural Joints Using High-Strength Bolts (Section 9.2)		**X**	Required for all pretensioned and slip-critical joints.	
	Protected storage for bolts, nuts, washers, other fastener components.	1705.2.1	AISC 360 (N5.6)		**X**		
	Pretensioned joints; direct tension indicator.	1705.2.1	RCSC Specification for Structural Joints Using High-Strength Bolts (Section 9.2.4)		**X**	Verify the appropriate feeler gage is accepted in at least half ot the spaces between the protrusions, and that the protrusions are properly oriented away from the work.	
Verify the following during bolting:							
	Fastener assemblies placed in all holes and washers and nuts positioned as required.	1705.2.1	AISC 360 (N5.6)		**X**		
	Joint brough to the snug-tight position prior to pretensioning.	1705.2.1	AISC 360 (N5.6)		**X**		
	Fastener component not turned by the wrench is prevented from rotating.	1705.2.1	AISC 360 (N5.6)		**X**		
	Fasteners pretensioned in accordance with RCSC specification, progressing systematically from the most rigid point to the free edges.	1705.2.1	AISC 360 (N5.6)		**X**		

Schedule of Special Inspections - Table 2 of 9 (Structural Special Inspections)							
System or Material		**Inspection**				**Remarks**	**Inspection Agent No.** (see Table 9)
		Building Code Reference	**Other Code, Standard or Reference**	**Frequency**			
				Continuous	**Periodic**		
	Pretensioned joints; calibrated wrench.	1705.2.1	AISC 360 (N5.6) RCSC Specification for Structural Joints Using High-Strength Bolts (Section 9.2.2)		**X**	All connections visually inspected to confirm that plies of the connected elements are in firm contact and washers have been used. Verify that the crew properly applies the calibrated wrentch to the turned element.	
Verify the following after bolting:							
	Snug-tight joints.	1705.2.1	AISC 360 (N5.6) RCSC Specification for Structural Joints Using High-Strength Bolts (Section 9.1)		**X**	All connections visually inspected to confirm that plies of the connected elements are in firm contact and washers have been used. Nuts shall not be turnable without a wrench.	
	Pretensioned joints; turn-of-nut.	1705.2.1	AISC 360 (N5.6) RCSC Specification for Structural Joints Using High-Strength Bolts (Section 9.2.1)		**X**	All connections visually inspected to confirm that plies of the connected elements are in firm contact and washers have been used. Verify the turned element is rotated relative to the unturned element by the amount indicated in RCSC Table 8.2.	
	Pretensioned joints; twist-off type tension control bolts.	1705.2.1	AISC 360 (N5.6) RCSC Specification for Structural Joints Using High-Strength Bolts (Section 9.2.3)		**X**	All connections visually inspected to confirm that plies of the connected elements are in firm contact and washers have been used. Verify the splined ends are properly severed.	

Schedule of Special Inspections - Table 2 of 9 (Structural Special Inspections)							
System or Material		**Inspection**				**Remarks**	**Inspection Agent No**. (see Table 9)
		Building Code Reference	**Other Code, Standard or Reference**	**Frequency**			
				Continuous	**Periodic**		
	Pretensioned joints; direct tension indicator.	1705.2.1	AISC 360 (N5.6) RCSC Specification for Structural Joints Using High-Strength Bolts (Section 9.2.4)		**X**	All connections visually inspected to confirm that plies of the connected elements are in firm contact and washers have been used. Verify the appropriate feeler gage is refused entry into at least half ot the spaces between the protrusions.	
After bolting, document acceptance or rejection of bolted connections.		1705.2.1	AISC 360 (N5.6)		**X**		
Post-Installed Anchors – Expansion and Undercut Anchors into Concrete							
Verify anchor type, size, dimensions, location, spacing, edge distance, drill bit type, drill bit diameter, embedment depth, tightening torque, hole dimensions, hole cleaning procedure, concrete compressive strength, concrete thickness, and adherence to the manufacturer's installation instructions.		1705.3 1703.4.2 1705.1.1	Manufacturer's research report		**X**	Continuous inspection is required if mandated by manufacturer's research report.	
Post-Installed Anchors – Adhesive Anchors into Concrete							

Schedule of Special Inspections - Table 2 of 9 (Structural Special Inspections)						
	Inspection					
	Building Code Reference	Other Code, Standard or Reference	Frequency		Remarks	Inspection Agent No. (see Table 9)
System or Material			Continuous	Periodic		
Adhesive anchors installed in overhead, upwardly inclined, or horizontal positions: Verify anchor type, size, dimensions, location, spacing, edge distance, embedment depth, tightening torque, hole dimensions, hole cleaning procedure, concrete compressive strength, concrete thickness, adhesive identification, adhesive expiration date, and adherence to the manufacturer's installation instructions.	1705.3 1703.4.2 1705.1.1	Manufacturer's research report	**X**			
Adhesive anchors installed in other positions: Verify anchor type, size, dimensions, location, spacing, edge distance, embedment depth, tightening torque, hole dimensions, hole cleaning procedure, concrete compressive strength, concrete thickness, adhesive identification, adhesive expiration date, and adherence to the manufacturer's installation instructions.	1705.3 1703.4.2 1705.1.1	Manufacturer's research report		**X**	Inspection required at start of job for each type and size of adhesive anchor by construction personnel on site. Subsequent installations of the same anchor type and size by the same personnel shall be inspected periodically, unless continuous inspections are mandated by the manufacturer's research report. Any change in the anchor product being installed or the personnel performing the installation shall require another initial inspection.	
Aluminum						
Material verification of structural aluminum: Certified mill test reports.	1705.1.1			**X** (each mill order)		

Schedule of Special Inspections - Table 2 of 9 (Structural Special Inspections)						
System or Material	**Inspection**				**Remarks**	**Inspection Agent No.** (see Table 9)
	Building Code Reference	**Other Code, Standard or Reference**	**Frequency**			
			Continuous	**Periodic**		
Material verification of bolts: Manufacturer's certified test reports.	1705.1.1			**X** (each lot)		
Material verification of weld filler metals.	1705.1.1	AWS D1.2 (Section 5)		**X** (3 rods from each lot)	Checked at fabricator’s shop and at jobsite.	
Verify use of proper WPS's.	1705.1.1	AWS D1.2 (Section 5)		**X** (prior to start of work)	Obtain copy of welding procedure specifications.	
Verify welder qualifications.	1705.1.1	AWS D1.2 (Section 5)		**X** (prior to start of each welder’s work)	Obtain copy of qualification records.	
Complete and partial penetration groove welds.	1705.1.1	AWS D1.2 (Section 5)	**X**			
Multipass fillet welds.	1705.1.1	AWS D1.2 (Section 5)	**X**			
Single pass fillet welds.	1705.1.1	AWS D1.2 (Section 5)		**X** (observe once daily for each welder and visually inspect all welds at the completion of each weld)		

Schedule of Special Inspections - Table 3 of 9 (Architectural Special Inspections) Not Used.						
	Inspection					
	Building Code Reference	**Other Code, Standard or Reference**	**Frequency**			**Inspection Agent No**. (see Table 9)
System or Material			**Continuous**	**Periodic**	**Remarks**	

Schedule of Special Inspections - Table 4 of 9 (Inspections for Special Cases) Not Used.						
	Inspection					
	Building Code Reference	Other Code, Standard or Reference	Frequency		Remarks	Inspection Agent No. (see Table 9)
System or Material			Continuous	Periodic		

Schedule of Special Inspections - Table 5 of 9 (Testing for Special Inspections)					
	Testing				
System or Material	Building Code Reference	Other Code, Standard or Reference	Frequency	Remarks	Testing Agent No. (see Table 9)
Geotechnical					
Classification of controlled fill material.	1705.6	ASTM D2488	One per stratum of on-site excavated material. One per common supply of off-site material.	Per Geotechnical Report and excavation and fill for structures specification.	
Foundation subgrade, in-place density.	1705.6	ASTM D2922 ASTM D1556 or ASTM D2167 (10% of tests to be ASTM D1556 or ASTM D2167)	One test per 1,000 SY, or as required in the excavation and fill for structures specification. Min one per foundation for foundations over 10 SY.	Per Geotechnical Report and excavation and fill for structures specification.	
Controlled fill beneath foundations, in-place density.	1705.6	ASTM D2922 ASTM D1556 or ASTM D2167 (10% of tests to be ASTM D1556 or ASTM D2167)	One test per 200 CY, or as required in the excavation and fill for structures specification. Min one per foundation for foundations over 10 SY.	Per Geotechnical Report and excavation and fill for structures specification.	
Concrete					

Schedule of Special Inspections - Table 5 of 9 (Testing for Special Inspections)					
	Testing				
System or Material	**Building Code Reference**	**Other Code, Standard or Reference**	**Frequency**	**Remarks**	**Testing Agent No**. (see Table 9)
Concrete strength.	1705.3	ASTM C31 ASTM C39 ASTM C172	See concrete specification.	See concrete specification for quantity of cylinders.	
Concrete slump, air content, temperature, unit weight, water soluble chloride ion, shrinkage.	1705.3	ASTM C31 ASTM C138 ASTM C143 ASTM C157 ASTM C172 ASTM C231 ASTM C1064 ASTM C1218	See concrete specification.		

Schedule of Special Inspections - Table 6 of 9 (Special Inspections for Seismic Resistance) Not Used						
	Inspection					
			Frequency			
System or Material	**Building Code Reference**	**Other Code, Standard or Reference**	**Continuous**	**Periodic**	**Remarks**	**Inspection Agent No**. (see Table 9)

Schedule of Special Inspections - Table 7 of 9 (Testing for Seismic Resistance)					
	Testing				
System or Material	**Building Code Reference**	**Other Code, Standard or Reference**	**Frequency**	**Remarks**	**Testing Agent No**. (see Table 9)
Non-Structural Components (Architectural, Mechanical and Electrical)					
For non-structural components and their anchorage that are qualified by means of analysis, testing, or experience data, examine the certificate of compliance furnished by the product manufacturer.	1705.14.2 1705.14.3	ASCE 7 (13.2.1, part 2), ASCE 7 (13.2.2 parts 1, 2)	Each applicable piece of equipment	See the Meteorological and Seismic Design Criteria section (Non-Structural Components Schedule) for the specific components and their anchorages that must be qualified.	

Schedule of Special Inspections - Table 8 of 9 (Special Inspections for Wind Resistance) Not Used						
	Inspection					
			Frequency			
System or Material	**Building Code Reference**	**Other Code, Standard or Reference**	**Continuous**	**Periodic**	**Remarks**	**Inspection Agent No.** (See Table 9)

Schedule of Special Inspections - Table 9 of 9 (Individual Inspection and Testing Agents)					
NAME	**LICENSE NO.**	**FIRM**	**ADDRESS**	**EMAIL**	**TELEPHONE NO.**
1.					( )
2.					( )
3.					( )
4.					( )
5.					( )
6.					( )
7.					( )
8.					( )
9.					( )
10.					( )

Request for Approval of Individual Inspector or Testing Technician

Project:
Project Address:
Name of Inspection/Testing Agency:
Address:
Phone Number:
Name of Primary Inspection Agency's manager/supervisor:

Special Inspector or Testing Technician Name:

Special Inspector or Testing Technican Signature: _____
(as it will appear on reports)

This individual is qualified to inspect:

[ ] Verification of Soils
[ ] Earth Retaining Structure
[ ] Excavation and Filling
[ ] Piling
[ ] Drilled Piers
[ ] Testing of Concrete
[ ] Placement of Concrete
[ ] Placement of Shotcrete
[ ] Placement of Rebar
[ ] Prestressing Concrete
[ ] High Strength Bolting
[ ] Structural Welding
[ ] Steel Frame Inspection
[ ] Structural Masonry
[ ] Erection of Precast
[ ] Inspection of Fabricators
[ ] Precast Fabrication
[ ] Structural Steel
[ ] Metal Building
[ ] EIFS Inspection
[ ] Smoke Control
[ ] Seismic Resistance
[ ] Sprayed Fireproofing
[ ] Architectural Systems
[ ] Mechanical Systems
[ ] Electrical Systems

Current certifications and/or professional licenses retained by the individual:

[ ] Professional Engineer
[ ] Geotechnical Engineer
[ ] Structural Engineer
[ ] Registered Architect
[ ] Registered Geologist
[ ] EI/EIT (min. of 1 yr. related experience)
[ ] GIT (min. of 1 yr. related experience)
[ ] ACI Concrete Field Testing Technician Grade 1
[ ] ACI Concrete Construction Inspector
[ ] ACI Laboratory Testing Technician, Grade 1 or 2
[ ] ACI Strength Testing Technician
[ ] AWS Certified Welding Inspector
[ ] AWS/AISC Certified Structural Steel Inspector
[ ] ASNT NDT Technician Level II or III
[ ] ICC Building Inspector
[ ] ICC Structural Masonry
[ ] ICC Structural Steel and Welding
[ ] ICC Spray-Applied Fire Proofing
[ ] ICC Prestressed Concrete
[ ] ICC Reinforced Concrete
[ ] ICC Structural Steel and Bolting
[ ] ICC Structural Welding
[ ] NCMA Concrete Masonry Testing Technician
[ ] NICET Concrete Technician Level II, III, or IV
[ ] NICET Soils Technician Level II, III, or IV
[ ] NICET Geotechnical Engineering Technician Level II, III, or IV
[ ] EDI EIFS
[ ] Other _____

Copies of current certifications and/or professional licenses and a resume showing the individual's work experience are attached.

I hereby certify that in my judgment the individual is qualified to inspect and/or test the items indicated above.

Primary Special Inspection Agency:

Signed:_____Date:_____
(Primary inspection agency's manager/supervisor)

Contractor's Statement of Responsibility

Each Fabricator, Contractor, or Supplier responsible for the construction or fabrication of a system or component designated in the Statement of Special Inspections shall submit this Statement of Responsibility.

Project:
Contractor's or Supplier's Name:
Address:
License No.:

Description of designated building systems and components included in the Statement of Responsibility:

Acknowledgment of Special Requirements

I hereby acknowledge that I have received, read, and understand the Code Required Special Inspections and Tests program and the Schedule of Special Inspections.

I hereby acknowledge that control will be exercised to obtain conformance with the construction documents approved by the Authority Having Jurisdiction.

Signature Date

Title

Provisions for Quality Control

Procedures for exercising control within the Fabricator's, Contractor's, or Supplier's organization, the method and frequency of reporting and the distribution of reports are attached to this Statement.

Identification and qualifications of the person(s) exercising such control and their position(s) in the organization are attached to this Statement.

Fabricator's Certificate of Compliance

Each approved fabricator that is exempt from Special Inspection of their shop fabricated items shall submit this *Fabricator's Certificate of Compliance* at the completion of fabrication.

Project:
Fabricator's Name:
Address:
Certification or Approval Agency:
Certification Number:
Date of Last Audit or Approval:

Description of structural members and assemblies that have been fabricated:

I hereby certify that items described above were fabricated in strict accordance with the approved construction documents.

Signature Date

Title

Attach copies of fabricator's certification or building code evaluation service report and fabricator's quality control manual.

Final Report of Special Inspections

Project:
Project Address:

Testing / Inspection Agent:
Testing / Inspection Agent Address:
Scope of Testing / Inspections:

To the best of my information, knowledge, and belief, the special inspections or testing required for this project, and designated for this Agent in the Statement of Special Inspections submitted for permit, have been completed in accordance with the contract documents. Based upon my personal observations and written reports, it is my judgment that the inspected work was performed, to the best of my knowledge, in accordance with the building department approved design drawings, specifications, approved change orders, and applicable workmanship provisions of the governing building code.

Interim reports submitted prior to this final report and numbered _____ to _____, form a basis for, and are to be considered an integral part of this final report.

The following discrepancies that were outstanding since the last interim report dated have been corrected:

Items not in conformance, unresolved items or any discrepancies in inspection coverage (i.e., missed inspections, periodic inspections when continuous was required, etc.) are as follows:

Special Inspector's Seal

Prepared By:

Type or print name

Signature Date

(Licensed Professional)

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SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 UNITS OF MEASUREMENT

A. When both inch-pound (English) and SI (metric) units of measurement are specified herein, the values expressed in inch-pound units shall govern.

1.2 OFFICE AT SITE OF WORK

A. During the performance of this Contract, Contractor shall maintain a suitable office at or near the Site which shall be the headquarters of its representative authorized to receive drawings, instructions, or other communication or articles. Office location shall be as shown on the Drawings. Contractor shall limit their office space to what is depicted on the Drawings unless an alternative Use of Site Plan is submitted and accepted by Owner.

B. Any communication given to the said representative or delivered at Contractor's office at the Site in the representative's absence shall be deemed to have been delivered to Contractor.

C. Copies of the Drawings, Specifications, and other Contract Documents shall be kept at Contractor's office at the Site and available for use at all times.In addition, Contractor shall purchase and install a suitable field office with dimensions at least 20 feet wide by 36 feet long, as shown on the Drawings for use of the Resident Project Representative (RPR) and inspectors.

1. The partitioning off of the Contractor’s own office space for use by the RPR will not be permitted.

2. The office trailer shall be provided with an outside entrance door having a substantial lock and stairs with handrail to access the office.

3. A concrete stoop with boot scraper shall be provided at the foot of the stairs. Gravel shall be placed and maintained throughout the life of the project in a 10 foot wide area around the office perimeter.

4. Skirting shall be installed around the entire perimeter of the office, and the office shall be provided with the necessary tie downs. A pole mounted light shall be provided to adequately illuminate the area outside the office.

5. Five parking spaces shall be reserved for the RPR next to the office with the reserved space clearly identified.

6. Windows for light and ventilation shall be provided in the RPR's office. All windows shall be equipped with blinds. Adequate indoor lighting and thermostatically controlled heating and air conditioning shall be provided.

7. Owner shall pay all electricity, water, and data services bills. Contractor shall provide sanitary sewer disposal services as specified herein.

8. The RPR's office shall be plumbed for both hot and cold water service. A restroom located inside the office shall be provided and shall include a sink with hot and cold water service and a toilet. Each of the four offices shall be furnished with a desk, a four-drawer filing cabinet, a worktable, and two chairs. The office shall be furnished with two plan racks, a 4' by 8' table, 6 six chairs, and a 2'-6" wide X 6' high bookcase with six shelves. Appliances to be provided shall include a 1.2 cubic foot, 1000 watt microwave oven and a 4.4 cubic foot refrigerator with freezer.

9. A cleaning service shall clean the RPR's office weekly throughout the project duration. All office cleaning fees shall be paid by Contractor.

10. Maintenance of the RPR's office shall be by Contractor throughout the duration of the project. Maintenance requests not resolved in 48 hours may be resolved by the RPR and the cost of such maintenance backcharged to Contractor.

11. The general arrangement of the RPR's office and facilities provided shall be acceptable to Engineer.

1.3 WATER.

A. All water required for and in connection with the Work to be performed will be furnished by Owner in the vicinity of the Site without charge to Contractor, provided:

1. Contractor shall procure such water in the location and in the manner designated by Engineer.

2. Contractor at its own expense shall make authorized connections and provide means for delivering the water to the Site. Contractor shall make connections to the water lines and install the service water lines as shown on the Drawings.

3. Contractor shall provide adequately against waste and needless use of water.

1.4 POWER.

A. Contractor shall provide all power for heating, lighting, operation of Contractor's equipment, or for any other use by Contractor. Temporary heat and lighting shall be maintained until the Work is accepted.

B. Contractor may obtain power for their site office and trailers at the location shown on the Drawings.

1. Power will be available at:

a. *120/240 volts, 60 Hz, single phase.*

2. Contractor at its own expense shall make authorized connections to the existing power sources and shall extend temporary service lines to the required areas. Temporary wiring shall conform to Article 590 of the NEC.

3. Contractor shall at all times provide adequately against waste and needless use of power. Electrical power shall be used only in such quantities as will not interfere with Owner's requirements, and care shall be taken not to overload the existing facilities. Contractor shall provide any additional or temporary electrical power or power of other voltages it may require for prosecution of the Work.

C.

1.5 VOICE AND DATA SERVICES

A. Contractor shall make all necessary arrangements and pay all installation charges for voice and cellular phone services for its operations. Contractor shall install data lines in its offices at the Site and for separate data lines in the office of the Resident Project Representative.

B. Data service shall consist of a dedicated data line with symmetrical bandwidth equivalent to a standard T1 line (1.4 MB/s or greater) with at least one static IP address dedicated for the exclusive use of the Resident Project Representative’s office. Service shall be similar to Cable Modem data service. The data line shall be terminated in the office space provided for the Resident Project Representative in a wall mounted RJ-45 jack.

1.6 SANITARY FACILITIES

A. Contractor shall furnish temporary sanitary facilities at the Site, as provided herein, for the needs of all construction workers and others performing work or furnishing services on the Project.

B. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 persons. Contractor shall enforce the use of such sanitary facilities by all personnel at the Site.

1.7 MAINTENANCE OF TRAFFIC

A. Contractor shall conduct its work to interfere as little as possible with public travel, whether vehicular or pedestrian. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, Contractor shall provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel, and shall give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when Contractor has obtained permission from the owner and tenant of private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point.

B. In making open-cut street crossings, Contractor shall not block more than one-half of the street at a time. Whenever possible, Contractor shall widen the shoulder on the opposite side to facilitate traffic flow. Temporary surfacing shall be provided as necessary on shoulders. Such maintenance of traffic will not be required when Contractor has obtained permission to obstruct traffic at the designated point.

C. Detours

1. Where required by the authority having jurisdiction that traffic be maintained over any construction work in a public street, road, or highway, and the traffic cannot be maintained on the alignment of the original roadbed or pavement, Contractor shall, at its own expense, construct and maintain a detour around the construction work.

2. Each detour shall include a bridge across the pipe trench and all necessary barricades, guardrails, approaches, lights, signals, signs, and other devices and precautions necessary for protection of the Work and safety of the public.

1.8 BARRICADES AND LIGHTS

A. All streets, roads, highways, and other public thoroughfares which are closed to traffic shall be protected by effective barricades on which shall be placed acceptable warning signs. Barricades shall be located at the nearest intersecting public highway or street on each side of the blocked section.

B. All open trenches and other excavations shall have suitable barricades, signs, and lights to provide adequate protection to the public. Obstructions, such as material piles and equipment, shall be provided with similar warning signs and lights.

C. All barricades and obstructions shall be illuminated with warning lights from sunset to sunrise. Material storage and conduct of the Work on or alongside public streets and highways shall cause the minimum obstruction and inconvenience to the traveling public.

D. All barricades, signs, lights, and other protective devices shall be installed and maintained in conformity with applicable statutory requirements and, where within railroad and highway rights-of-way, as required by the authority having jurisdiction.

1.9 FENCES

A. All existing fences affected by the Work shall be maintained by Contractor until completion of the Work. Fences which interfere with construction operations shall not be relocated or dismantled until written permission is obtained from the owner of the fence, and the period the fence may be left relocated or dismantled has been agreed upon. Where fences must be maintained across the construction easement, adequate gates shall be installed. Gates shall be kept closed and locked at all times when not in use.

B. On completion of the Work across any tract of land, Contractor shall restore all fences to their original or to a better condition and to their original locations.

1.10 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

A. Contractor shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by its construction operations. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and shrubs in yards, parkways, and medians, shall be restored to their original condition, whether within or outside the easement. All replacements shall be made with new materials.

B. No trees shall be removed outside the permanent easement, except where authorized by Engineer . Whenever practicable, Contractor shall tunnel beneath trees in yards and parkings when on or near the line of trench. Hand excavation shall be employed as necessary to prevent injury to trees. Trees left standing shall be adequately protected against damage from construction operations.

C. Contractor shall be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, and other public or private property, regardless of location or character, which may be caused by transporting equipment, materials, or workers to or from the Work or any part or site thereof, whether by Contractor of its Subcontractors. Contractor shall make satisfactory and acceptable arrangements with the owner of, or the agency or authority having jurisdiction over, the damaged property concerning its repair or replacement or payment of costs incurred in connection with the damage.

D. All fire hydrants and water control valves shall be kept free from obstruction and available for use at all times.

1.11 DAMAGE TO EXISTING PROPERTY

A. Contractor will be held responsible for any damage to existing structures, Work, materials, or equipment because of his operations and shall repair or replace any damaged structures, Work, materials, or equipment to the satisfaction of, and at no additional cost to, Owner.

B. Contractor shall protect all existing structures and property from damage and shall provide bracing, shoring, or other work necessary for such protection.

C. Contractor shall be responsible for all damage to streets, roads, curbs, sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property, which may be caused by transporting equipment, materials, or workers to or from the Work. Contractor shall make satisfactory and acceptable arrangements with the agency having jurisdiction over the damaged property concerning its repair or replacement.

1.12 TREE AND PLANT PROTECTION

A. All trees and other vegetation which must be removed to perform the Work shall be removed and disposed of by Contractor; however, no trees or cultured plants shall be unnecessarily removed unless their removal is indicated on the Drawings. All trees and plants not removed shall be protected against injury from construction operations.

B. Trees considered by Engineer to have any significant effect on construction operations are indicated on the Drawings and those which are to be preserved are so indicated.

C. Contractor shall take extra measures to protect trees designated to be preserved, such as erecting barricades, trimming to prevent damage from construction equipment, and installing pipe and other Work by means of hand excavation or tunneling methods. Such trees shall not be endangered by stockpiling excavated material or storing equipment against their trunks.

D. When injuring or removal of trees designated to be preserved cannot be avoided, or when removal and replacement is indicated on the Drawings, each tree injured beyond repair or removed shall be replaced with a similar tree of the nearest size possible.

E. All trimming, repair, and replacement of trees and plants shall be performed by qualified nurserymen or horticulturists.

1.13 SECURITY

A. Contractor shall be responsible for protection of the Site, and all Work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons. Any personnel employed by the Contractor who are not authorized to be working within the confines of the existing plant may be removed from the project if

they are found to be within the existing plant. Any work which requires the Contractor to enter the confines of the existing plant or any of the existing facilities shall be coordinated with the Owner at least 24 hours in advance.

B. No Claim shall be made against Owner by reason of any act of an employee or trespasser, and Contractor shall make good all damage to Owner's property resulting from Contractor's failure to provide security measures as specified.

C. Security measures shall be at least equal to those usually provided by Owner to protect Owner's existing facilities during normal operation, but shall also include such additional security fencing, barricades, lighting, and other measures as required to protect the Site.

1.14 ACCESS ROADS

A. Contractor shall establish and maintain temporary access roads to various parts of the Site as required to complete the Project. Such roads shall be available for the use of all others performing work or furnishing services in connection with the Project. Haul routes for heavy truck traffic removing excavation spoils or importing materials shall be limited to the areas shown on the Drawings unless otherwise approved by Owner. Where existing ductbanks, pipelines, or other utilities must be crossed, steel road plates, crane mats, or other suitable materials shall be installed over the utilities to avoid damage. Methods for protecting buried infrastructure shall be provided to the Owner to review.

1.15 PARKING

A. Contractor shall provide and maintain suitable parking areas for the use of all workers and others performing work or furnishing services in connection with the Project, as required to avoid any need for parking personal vehicles where they may interfere with public traffic, Owner's operations, or construction activities. Parking shall be limited to the areas shown on the Drawings unless approved by Owner.

1.16 NOISE CONTROL

A. Contractor shall take reasonable measures to avoid unnecessary noise. Such measures shall be appropriate for the normal ambient sound levels in the area during working hours. All construction machinery and vehicles shall be equipped with practical sound-muffling devices, and operated in a manner to cause the least noise consistent with efficient performance of the Work.

1.17 DUST CONTROL

A. Contractor shall take reasonable measures to prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by application of a chemical dust suppressant. When practicable, dusty materials in piles or in transit shall be covered to prevent blowing dust.

B. Buildings or operating facilities which may be affected adversely by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels, or similar equipment shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.

1.18 TEMPORARY DRAINAGE PROVISIONS

A. Contractor shall provide for the drainage of storm water and such water as may be applied or discharged on the Site in performance of the Work. Drainage facilities shall be adequate to prevent damage to the Work, the Site, and adjacent property.

B. Existing drainage channels and conduits shall be cleaned, enlarged, or supplemented as necessary to carry all increased runoff attributable to Contractor's operations. Dikes shall be constructed as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect Owner's facilities and the Work, and to direct water to drainage channels or conduits. Ponding shall be provided as necessary to prevent downstream flooding.

1.19 EROSION CONTROL

A. Refer to the Erosion and Sedimentation Controls section.

1.20 POLLUTION CONTROL

A. Contractor shall prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities. No sanitary wastes shall be permitted to enter any drain or watercourse other than sanitary sewers. No sediment, debris, or other substance shall be permitted to enter sanitary sewers, and reasonable measures shall be taken to prevent such materials from entering any drain or watercourse.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

Section 01 61 00 - GENERAL EQUIPMENT STIPULATIONS

PART 1 - GENERAL

1.1 SCOPE

A. When an equipment specification section in this Contract references this section, the equipment shall conform to the general stipulations set forth in this section, except as otherwise specified in other sections.

1.2 COORDINATION

A. Contractor shall coordinate all details of the equipment with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible. Contractor shall be responsible for all structural and other alterations in the Work required to accommodate equipment differing in dimensions or other characteristics from that contemplated in the Drawings or Specifications.

1.3 MANUFACTURER'S EXPERIENCE

A. Unless specifically named in the Specifications, a manufacturer shall have furnished equipment of the type and size specified which has been in successful operation for not less than the past 5 years.

1.4 WORKMANSHIP AND MATERIALS

A. Contractor shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.

B. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests.

C. Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be at least

1/4 inch thick. When dissimilar metal components are used, consideration shall be given to prevention of galvanic corrosion.

1.5 STRUCTURAL DESIGN REQUIREMENTS

A. All equipment, including non-structural components and non-building structures as defined in ASCE 7, and their anchorage, shall be designed and detailed in accordance with the Meteorological and Seismic Design Criteria section.

1.6 LUBRICATION

A. Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during startup or shutdown and shall not waste lubricants.

B. Lubricants of the types recommended by the equipment manufacturer shall be provided in sufficient quantities to fill all lubricant reservoirs and to replace all consumption during testing, startup, and operation prior to acceptance of equipment by Owner. Lubricants for equipment where the lubricants may come in contact with water before or during a potable water treatment process or with potable water, shall be food grade lubricants. This includes lubricants for equipment not normally in contact with water, but where accidental leakage of the lubricants may contaminate the water.

C. Lubrication facilities shall be convenient and accessible. Oil drains and fill openings shall be easily accessible from the normal operating area or platform. Drains shall allow for convenient collection of waste oil in containers from the normal operating area or platform without removing the unit from its normal installed position.

1.7 ELEVATION

A. The elevation of the site shall be as indicated in the Meteorological and Seismic Design Criteria section. All equipment furnished shall be designed to meet stipulated conditions and to operate satisfactorily at the specified elevation.

1.8 ELECTRIC MOTORS

A. Unless otherwise specified, motors furnished with equipment shall meet the requirements specified in Common Motor Requirements for Process Equipment section or specified in specific equipment sections.

1.9 DRIVE UNITS

A. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor. Drive units shall be designed for 24 hour continuous service.

B. GEARMOTORS

1. The use of gearmotors sharing an integral housing or cutgears into the motor output shaft, or that require removal of lubricant from the gear reducer to change out the motor will not be acceptable.

C. GEAR REDUCERS

1. Each gear reducer shall be a totally enclosed unit with oil or grease lubricated, rolling element, antifriction bearings throughout.

D. Unless superseded by individual specification requirements each helical, spiral bevel, combination bevel-helical, and worm gear reducers shall have a service factor of at least 1.50 based on the nameplate horsepower of the drive motor. Cycloidal gear reducers shall have a service factor of at least 2.0 based on the nameplate horsepower of the drive motor. Shaft-mounted and flange-mounted gear reducers shall be rated AGMA Class III. Helical gear reducers shall have a gear strength rating to catalog rating of 1.5. Each gear reducer shall be designed and manufactured in compliance with applicable most current AGMA standards, except the L_{10} bearing life shall be 200, 000 hours.

E. The thermal horsepower rating of each unit shall equal or exceed the nameplate horsepower of the drive motor. During continuous operation, the maximum sump oil temperature shall not rise more than 100°F above the ambient air temperature in the vicinity of the unit and shall not exceed 200°F .

F. Each grease lubricated bearing shall be installed in a bearing housing designed to facilitate periodic regreasing of the bearing by means of a manually operated grease gun. Each bearing housing shall be designed to evenly distribute new grease, to properly dispose of old grease, and to prevent overgreasing of the bearing. The use of permanently sealed, grease lubricated bearings will not be acceptable in large sized reducers. In small reducers, similar to basin equipment, permanently sealed grease lubricated bearings rated L_{10} 200,000 hour life may be provided at the manufacturer's option. An internal or external oil pump and appurtenances shall be provided if required to properly lubricate oil lubricated bearings. A dipstick or a sight glass arranged to permit visual inspection of lubricant level shall be provided on each unit.

G. Gear reducers which require the removal of parts or the periodic disassembly of the unit for cleaning and manual regreasing of bearings will not be acceptable.

H. Certification shall be furnished by the gear reducer manufacturer indicating that the intended application of each unit has been reviewed in detail by the manufacturer and that the unit provided is fully compatible with the conditions of installation and service.

I. Adjustable Speed Drives.

1. Each mechanical adjustable speed drive shall have a service factor of at least 1.75 at maximum speed based on the nameplate horsepower of the drive motor. A spare belt shall be provided with each adjustable speed drive unit employing a belt for speed change. Unless specifically permitted by the detailed equipment specifications, bracket type mounting will not be acceptable for variable speed drives.

J. V-Belt Drives.

1. Each V-belt drive shall include a sliding base or other suitable tension adjustment. V-belt drives shall have a service factor of at least 1.75 at maximum speed based on the nameplate horsepower of the drive motor.

1.10 SAFETY GUARDS

A. All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 USS gage thick or thicker galvanized, aluminum-clad sheet steel, or stainless sheet steel or from 1/2 inch mesh galvanized expanded metal, or pultrusion molded UV resistant materials. Each safety guard shall be reinforced or shaped to provide suitable strength to prevent vibration and deflection and shall comply with OSHA. Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

1.11 ANCHOR BOLTS

A. Equipment suppliers shall design and detail suitable anchor bolts for each item of equipment. Anchor bolts shall be designed for all operating conditions of the equipment, including wind and seismic loadings when applicable. Wind and seismic loads shall be as indicated in the Meteorological and Seismic Design Criteria section.

B. Requirements for anchor bolt type, material, and minimum diameter shall be as indicated in the Anchorage in Concrete and Masonry section.

C. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete or masonry grout is placed.

D. Unless otherwise indicated or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete.

1.12 EQUIPMENT BASES

A. Unless otherwise indicated or specified, all equipment shall be installed on concrete bases at least 6 inches . Cast iron or welded steel baseplates shall be provided for pumps, compressors, and other equipment. Each unit and its drive assembly shall be supported on a single baseplate of neat design. Baseplates shall have pads for anchoring all components, and adequate grout holes. Baseplates for pumps shall have a means for collecting leakage and a threaded drain connection. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with grout as specified in the Grouting section.

1.13 SPECIAL TOOLS AND ACCESSORIES

A. Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

1.14 SHOP PAINTING

A. All iron and steel surfaces of the equipment shall be protected with suitable protective coatings applied in the shop. Surfaces of the equipment that will be inaccessible after assembly shall be protected for the life of the equipment. Coatings shall be suitable for the environment where the equipment is installed. Exposed surfaces shall be finished, thoroughly cleaned, and filled as necessary to provide a smooth, uniform base for painting. Electric motors, speed reducers, starters, and other self-contained or enclosed components shall be shop primed or finished with an epoxy or polyurethane enamel or universal type primer suitable for top coating in the field with a universal primer and aliphatic polyurethane system.

B. Surfaces to be coated after installation shall be prepared for painting as recommended by the paint manufacturer for the intended service, and then shop painted with one or more coats of a universal primer.

C. Machined, polished, and nonferrous surfaces which are not to be painted shall be coated with rust-preventive compound as recommended by the equipment manufacturer.

1.15 PREPARATION FOR SHIPMENT

A. Equipment shall be prepared for shipment as specified in the Product Delivery Requirements section.

1.16 STORAGE

A. Handling and storage of equipment shall be as specified in the Product Storage and Handling Requirements section.

1.17 INSTALLATION AND OPERATION

A. Installation and operation shall be as specified in respective equipment sections and the Commissioning section.

1.18 OBSERVATION OF PERFORMANCE TESTS

A. Where the Specifications require the presence of Engineer, initial tests shall be observed or witnessed by Engineer. Owner shall be reimbursed by Contractor for all costs of subsequent visits by Engineer to witness or observe incomplete tests, retesting, or subsequent tests.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

Section 01 65 00 - PRODUCT DELIVERY REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE

A. This section covers packaging and shipping of materials and equipment.

1.2 PREPARATION FOR SHIPMENT

A. All equipment shall be suitably packaged to facilitate handling and to protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept dry at all times.

B. Painted and coated surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted and coated surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

C. Grease and lubricating oil shall be applied to all bearings and similar items.

1.3 SHIPPING

A. Before shipping each item of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

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Section 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE

A. This section covers delivery, storage, and handling of materials and equipment.

1.2 DELIVERY

A. Contractor shall bear the responsibility for delivery of equipment, spare parts, special tools, and materials to the site and shall comply with the requirements specified herein and shall provide required information concerning the shipment and delivery of the materials specified in this Contract. These requirements also apply to any subsuppliers making direct shipments to the Site.

B. Contractor shall, either directly or through contractual arrangements with others, accept responsibility for the safe handling and protection of the equipment and materials furnished under this Contract before and after receipt at the port of entry. Acceptance of the equipment shall be made after it is installed, tested, placed in operation and found to comply with all the specified requirements.

C. All items shall be checked against packing lists immediately on delivery to the site for damage and for shortages. Damage and shortages shall be remedied with the minimum of delay.

D. Delivery of portions of the equipment in several individual shipments shall be subject to review of Engineer before shipment. When permitted, all such partial shipments shall be plainly marked to identify, to permit easy accumulation, and to facilitate eventual installation.

1.3 STORAGE

A. Upon delivery, all equipment and materials shall immediately be stored and protected until installed in the Work.

B. Stacked items shall be suitably protected from damage by spacers or load distributing supports that are safely arranged. No metalwork (miscellaneous steel shapes and reinforcing steel) shall be stored directly on the ground. Masonry products shall be handled and stored in a manner to hold breakage, chipping, cracking, and spalling to a minimum. Cement, lime, and similar products shall be stored off the ground on pallets and shall be covered and kept completely dry at all times. Pipe, fittings, and valves may be stored out of doors, but must be placed on wooden blocking. PVC pipe,

geomembranes, plastic liner, and other plastic materials shall be stored off the ground on pallets and protected from direct sunlight.

C. Pumps, motors, electrical equipment, and all equipment with antifriction or sleeve bearings shall be stored in weathertight structures maintained at a temperature above 60°F . Electrical equipment, controls, and insulation shall be protected against moisture and water damage. All space heaters furnished in equipment shall be connected and operated continuously.

D. Equipment having moving parts, such as gears, bearings, and seals, shall be stored fully lubricated with oil, grease, etc., unless otherwise instructed by the manufacturer. Manufacturer's storage instructions shall be carefully followed by Contractor.

E. When required by the equipment manufacturer, moving parts shall be rotated a minimum of twice a month to ensure proper lubrication and to avoid metal to metal "welding". Upon installation of the equipment, Contractor shall, at the discretion of Engineer, start the equipment at one-half load for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.

F. When required by the equipment manufacturer, 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 by Contractor at the time of acceptance.

G. Equipment and materials shall not show any pitting, rust, decay, or other deleterious effects of storage when installed in the Work.

H. In addition to the protection specified for prolonged storage, the packaging of spare units and spare parts shall be for export packing and shall be suitable for long-term storage in a damp location. Each spare item shall be packed separately and shall be completely identified on the outside of the container.

1.4 HANDLING

A. Stored items shall be laid out to facilitate their retrieval for use in the Work. Care shall be taken when removing the equipment for use to ensure the precise piece of equipment is removed and that it is handled in a manner that does not damage the equipment.

B. During handling, carbon steel constructed material including chains, straps, and forks on lifting equipment shall not directly contact any equipment or material constructed of stainless steel. It shall be the Contractor’s responsibility to correct any carbon steel contamination of stainless steel.

Product Storage and Handling Requirements

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

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SECTION 01 67 00 - METEOROLOGICAL AND SEISMIC DESIGN CRITERIA

PART 1 - GENERAL

1.1 SCOPE

A. Buildings, non-structural components and non-building structures shall be designed in accordance with this section. In the event of conflict with requirements in other sections, the more stringent criteria shall be followed.

1.2 DESIGN CRITERIA

A. Buildings and non-structural components including anchorage of such items, shall be designed in accordance with the following criteria.

1. General Design Data		
	Building code and references	Arkansas Fire Prevention Code Volume II, 2020, based on IBC 2021, ASCE 7-16 “Minimum Design Loads and Associated Criteria for Buildings and Other Structures”, AISC 360 “Specification for Structural Steel Buildings”, AISC 341 “Seismic Provisions for Structural Steel Buildings”
	Site elevation, above mean sea level (ft)	1365.00
	Design flood elevation (ft)	X (unshaded)
	Design groundwater elevation (ft)	1338.00
2. Wind Design Data		
	Basic (Ultimate) design wind speed, V (mph)	115
	Allowable Stress (Nominal) design wind speed, V_{asd} (mph)	89
	Exposure category	C
	Ground elevation factor, K_e	1.0
	Risk Category	III
3. Snow Design Data		
	Ground snow load, P_g (psf)	15

	Importance factor (snow loads), I	1.1
	Exposure factor (C_e)	1.0
	Thermal factor (C_t)	1.0
4. Ice Design Data		
	Nominal ice thickness, t (in)	2.00
	Concurrent wind speed, V_c (mph)	30
	Importance factor (ice loads – ice thickness), I_i	1.15
	Importance factor (ice loads – concurrent wind), I_w	1.00
5. Seismic Design Data		
	Mapped MCE short period spectral response acceleration, S_S	0.161 g
	Mapped MCE one second period spectral response acceleration, S_1	0.092 g
	Design short period spectral response acceleration, S_{DS}	0.139 g
	Design one second period spectral response acceleration, S_{D1}	0.092 g
	Risk Category	III
	Clearwell Building Importance factor, I	1.25
	Clearwell Building Seismic Design Category	B
	Flow Meter Vault Building Importance factor, I	1.25
	Flow Meter VaultBuilding Seismic Design Category	B
	Non-Structural Components Importance Factor, I_P	As indicated in the Non-Structural Components Schedule
	Non-Structural Components Seismic Design Category	B
	Non-Building Structures Importance Factors, I	As indicated in the Non-Building Structure Schedule or in the applicable reference documents, whichever is greater.

1.3 WIND ANCHORAGE

A. Equipment that is to be located outdoors shall have anchor bolts designed for the effects of wind forces, as determined in accordance with ASCE 7, Chapters 26-31.

B. Design of anchorage shall be in accordance with the Anchorage in Concrete and Masonry section.

1.4 SEISMIC DESIGN

A. General.

1. Structural systems shall provide continuous load paths, with adequate strength and stiffness to transfer all seismic forces from the point of application to the point of final resistance.

B. Non-Structural Components.

1. Non-structural components are architectural, mechanical, and electrical items that are permanently attached to and supported by a structure but are not part of the structural system, as indicated in Chapter 13 of ASCE 7. The Non-Structural Components Schedule identifies the components that require seismic design. The requirements of this paragraph are applicable only to the items listed in the Non-Structural Components Schedule.

2. General

   a. Design of non-structural components shall be in accordance with all applicable provisions of ASCE 7, Chapter 13.
   b. "W_p" shall include the total operating weight of the component or system, including, but not limited to, any insulation, fluids, and concentrated loads such as valves, condensate traps, and similar components.

3. Submerged Components

   a. Components that are to be submerged in water shall be designed to withstand loads from the effects of water sloshing during the seismic event.
   b. The calculation of the sloshing effects shall be in accordance with the latest edition of ACI 350.3.

4. Anchorage Design

   a. Every component in the Non-Structural Components Schedule shall have its anchorage to the supporting structure designed in accordance with ASCE 7, Chapter 13.
   b. Design of anchorage shall be in accordance with the Anchorage in Concrete and Masonry section.

c. Components shall be attached so that seismic forces are transferred to the structural system. Curbs that support roof-mounted equipment shall be designed to transfer forces from the equipment into the main structural roof members. All structural attachments shall be bolted, welded, or otherwise positively fastened. Frictional resistance due to gravity shall not be considered in evaluating the required resistance to seismic forces.

5. Component Design

a. Every component in the Non-Structural Components Schedule shall be designed for seismic conditions in accordance with ASCE 7, Chapter 13.
b. Components shall have sufficient strength and ductility to resist the specified seismic effects, and shall meet all of the design, proportioning, detailing, inspection, and quality assurance provisions of the specified building code and other referenced codes. Components shall be designed to be operable during and following a design level seismic event without collapsing, breaking away from supports, creating an ignition hazard, or releasing any contents.
c. Seismic effects that shall be analyzed in the design of piping systems include the dynamic effects of the piping system, contents, and supports. The interaction between piping systems and the supporting structures, including other mechanical and electrical equipment, shall also be considered. Where pipe supports are to be designed by Contractor, as required by the Pipe Supports section, both the piping and support systems shall be designed to meet the applicable requirements of ASCE 7, Chapter 13.

6. Seismic Certification

a. Design of components and their anchorage shall be certified by one of the following methods.
    1) Analysis and design by a design professional registered in the state of the project. Certification by analysis shall be permitted only for nonactive components, and shall be based on seismic demand considering R_p/I_p equal to 1.0.
    2) Shake table testing based upon a nationally recognized testing standard procedure, such as ICC-ES AC 156, acceptable to the authority having jurisdiction.
    3) Experience data, based upon nationally recognized procedures acceptable to the authority having jurisdiction.

b. Components indicated in the Non-Structural Components Schedule to require special seismic certification shall be certified only by methods 2 or 3 above, except that certification for containment of hazardous materials may be by any of the three methods.

7. Construction Documents

a. Construction documents (fabrication or shop drawings) of non-structural components shall be sealed by a design professional that is registered in the state of the project.
b. Documents shall be sealed whether the basis for certification is analysis and design, shake table testing, or experience data.
c. The sealing method shall clearly indicate that the component and its anchorage have been designed for the code required seismic forces.

8. Submittals

a. The construction documents, structural design calculations, shake table certification, and experience data certification, as applicable, shall be submitted in accordance with the Submittal Procedures section.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

Non-Structural Components Schedule			
Component	Applicable Specification Section	Importance Factor (I_p)	Special Seismic Certification Required
Floor Access Doors and Hatches	08 31 19		
Treated Water Sample Pumps	22 13 29.14	1.0	
Submersible Sump Pumps	22 13 29.17	1.0	
Panels, Consoles, and Appurtenances	40 67 00	1.0	
Piping Systems and Related Pipe Supports	Division 40	1.0	
HVAC Equipment	23 00 00	1.0	
Ductwork Including Inline Components	23 00 00	1.0	
Lighting Fixtures	26 05 11	1.0	
Lighting Panels	26 05 11	1.0	
Control Stations	26 05 11	1.0	

Note: Some specification sections listed in the Non-Structural Components Schedule cover multiple items. Within those sections, some components may be exempt from seismic design based on their weight and/or their height above the floor. Reference ASCE 7, Paragraph 13.1.4 for specific conditions of the exemptions. Some distribution systems such as conduit, cable tray, raceways, duct systems, and piping and tubing systems may also be exempt from seismic design based on their loads and support mechanisms as indicated in their respective paragraphs in ASCE 7, Chapter 13.

Section 01 68 00 - EQUIPMENT AND VALVE IDENTIFICATION

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the furnishing and installation of nameplates and tags for identification of equipment, valves, panels, and instruments.

1.2 GENERAL

A. Except as otherwise specified in equipment, valve, and instrumentation sections, nameplates and tags shall be as specified herein. Nameplates or tags shall be provided for all equipment, valves, operator interfaces, control and electrical panels, cabinets, instruments, and instrument racks that have been named and/or tagged on the Drawings.

1.3 SUBMITTALS

A. Drawings and Data

1. Drawings and data shall be submitted in accordance with the requirements of the Submittals Procedures section for each type of tag provided including materials, colors, sizes, letter sizes, and installation instructions.

PART 2 - PRODUCTS

2.1 EQUIPMENT NUMBER PLATES

A. All equipment tagged on the drawings, except for submerged equipment shall be provided with number plates bearing the equipment tag number identified on the Drawings.

B. Number plates shall be bevelled, 1/8th inch thick laminated black phenolic plastic engraving stock with white core. Lettering on number plates shall be capitalized block letters ¾ inch high.

C. Number plate height shall be twice the letter height. Number plate length shall be as needed, with suitable margins all around.

D. Lettering shall be placed in one row where practicable; however, where necessary due to excessive length, lettering shall be placed on more than one row and centered.

E. Number plates shall be attached with stainless steel panhead screws, rivets, or drive screws.

F. When a number plate cannot be installed due to the physical size, space, or mounting surface geometry of the equipment, the Contractor shall provide a 12 gauge stainless steel tag with engraved or imprinted equipment tag number. Lettering on tags shall be ¼ inch high. Tags shall be rectangular with smooth edges and shall be fastened to the equipment with stainless steel mechanical fasteners or with a stainless steel chain.

2.2 EQUIPMENT INFORMATION PLATES

A. Equipment shall be provided with engraved or stamped equipment information plates securely affixed with mechanical fasteners to the equipment in an accessible and visible location.

B. Equipment information plates shall be in addition to the number plates specified.

C. Equipment information plates shall indicate the manufacturer's name, address, product name, catalog number, serial number, capacity, operating and power characteristics, labels of tested compliances, and any other pertinent design data.

D. Equipment information plates listing the distributing agent only will not be acceptable.

2.3 VALVE AND GATE TAGS

A. Temporary Tags

1. Each valve and gate with an identifying number indicated on the Drawings or listed in the valve or gate schedule, shall be tagged or marked in the factory with the identifying number.

B. Permanent Tags

1. All valves and gates, except buried or submerged valves, that have been assigned a number on the Drawings or in the valve or gate schedule, shall be provided with a permanent number plate.

2. Tags shall be permanently attached to valves and gates with stainless steel mechanical fasteners or with stainless steel chains. Numerals shall be ¾ inch high and shall be black baked enamel on an anodized aluminum plate.

C. All buried valves shall be tagged with a brass plate cast into a 12-inch by 8 inch concrete pad at grade next to the valve box. The valve number, number of rotations to open or close the valve, and the direction to open the valve shall be engraved in the brass plate with lettering and numerals at least 1 inch high.

2.4 PANEL NAMEPLATES

A. Nameplates shall be provided on the face of each panel and cabinet. Panel identification nameplates shall be mounted at the top of the panel shall include the panel descriptive name and tag number as indicated on the Drawings, in two or three lines of text. Lettering shall be ¾ inch high.

B. Nameplates for devices mounted on or in the panel shall be inscribed with the text as indicated on the Drawings. Where nameplate information is not indicated on the Drawings, inscriptions shall be in accordance with information in the supplier's submittal drawings as guided by information in the relevant specification section. Panel device nameplates shall have engraved letters 3/16 inch high.

C. Nameplate material and size shall be as specified above for equipment number plates. Nameplates shall be secured to the panel with stainless steel panhead screws.

2.5 INSTRUMENT TAGS

A. Temporary Tags

1. Where instruments are not provided with permanent tags furnished from the factory, instruments shall be tagged or marked in the factory with the instrument tag number indicated on the Drawings.

B. Permanent Tags

1. Instruments shall be tagged with the instrument tag number indicated on the Drawings. Tags shall be 12 gauge stainless steel with engraved or imprinted symbols. Lettering on tags shall be ¼ inch high. Tags shall be rectangular with smooth edges, and shall be fastened to the instrument with stainless steel mechanical fasteners or with a stainless steel chain.

PART 3 - EXECUTION (NOT USED)

End of Section

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Section 01 69 00 - EQUIPMENT SCHEDULE

PART 1 - GENERAL

1.1 SCOPE

A. This section consists of an equipment schedule for items for which a basic level of manufacturer's field services or operation and maintenance manuals are required, but not covered in other sections. When other sections indicate that manufacturer's field services and operation and maintenance manuals are required, the requirements shall be as specified in the other sections.

B. Specific requirements for manufacturer's field services are covered in the Quality Control section and the equipment specifications.

C. Specific requirements for operation and maintenance manuals are covered in the Submittals Procedures section and the equipment specifications.

1.2 SCHEDULE

A. Manufacturer's field services, including equipment installation checks and training, and operation and maintenance manuals shall be provided for the items of equipment indicated in the following schedule:

Spec Section	Type of Equipment	Mfr's. Field Services	O&M Manual
22 13 29.14	Treated Water Sample Pumps		X
22 13 29.16	Submersible Sump Pumps		X
40 05 64.11	AWWA Butterfly Valves	X	X
40 05 59.13	Slide Gate	X	X
40 61 11	Instrumentation and Control System		X
40 71 00	Flow Instruments	X	X

Equipment Schedule

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section

Section 01 73 19 - EQUIPMENT INSTALLATION

PART 1 - GENERAL

1.1 SCOPE

A. This section covers general installation requirements of new equipment units that have been purchased by Contractor as part of this Work. Equipment specific installation requirements are covered in the equipment sections.

1.2 GENERAL

A. Equipment installed under this section shall be erected and placed in proper operating condition in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

B. Any existing equipment which is removed and salvaged for reinstallation shall be handled as indicated in the Demolition section.

C. Coordination

1. When manufacturer's field services are provided by the equipment manufacturer, Contractor shall coordinate the services with the equipment manufacturer. Contractor shall give Engineer written notice at least 30 days prior to the need for manufacturer's field services furnished by others.

2. Flanged connections to equipment including the bolts, nuts, and gaskets are covered in the appropriate pipe specification section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall be as follows:

1. Grout: As specified in the Grouting section.

2. Anti-Seize thread lubricant for SS bolts: As specified in the Anchorage in Concrete and Masonry section.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment shall not be installed or operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary to obtain proper results as specified in the Commissioning section.

B. Each equipment unit shall be leveled, aligned, and shimmed into position. Installation procedures shall be as recommended by the equipment manufacturer and as required herein. Shimming between machined surfaces will not be permitted.

C. Anti-seize thread lubricant shall be liberally applied to the threaded portion of all stainless steel bolts during assembly. For equipment installed in drinking water facilities, the anti-seize lubricant shall meet requirements of NSF-61.

D. When specified in the equipment sections, the equipment manufacturer will provide installation supervision and installation checks. For installation supervision, the manufacturer’s field representative will observe, instruct, guide, and direct Contractor's erection or installation procedures as specified in the equipment specifications. For installation checks, the manufacturer’s field representative will inspect the equipment installation immediately following installation by Contractor, and observe the tests indicated in the Commissioning section. The manufacturer's representatives will revisit the site as often as necessary to ensure installation satisfactory to Owner.

E. All equipment shall be protected after installation, prior to final acceptance by Owner. Protection provisions shall be as recommended by the manufacturer, and shall include provisions to prevent rust, mechanical damage, and foreign objects entering the equipment.

3.2 STARTUP AND TESTING

A. Commissioning, and tests associated with startup shall be as indicated in the Commissioning section. Other field tests shall be as indicated in the specific equipment sections. Startup and tests required shall occur in the order listed in the following paragraphs. Tests shall not begin until any installation supervision and installation checks by the equipment manufacturer have been completed, except where noted below.

B. Preliminary Field Tests.

1. Preliminary field tests shall be conducted on all equipment by Contractor as indicated in the Commissioning section. When an installation check is specified

in the equipment sections, the equipment manufacturer's representative will participate in these tests to the extent described in the Commissioning section and in the equipment sections.

C. Field System Operation Tests.

1. Field system operation tests shall be conducted on all equipment by Contractor as indicated in the Commissioning section. When an installation check is specified in the equipment sections, the equipment manufacturer's service personnel will participate in these tests to the extent described in the Commissioning section and in the equipment sections.

D. Field Demonstration Tests.

1. Field demonstration tests will be conducted by the equipment manufacturer on equipment as indicated and as specified in the equipment sections.

E. Field Performance Tests & Distribution Tests.

1. Field performance tests or distribution tests will be conducted by the equipment manufacturer on equipment as indicated and as specified in the equipment sections.

End of Section

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Section 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 DESCRIPTION.

A. This section contains requirements for training the Owner's personnel in the proper operation and maintenance of the equipment and systems installed under this contract.

1.2 GENERAL.

A. Where indicated in the Equipment Schedule section and as required by the specifications, the manufacturer's representative shall provide on-the-job training of the Owner's personnel. The training sessions shall be conducted by qualified, experienced, factory trained representatives of the various equipment manufacturers. Training shall include instruction in both operation and maintenance of the subject equipment.

1.3 SUBMITTALS.

A. General

1. The following information shall be submitted to the Engineer in accordance with the provisions of the Submittals section. The material shall be submitted not less than 4 weeks prior to the provision of training.

2. Lesson plans, training manuals, handouts, visual aids, and other reference materials for each training session to be conducted by the manufacturer's representatives.

3. Subject of each training session, identity and qualifications of individuals to be conducting the training, and tentative date and time of each training session.

PART 2 - PRODUCTS

2.1 GENERAL.

A. Where specified, the Contractor shall conduct training sessions for the Owner's personnel to instruct staff on the proper operation, care, and maintenance of the equipment and systems installed under this contract. Training shall take place at the site of the work and under the conditions specified in the following paragraphs. Approved operation and maintenance manuals shall be available at least 30 days prior to the date schedule for the individual training session.

2.2 LOCATION.

A. Training sessions shall take place at the site of the work at a location designated by the Owner.

2.3 LESSON PLANS.

A. Formal written lesson plans shall be prepared for each training session. Lesson plans shall contain an outline of the material to be presented along with a description of the visual aids to be utilized during the sessions. Each plan shall contain time allocation for each subject.

B. One complete set of originals of the lesson plans, training manuals, handouts, visual aids and reference materials shall be the property of the Owner and shall be suitable bound for proper organization and easy reproduction. The Contractor shall furnish ten copies of necessary training manuals, handouts, visual aids, and reference materials at least 1 week prior to each training session.

2.4 FORMAT AND CONTENT.

A. Each training session shall include classroom and time at the location of the subject equipment or system. As a minimum, training sessions shall cover the following subjects for each item of equipment or system:

1. Familiarization

a. Review catalog, parts lists, drawings, etc, which have been previously provided for the plan files and operation and maintenance manuals.
b. Guided inspection of the subject equipment.
c. Demonstration of the subject equipment and how operation in accordance with the specified requirements.

2. Safety

a. Review and demonstration of safety procedures and related documentation.
b. Inspection and discussion of hazardous components of the subject equipment.

3. Operation

a. Review of subject equipment operations literature and theory of operation.
b. Overview of equipment operation and function.
c. Explanation and demonstration of all modes of operation including start up, shut down, normal, and emergency operation, and manual and automatic operation through the plant control system.

d. Explanation of all hardwired interlocks.
e. Explanation and demonstration of equipment related valves and their purpose.
f. Explanation of all equipment related instruments including primary element, instrument indicator, purpose, and interpretation of information.
g. Check out of Owner's personnel on proper use of the equipment.

4. Preventive maintenance

a. Review preventative maintenance documentation and discussion of maintenance require at various intervals; e.g. daily, weekly, monthly, annually.
b. Demonstrate performance of each preventive maintenance task.
c. Identification of indicators of equipment problems.
d. Discussion of corrosion protection and lubrication requirements.
e. Requirements for periodic exercise of equipment and demonstration of equipment exercise where required.
f. Identification of inspection points and demonstration of inspection covers removal and routine disassembly and assembly of equipment.

5. Corrective Maintenance and Equipment Repair

a. Discussion of common repairs and identification of special problems.
b. Explanation and demonstration of equipment inspection and troubleshooting.
c. Demonstration of calibration procedures.
d. Demonstration of repair procedures where practical.

6. Parts

a. Discussion of the parts list and ordering of parts.
b. Review of spare parts provided with the equipment and identification of other recommended spare part.

7. Local Representatives

a. Name, address, telephone of local representative.
b. Review of contact information for providers of routine and emergency repair and operational assistance.

8. Operation and Maintenance Manuals

a. Review of O&M manual content and organization.
b. Update O&M material as required.

2.5 VIDEO RECORDING.

A. The Contractor shall record each training session and shall give the Owner exclusive rights to each training session recording. The Contractor shall advise all manufacturers providing training sessions that the material will be recorded.

PART 3 - EXECUTION

3.1 General

A. Training shall be conducted in conjunction with the operational testing and commissioning periods. Classes shall be scheduled so that training is performed when equipment is available for operation. The Contractor shall arrange to have the training conducted on consecutive days, with no more than 6 hours of class scheduled for any one day. Concurrent classes will not be permitted.

End of Section

SECTION 01 91 00 - COMMISSIONING

1.1 SCOPE.

A. This section covers startup requirements for all items of equipment and systems including mechanical equipment. Additional requirements may be specified in specific equipment specifications. The requirements of this section shall be satisfactorily completed prior to any field tests specified in the specific equipment sections.

1.2 GENERAL.

A. Equipment shall not be operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary to obtain proper results. All items of equipment and systems shall be tested for proper operation, efficiency, and capacity. All required adjustments, tests, operation checks, and other startup activity shall be provided by qualified personnel. Contractor shall be responsible for planning, supervising, and executing the installation of Work.

1.3 Coordination.

A. Contractor shall coordinate all tests related to startup of equipment and systems and shall report the results to Engineer in accordance with the submittals section. Contractor shall accept the equipment and the test results related to starting of equipment and systems before Engineer will accept the equipment and the test results.

B. When equipment is ready for a witness test, Contractor shall give written notice to Engineer at least 14 days before any offsite witness testing is performed or any field witnessed performance testing, unless otherwise specified.

1.4 EQUIPMENT TESTS.

A. Factory Tests.

1. When specified in the specific equipment sections, the equipment will be test run at the point of manufacture and the test results will be delivered to Engineer. Such equipment will not be shipped until Engineer has reviewed the test results and advised the Contractor, in writing, that the equipment is acceptable for shipment. Such acceptance, however, will not be considered as final acceptance, which will only be made on the basis of the test results of the equipment after installation.

B. Preliminary Field Tests.

1. All items of mechanical equipment shall be given a preliminary field test by Contractor after installation for proper operation, efficiency, and capacity. The preliminary field test

shall consist of the requirements listed herein, unless exceptions or additions are indicated in the specific equipment sections.

2. Contractor's test operation of each piece of mechanical equipment shall continue for not less than 8 hours without interruption. All moving parts of equipment and machinery shall be carefully tested for operation, and adjusted so all parts move freely and function to secure satisfactory operation. All equipment shall be tested continuously under actual or simulated operating conditions. All parts shall operate satisfactorily in all respects, under continuous full load and in accordance with the specified requirements, for the full duration of the 8 hour test period. If any part of a unit shows evidence of unsatisfactory or improper operation during the 8 hour test period, correction or repairs shall be made and the full 8 hour test operation, as specified, shall be completed after all parts operate satisfactorily.

3. Tests of all process and pumping equipment, drive motors, including auxiliaries shall be made in accordance with the appropriate and approved test codes such as the American Society of Mechanical Engineers, Hydraulic Institute Standards, and IEEE.

4. Tests shall be conducted after the Work is substantially complete so each item of equipment is ready for integrated operation with other equipment at the plant. Testing, measuring, and calibrating procedures shall be submitted to Engineer for review and acceptance prior to startup and testing of equipment.

5. The equipment shall be properly filled, by Contractor, with oil and grease, and Contractor shall furnish all power, personnel, water, chemicals, fuels, oil, grease, and auxiliaries necessary for conducting the testing of the equipment for proper operation, efficiency, and capacity.

6. The period of inspection, initial startup operation, and field adjustment shall be as needed to achieve satisfactory installation and operation of the items furnished. Any period required for instruction of Owner's personnel shall be as specified in the Contract Documents.

7. When the specific equipment sections indicate that an installation check is required by the equipment manufacturer, the manufacturer's representative will make all necessary field adjustments and correct defects in materials or workmanship during this test period.

8. All equipment installed under this Contract, including that furnished by others, shall be placed into successful operation according to the written instructions of the equipment manufacturer and the instructions of the manufacturer's field representative.

C. Field System Operation Test.

1. After all equipment is installed and the entire plant or system is ready to operate, Contractor shall conduct a field system operation test. The test shall consist of the requirements listed herein, unless exceptions or additions are indicated in the specific equipment sections.

2. The test period shall be at least 7 days, and each system shall operate under actual or simulated operating conditions before a certificate of Substantial Completion of the Work is issued. All defects of material, workmanship, or equipment which appear during this test period shall be corrected by Contractor. After such corrections are made, the 7 day test

shall be repeated before a certificate of Substantial Completion of Work is issued, unless waived by Engineer.

3. Contractor shall supply all power, water, oil, grease, auxiliaries, and operating personnel required for this operation test.

4. When necessary for certain items of equipment, the final adjustments and inspections will be made by factory trained service personnel (other than sales representatives), rather than by Contractor. The service personnel will also supervise the test operation. This requirement will be stated under the detailed specification for the particular piece or pieces of equipment. The manufacturer's service personnel will make adjustments and supervise testing by Contractor until such tests have been accepted by Engineer.

1.5 ACCEPTANCE.

1. When no other field tests for acceptance are specified in the equipment sections, at the end of the field system operation testing, each system will be accepted if, in the opinion of Engineer, it has operated satisfactorily without excessive power use, wear, or need for lubrication, or requiring undue attention; and if all its rotating parts operate without excessive vibration or noise at any operating condition.

2. When other field tests for acceptance are specified in the equipment sections, acceptance shall be after all tests are satisfactorily conducted as specified in the appropriate equipment procurement specification.

3. When a field performance test for baseline is specified in the equipment sections, acceptance shall be after a completion of the baseline performance test that is conducted as specified in the pumping unit field testing - baseline performance section.

4. Acceptance of Work in connection with the installation of equipment furnished by others will be subject to approval of the manufacturer's field representative. Acceptance by Owner or approval of the manufacturer's field representative will not relieve Contractor of responsibility for defective Work.

End Section

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SECTION 02 4100 - DEMOLITION

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the demolition of existing piping, and sitework.

1.2 GENERAL

A. Contractor shall be responsible for all work under this section. Contractor shall provide seven (7) days written notice prior to beginning demolition activities.

B. All structures and facilities of the existing Beaver Water District Water Treatment Facility which are not to be removed must remain in continuous operation during the work.

C. Demolition work shall create minimum interference with Owner's operations and minimum inconvenience to Owner. Contractor shall provide protection and safety of all roadways, sidewalks, and all accessible areas during demolition activities.

D. Blasting will not be permitted.

1.3 SUBMITTALS

A. Demolition Plan.

1. Contractor shall submit a detailed demolition plan indicating the major demolition activities, planned dates, Owner coordination requirements, permit requirements (if any), and any special planning considerations that require coordination with third-parties.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Removal of equipment or facilities shall include removal of all accessories, piping, wiring, supports, associated electrical starters and devices, baseplates and frames, and all other appurtenances, unless otherwise directed. Existing materials and equipment removed, and not indicated to be reused as a part of the Work, shall become Contractor's property unless

otherwise specified, and shall be removed from the Site and properly disposed of or recycled in accordance with state laws.

B. Contractor shall conduct demolition activities in a manner that prevents damage to existing facilities which are indicated to remain and shall provide all necessary protection for existing facilities. Any remaining facilities damaged during demolition shall be repaired by Contractor to a condition equal to or better than the original condition.

C. When demolition is complete, all debris shall be removed from the Site and the Site graded to the lines and grades indicated on the Drawings.

D. Sitework Demolition

1. Sitework demolition shall include the following:

a. Removal of gravel drives, concrete pavement, sidewalks, curb, and slabs on grade within the limits indicated on the Drawings.
b. Removal of asphaltic concrete pavement as required for construction of pipelines and flow meter vault.
c. Removal of trees and shrubs indicated on the Drawings to be removed and as required to complete the work.

End of Section

SECTION 03 01 26.66 - CONCRETE CRACK REPAIR

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the repair of concrete and shotcrete cracks and joints.

B. Both inch-pound (English) and SI (metric) units of measurement are specified herein; the values expressed in inch-pound units shall govern.

C. General Crack Repair

1. General crack repair is applicable only to new construction, and shall include the following:

a. Sealing of all cracks and crack networks that are wider than 10 mils (0.01 inch) as measured at the exposed surface.
b. All necessary repairs to structures that have failed a tightness test, including sealing of construction joints.

2. All costs for general crack repair shall be included in the Contract Price. General crack repair work is expected to be necessary due to cracks that commonly develop during concrete construction.

D. Engineer-Directed Crack Repair

1. Engineer-directed crack repair is applicable only to new construction, and shall only be performed when instructed by Engineer. The work shall include, but is not limited to, the following:

a. Sealing of construction joints that are not otherwise required to be sealed as the result of a failure of a leakage test.
b. Sealing of cracks and crack networks with a width of 10 mils (0.01 inch) or less as measured at the exposed surface.

2. Contractor shall include 150 linear feet of Engineer-directed crack repair in the Contract Price. The Engineer-directed crack repair may be either epoxy resin or foam resin, as determined by Engineer.

E. Pre-Defined Crack Repair

1. Pre-defined crack repair is applicable only to existing structures, and the extent of this type of repair is indicated on the Drawings.

2. Prior to beginning the repair work Contractor shall field verify and provide clear bright colored marking to the cracks to be repaired. Crack repair work shall not begin until marking is complete and has been approved by Engineer.

1.2 SUBMITTALS

A. All submittals shall be made in accordance with the Submittal Procedures section.

B. The following items shall be submitted, as a minimum.

Manufacturer's information for all products supplied under this section, in the form of technical data sheets, certificates of compliance, test data, or reports.

Experience record of the applicator.

A letter from each product manufacturer indicating their approval of the following.

Selection of repair material.

Qualifications of the individuals performing the work.

Surface preparation procedures.

Application procedures.

Curing procedures.

1.3 QUALITY ASSURANCE

A. Manufacturer's Field Services

1. The material manufacturer shall provide engineering field services to review the Work and the material application prior to any preparation; to approve the applicator, the material used, and the procedure to be used; to observe surface preparation; to approve surface preparation; and to observe application. The field representative of the material manufacturer shall submit, in writing through Contractor, approvals of proposed material, application procedures, applicator, and surface preparation. The field representative shall be an employee of the material manufacturer.

B. Applicator

1. The applicator shall submit through Contractor a satisfactory experience record including references from previous application of the specified materials to structures of similar design and complexity.

C. Pre-Construction Meeting

1. At least 30 days prior to concrete crack repairs, Contractor shall conduct a meeting to review the detailed requirements for rehabilitation work. Site conditions, surface preparation, proposed equipment, procedures, material mixing, placing procedures, and curing methods shall be discussed and approved by Engineer and by the manufacturer's field representative. Contractor shall require the attendance of all involved parties, including but not limited to Contractor's superintendent, repair contractor, manufacturer's field representative and proposed equipment supplier representative. Minutes of the meeting shall be recorded, typed and printed by Contractor and distributed to all parties within 5 days after the meeting.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN REQUIREMENTS

A. Unless otherwise specified or authorized, repairs shall conform to the requirements specified herein. Types of repairs not specified herein shall be as specified in other sections, as indicated on the Drawings, or, in the absence of any definite requirement, as recommended by the manufacturer's representative and subject to acceptance by Engineer. The following types of repairs shall be performed as required.

B. Epoxy Resin

1. Unless indicated otherwise on the drawings, epoxy resin shall be used to seal construction joints and cracks. Epoxy resin shall be pressure-injected for vertical and overhead applications. Epoxy resin may be applied by gravity feed in lieu of pressure injections for cracks in floors, using a very low-viscosity material.

C. Foam Resin

1. Foam resin shall be used to seal expansion joints. Otherwise, foam resin shall only be used to seal crack and joints when indicated on the drawings or when permitted by Engineer in lieu of epoxy resin. Foam resin shall be pressure-injected.

2.2 ACCEPTABLE PRODUCTS

A. Repair products/materials shall be as specified herein. Equivalent products of other manufacturers regularly producing high quality concrete crack repair products/materials, providing engineering field services, and meeting the specified quality assurance requirements may be furnished subject to review and acceptance by Engineer.

2.3 MATERIALS

A. Materials shall be approved by the manufacturer for the type of application, including temperature and moisture conditions encountered. Products shall meet the applicable requirements of NSF/ANSI 61 and NSF/ANSI 600 for structures that are part of the treatment process for producing potable water.

Epoxy Resin	ASTM C881, Type I or Type IV, moisture tolerant or moisture insensitive.
Crack Sealant	As recommended by the manufacturer of the epoxy resin product.
Foam Resin	Hydrophilic polyurethane foam; Prime Resins “Prime-Flex 900 XLV”, DeNeef "Sealfoam PURe", Euclid “Dural Aqua-Fil”, or Avanti “AV 330 Safeguard”.
Foam Resin Accelerator	As recommended by foam resin manufacturer.
Water	Clean and free from deleterious substances.

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior to the placement of the repair materials, the crack to be repaired shall be inspected by the material manufacturer to assure that preparation and conditions are correct for the type of repair and the product/material being used as specified herein.

3.2 PREPARATION

A. All cracks and surfaces around the cracks shall be free of objectionable substances and shall conform to the requirements of the material manufacturer. Concrete and shotcrete to be repaired shall be cleaned by methods acceptable to the material manufacturer so that the cracks are free of dirt, oil, grease, laitance, and other foreign matter. All loose and deteriorated existing concrete and shotcrete shall be removed down to sound materials. All concrete and shotcrete surfaces shall be checked for delamination to ensure that all surfaces are sound. All edges shall be square cut to avoid feather edges.

B. Any other preparation recommended by the material manufacturer shall be brought to Engineer's attention and may be incorporated into the work if acceptable to Engineer.

C. Concrete and shotcrete surfaces in the area of a crack to be repaired shall be cleaned by wire brushing, blasting, or other acceptable methods.

D. Wall surfaces shall be sandblasted clean to expose crack networks and construction joints. If there is active water seepage in the repair area, the seepage shall be stopped as recommended by

the injection material manufacturer and as acceptable to Engineer. Injection ports shall be installed, when recommended by the injection material manufacturer.

E. Injected Epoxy Resin

1. Preparation for injected epoxy resin shall include sealing the surface at the crack, on both sides when possible, with crack sealant as recommended by the material manufacturer and as acceptable to Engineer for the pressure injection work. Injection ports for epoxy resin shall penetrate through the crack sealant into the cracks at spacings recommended by the material manufacturer.

F. Injected Foam Resin

1. Preparation for injected foam resin shall include drilling offset injection holes at an angle that will intersect the crack, joint, or crack network at approximately one-half the thickness of the concrete or shotcrete up to a thickness of 36 inches . Spacing of injection ports shall be determined as recommended by the injection material manufacturer and as acceptable to Engineer. When the injection material manufacturer certifies, in writing, that spacing of injection ports and installation procedures are acceptable, the injection ports may be installed directly into the crack, subject to review by Engineer.

3.3 APPLICATION

A. Concrete and shotcrete repair work shall be performed in accordance with the following requirements.

B. Crack Sealant

1. Crack sealant shall be trowel-applied to a minimum dried thickness of 1/8 inch , or thicker if directed by manufacturer’s literature. The concrete surface where the sealant is applied shall be smooth, uniform, and free from irregularities. Crack sealant shall be removed after the injection of resin is completed, except for portions of wall faces that will be at least 12 inches below the finished grade.

C. Pressure-Injected Resin

1. The injected areas shall be prepared as specified and as recommended by the manufacturer.

2. After the joints and cracks are prepared and before the injection of the resin, the joints shall be flushed with water. The water flush shall be terminated when the turbidity of the expelled water is equal to that of the flush water. Unless otherwise acceptable to resin manufacturer and Engineer, cracks shall be dry prior to injecting resin.

3. The pumping equipment used for the pressure injection of resin shall have pressure metering. Written procedures for use and quality control of the injection equipment shall be furnished to Engineer for review and acceptance. The pump shall be electric. The material and process used for the pressure injection of the resin shall have been in use a minimum of 5 years.

4. The joints and crack networks shall have a minimum of 90 percent penetration of resin into the joint or crack network. Core samples may be taken at Engineer's discretion.

5. Epoxy Resin

a. Epoxy resin shall be injected into the structure in accordance with the material manufacturer's recommendations and as acceptable to Engineer. Epoxy resin shall be injected until the resin appears at the next injection port.

6. Foam Resin

a. Foam resin shall be premixed and injected into the structure in accordance with the material manufacturer's recommendations and as acceptable to Engineer. Foam resin shall be injected into the structure until the resin appears at the next injection port.
b. Surfaces of cracks and joints may need to be sealed with crack sealant.

D. Gravity Fed Resin

1. A bead of the epoxy resin shall be placed over the entire surface of the crack. Enough resin shall be applied so that there is a visible heaping above the floor surface.

2. The applicator shall periodically inspect the resin to verify that it has penetrated the crack and flattened against the floor surface.

3. After the resin has flattened, another bean shall be applied, and the process repeated until the crack cannot receive additional resin.

E. Cold Weather

1. When ambient temperatures below 40° F are expected during the curing period, the repair materials shall be maintained at a temperature of at least 50° F for 14 days or 75° F for 7 days after placement. Sudden cooling of the repair materials shall not be permitted.

3.4 PROTECTION

A. Post-placement curing and protection shall be as specified herein and in accordance with the manufacturer's recommendations.

3.5 CLEANING

A. Work areas shall be cleaned each day in accordance with the Work Covered by Contract Documents section. Upon completion of the final cleanup, Contractor shall restore all areas affected by the repair procedures to their original condition, leaving no trace of material piles or other wasted materials.

End of Section

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SECTION 03 01 26.76 - CONCRETE SURFACE REPAIR

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the repair of existing concrete surfaces as indicated on the drawings, as specified, or as required to complete the Work. This section covers the furnishing of all labor, equipment and materials required to repair, rehabilitate or reconstruct spalled, deteriorated, or structurally damaged concrete surfaces. Depth of repairs shall be adequate to restore concrete members to original dimensions and surface profiles.

B. The Work covered by this section includes, but is not limited to, the following locations:

1. Existing Clearwell

1.2 SUBMITTALS

A. All submittals shall be made in accordance with the Submittal Procedures section.

B. The following items shall be submitted, as a minimum.

Manufacturer’s information for all products supplied under this section, in the form of technical data sheets, certificates of compliance, test data, or reports.

Experience record of the applicator.

A letter from each product manufacturer indicating their approval of the following.

Selection of repair material.

Qualifications of the individuals performing the work.

Surface preparation procedures.

Application procedures.

Curing procedures.

1.3 QUALITY ASSURANCE

A. Manufacturer’s Field Services

1. The material manufacturer shall provide engineering field services to review the project and the selected material application prior to any preparation; to approve the applicator, the material used, and the procedure to be used; to observe and approve surface

preparation; and to observe application and curing procedures. The field representative of the material manufacturer shall submit, in writing through Contractor, approvals of proposed materials, surface preparation, applicator, and application procedures. The field representative shall instruct the applicator, as needed, to assure that handling, mixing, placing, finishing, and curing of materials are in accordance with specifications and manufacturer's requirements. The field representative shall be an employee of the material manufacturer.

B. Applicator

1. The repair contractor shall have experience and proficiency specific to the repair type and shall be acceptable to Engineer and the material supplier. The applicator shall submit, through Contractor, a satisfactory experience record including references for previous application of the specified materials to concrete structures of similar design and complexity.

C. Pre-construction Meeting

1. At least 30 days prior to planned performance of the Work, Contractor shall conduct a meeting to review the detailed requirements for the Work. Site conditions, surface preparation, proposed equipment, procedures, material mixing, placing and finishing procedures, and curing methods shall be discussed and approved by Engineer and by the manufacturer's field representative. Contractor shall require the attendance of all involved parties, including but not limited to Contractor's superintendent, repair contractor if applicable, manufacturer's field representative and proposed equipment supplier representative. Minutes of the meeting shall be recorded, typed and printed by Contractor and distributed to all parties, including Engineer, within 5 days after the meeting.

D. Site Conditions

1. Job conditions shall be maintained at standards that allow material placement within temperature and cleanliness requirements. Unusual conditions or unexpected additional deterioration uncovered during the course of Work by Contractor shall be brought to Engineer's attention for analysis and disposition. These conditions include but are not limited to poor quality base concrete, severely corroded reinforcing steel, random cracks, deep oil penetration and any other condition which would prevent completion of the Work in accordance with manufacturer's recommendations and this section.

PART 2 - PRODUCTS

2.1 ACCEPTABLE PRODUCTS

A. Concrete repair products shall be manufactured by the Euclid Chemical Company, Master Builders Solutions, Sika Corporation, or equal as specified herein. Equivalent products of other manufacturers regularly producing high quality concrete repair materials, providing engineering field services, and meeting the specified quality assurance requirements may be furnished subject to acceptance by Engineer.

2.2 MATERIALS

A. Unless otherwise specified or authorized, materials shall conform to the requirements specified herein. Types of materials or concrete repair not specified herein shall be as specified in other sections, as indicated on the drawings or, in the absence of any definite requirement, as recommended by the manufacturer's field representative and acceptable to Engineer.

B. Products shall not exceed VOC limits established by the federal, state, or local regulatory agency having jurisdiction over the project site.
   1)

C. Vertical and Overhead Surface Repairs, Trowel Applied

   1. One or two-component, polymer modified, cementitious mortar containing a corrosion inhibitor.

      a. Compressive strength
         1) 5,500 psi at 28 days using 2 inch cubes, per ASTM C109.

      b. Flexural Strength
         1) 600 psi at 28 days, per ASTM C348

      c. Bond Strength
         1) 1800 psi at 28 days, per ASTM C882

      d. Products
         1) Master Builders Soltuions "MasterEmaco N 400"
         2) Euclid "Eucorepair V100" or "Tamms Structural Mortar"
         3) Sika "SikaTop 123 Plus

      e. Bonding agent
         1) Repair mortar scrub coat per manufacturer's instructions

D. Vertical Repairs, Form and Pour, Thickness 6 Inches or Less

   1. One-component, cementitious material containing a corrosion inhibitor. Shrikage compensated or polymer modified.

      a. Compressive strength
         1) 6,500 psi at 28 days using 2 inch cubes, per ASTM C109.

      b. Flexural Strength
         1) 770 psi at 28 days, per ASTM C348

      c. Bond Strength
         1) 2500 psi at 28 days, per ASTM C882

      d. Rapid Chloride Permeability
         1) Maximum 650 coulombs at 28 days, per ASTM C1202

e. Products
   1) Master Builders Solutions “MasterEmaco S 466Cl”
   2) Euclid “Eucorepair SCC Fast”
   3) Sika “Sikacrete 211 SCC Plus”

f. Bonding agent
   1) Extended open time type; three component, epoxy modified, with corrosion inhibitor, minimum bond strength of 2000 psi at 7 days per ASTM C882.
      a) Master Builders Solutions “MasterEmaco P 124”
      b) Euclid “Duralprep A.C.”
      c) Sika “Armatec 110 EpoCem”

E. Vertical Repairs, Thickness Greater Than 6 Inches

1. Cast-in-place concrete, per the Cast-in Place Concrete section.

   a. Bonding agent
      1) Extended open time type; three component, epoxy modified, with corrosion inhibitor, minimum bond strength of 2000 psi at 7 days per ASTM C882.
         a) Master Builders Solutions “MasterEmaco P 124”
         b) Euclid “Duralprep A.C.”
         c) Sika “Armatec 110 EpoCem”

   b. Water
      1) Clean and free from deleterious substances.

F. Reinforcement Anti-Corrosion Coating

1. Extended open time type; three component, epoxy modified, with corrosion inhibitor, minimum bond strength of 2000 psi at 7 days per ASTM C882.

   a. Master Builders Solutions “MasterEmaco P 124”
   b. Euclid “Duralprep A.C.”
   c. Sika “Armatec 110 EpoCem”

G. Penetrating Sealer

1. Silane-based sealer with minimum 40% active ingredient. Minimum water repellency of 85% by ASTM C642.

   a. Master Builders Solutions “MasterProtect H 400”
   b. Euclid “Baracada Silane 40 WB”
   c. Sika “Sikagard 740 W”

H. Coarse Aggregate Extension of Cementitious Mortar

1. In areas where depth of repair exceeds manufacturer’s recommended limits for neat repair mortar, repair mortar may be extended with washed, graded, rounded, high-density, low-absorption coarse aggregate meeting ASTM C33. Aggregate shall be in size

and volumes recommended by the product manufacturer. Aggregate extension shall not be permitted unless approved by Engineer.

PART 3 - EXECUTION

3.1 GENERAL

A. Unless otherwise specified, all materials shall be prepared and applied in strict accordance with the manufacturer's printed installation instructions.

3.2 INSPECTION

A. Prior to the placement of repair material, the surface to be repaired shall be inspected by the material manufacturer's field representative to assure the surface conditions are correct for the type of repair and the material is being used as specified.

3.3 PREPARATION

A. Cleaning

1. The surface of existing concrete shall be clean and the pores free of any dirt or material that will be detrimental to the bond of the repair material. All oil, dirt, debris, paint, and unsound concrete shall be removed. Cleaning shall include complete removal of all dust, dirt, and residue by high pressure washing.

B. Surface Preparation

1. All prepared surfaces shall conform to the requirements of the material manufacturer. All edges shall be square cut to avoid feather edges. As required, surfaces shall be prepared mechanically using a scabbler, bushhammer, chipping hammer, shotblast, scarifier or hydrodemolition equipment which will give the specified surface profile. Means and methods selected, subject to acceptance by Engineer, shall minimize surface micro-cracking (i.e. "bruising") and impact on areas surrounding the Work area. Contractor shall provide a minimum Concrete Surface Profile (CSP) equal to that recommended by the material manufacturer.

2. Remove all loose and unsound concrete per International Concrete Repair Institute (ICRI) Guideline 310.1R "Guide for Surface Preparation." Repair areas shall be sawcut around the perimeter in a square or rectangular shape. For thin repairs of 1/4 inch or less, the saw cut depth shall not exceed 1/4 inch deep. For thicker repairs, the saw cut depth shall be a minimum of one-half inch but shall be limited to prevent the saw from damaging embedded reinforcement. Saw cuts shall be made perpendicular to the concrete surface and all concrete removal boundaries shall be straight.

3. Concrete shall be removed within repair boundaries to depth that is as uniform as practicable, and within the minimum and maximum layer thicknesses recommended by

the material manufacturer. Exposed concrete surfaces shall be visually examined and tested with a mason's hammer to confirm soundness of the base material. If delamination, cracking, or otherwise unsound material exists, Contractor shall notify Engineer for direction before continuing with the work.

C. Cracks

1. Cracks shall be located and repaired, if required, in accordance with the Concrete Crack Repair section. All cracks located within or adjacent to Work covered under this section shall be repaired prior to performance of the Work covered under this section.

D. Inspection and Replacement of Reinforcement

1. If reinforcement is exposed so that more than half the circumference of the bar is visible, the remaining concrete shall be removed to provide 1 inch of clear space all around the bar.

2. Reinforcement that has lost more than 20 percent of its original cross-sectional area shall be repaired by adding new reinforcement. The new reinforcement shall be spliced or connected to the existing reinforcement on both ends of the damaged portion of the original bar. Splices shall be Class B, and mechanical connectors shall be ACI 318 Type 2.

3. Contractor shall clean all exposed reinforcing steel to a bare metal finish prior to installation of repair materials.

4. Repaired reinforcement shall be inspected by Engineer or Owner's representative prior to placement of concrete repair materials.

3.4 APPLICATION

A. Concrete repair work shall be performed in accordance with the following requirements.

B. Bonding and Priming

1. Bonding agent shall be applied per manufacturer's recommendations. The manufacturer's coverage rate shall be followed. For rough surfaces, scrub bonding agent into the surface with a stiff broom.

2. Apply all prepackaged bonding agent materials within recommended ambient and substrate temperatures published in the manufacturer's printed installation instructions. Materials shall not be applied over frozen or liquid filled surfaces.

3. Upon completion of all concrete and reinforcing steel demolition, surface preparation, and cleaning operations, apply specified bonding agent to substrate. Provide complete and thorough coverage of surface assuring that bonding agent has been fully worked into profile of surface.

4. For repair mortar scrub coat bonding agents, the concrete surface shall be saturated with water one hour prior to placement of the scrub coat to provide a saturated substrate. Just prior to application of the scrub coat, water shall be removed by compressed air blasting. Compressed air shall be maintained free of oil and contaminants by filtration as needed. The mortar scrub coat shall be wet and not yet stiffened when repair material is applied.

5. For extended open time bonding agents, mix bonding agent and apply two uniform coats at manufacturer's published recommended coverage rates to properly prepared surfaces. Allow adequate time between coats per manufacturer's recommendations. The repair material shall be applied within the allowable open time of the bonding agent.

C. Treatment of Reinforcement and Other Metal Embedments

1. All existing and new reinforcement shall be secured and properly positioned by tying to other secured bars or supplemental anchoring pins as needed.

2. All exposed reinforcement and other metal embedments within the repair area shall be treated with two coats of anti-corrosion coating.

D. Forming

1. Forms shall be water-tight and constructed with sufficient rigidity to withstand head pressure and prevent excessive deflection during material placement. For pumped applications without open top forms, provide a port connection or birdmouth of sufficient size to allow pumping into the form. After forms are removed, all birdmouths and other protrusions resulting from the placement method shall be carefully removed and the surface smoothed.

2. Tolerances for formed work shall be as stipulated in ACI 117 for cast-in-place concrete, unless otherwise indicated. Formed surfaces shall meet Class C requirements for both abrupt and gradual irregularities.

E. Shoring and Support

1. When removal and repair of deteriorated concrete may cause temporary weakness, excessive deflections, structural instability, or other unacceptable damage, shoring or other suitable supports shall be provided until completion of the repair work is complete and the material has reached its design compressive strength.

F. Cold Weather Conditions

1. Repair materials shall not be applied without protection in temperatures below 45°F, nor when the temperature is expected to fall below 45°F during the curing period, unless more stringent requirements are provided by the material manfacturer's printed installation instructions.

3.5 FINISHING

1. All surfaces shall be finished to match the surrounding concrete.

3.6 CURING

A. General

1. Immediately following placement and finishing procedures, cure cementitious repair mortars for a minimum of seven (7) days. Curing procedures shall be in accordance with ACI 308.1 and the manufacturer's printed installation instructions. The more stringent requirements shall control.

2. When ambient temperatures below 45°F are expected during the curing period, the repair material shall be maintained at 50°F for the full period. Sudden cooling shall not be permitted. Gradual temperature drop shall be maintained at not more than 20°F in any 24 hour period. Carbon dioxide or exhaust gases from combustion heaters shall not be allowed within enclosures or allowed to contact the repair material. Repair materials shall not be exposed to freezing temperatures until at least 24 hours after the end of the curing period..

3. Unless specified otherwise, one or more of the following methods shall be used:

B. Water Curing

1. Keep concrete surfaces continuously wet with water during the curing period. The method used shall limit water runoff and any runoff shall be directed and controlled. The difference in temperature between the water used for curing and the concrete surface shall not exceed 20°F.

C. Wet Coverings Curing

1. Cover the surfaces with moisture retaining curing blankets, burlap, cotton mats, or other suitable moisture retaining materials. The coverings shall not stain or otherwise discolor the repair material or the surrounding surfaces, and shall keep the repair products fully saturated during the curing period. Lap all coverings at least 8 inches at joints.

D. Membrane Curing

1. Membrane curing compounds shall only be used if the repair material manufacturer's printed installation instructions recommend a compound be used instead of water or wet coverings. Membrane curing compounds shall not be used on surfaces to receive a penetrating sealer.

3.7 SEALING

A. Provide a penetrating sealer over the concrete repair product when recommended by the repair product manufacturer, or when no other sealer is specified on the drawings or other sections. The penetrating sealer shall be applied in accordance with the manufacturer's instructions.

3.8 FIELD QUALITY CONTROL

A. Material Storage and Handling

1. The material shall be delivered in original, unopened containers. Containers shall be labeled with the manufacturer's name, product name, and lot number. Materials shall be stored at the job site under dry conditions and at temperatures between 50°F and 90°F unless more stringent limitations are required by the manufacturer.

B. Protection

1. Repair areas shall be protected from other trades and weather for a minimum of 10 days after material is placed.

C. Cleaning

1. Work areas are to be cleaned each day in accordance with the Work Covered by Contract Documents section. Upon completion of the final cleanup, Contractor shall restore all areas affected by repair procedures to their original condition, leaving no trace of material piles or other wasted materials.

End of Section

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SECTION 03 08 13 - TIGHTNESS TESTING OF STRUCTURES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers hydrostatic tightness testing of concrete structures.

1.2 GENERAL

A. Unless otherwise specified, testing shall be completed after the entire concrete structure has been constructed, cured, and has attained its design strength, but prior to placement of backfill, cleaning and disinfection, and prior to the installation of equipment in the structure.

B. All testing work shall be performed by Contractor in the presence of Engineer.

C. Testing Schedule and Procedure

1. A testing schedule and procedure shall be submitted to Engineer for review and acceptance not less than 30 days prior to commencement of testing. The schedule shall indicate the proposed time and sequence of testing for each structure. The procedure shall indicate the limits of the area to be tested, define the method of isolation, the position and use of valves during testing, the location of temporary bulkheads, the process for introducing water and air into the structure, the method of measuring water and air losses, any correction methods required due to evaporation and precipitation, the method and location for disposal of testing water, and any other activities relevant to the testing.

2. Contractor shall notify Engineer and Owner at least five days in advance of the time that testing of any individual structure will begin.

D. Water

1. Water for testing will be furnished as stipulated in the Temporary Facilities section. Water shall be conserved through collection and reuse in subsequent tests. Contractor shall notify federal, state, and local regulatory agencies to determine if any special procedures or permits are required for disposal of water used for pressure and leakage testing and to identify acceptable locations for disposal of the water. All requirements and costs associated with notifications and obtaining any discharge permit or approvals shall be responsibility of Contractor. Following completion of testing work, the water shall be disposed of in a manner acceptable to Engineer and, unless otherwise permitted by Engineer, shall not be allowed to enter other parts of the system.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. All necessary connections between the structure to be tested and the water source or other test medium, together with pumping equipment, any necessary metering devices, pressure or vacuum gauges, and all other equipment, materials, and facilities required to perform the specified tests and dispose of the test medium after completion of testing, shall be provided by Contractor. Contractor shall provide all required temporary flanges, valves, bulkheads, bracing, blocking, and other sectionalizing devices that may be necessary to perform the testing. All temporary devices shall be removed upon satisfactory completion of testing.

2.2 STRUCTURES TO BE TESTED

A. The structures to be tested are indicated in the Tightness Testing of Structures schedule as follows:

	Hydrostatic Testing			
	Water Surface Elevation	Allowable Water Surface Drop	Test Duration	Consider Evaporation and Precipitation
Structure	ft	Inches	days	(Y/N)
New 16 MG Clearwell	19.7	0.47	4.0	N

2.3 ALLOWABLE WATER LOSS

A. The maximum allowable water loss and the test duration shall be as specified in the Tightness Testing of Structures schedule.

B. Each leak which is discovered during the correction period shall be located and repaired at the expense of Contractor.

PART 3 - EXECUTION

3.1 HYDROSTATIC TEST PROCEDURES

A. The hydrostatic test shall consist of both a visual inspection and a water loss measurement. Both tests shall be completed to the satisfaction of Engineer. The procedure and sequence of testing shall be subject to review and acceptance by Engineer.

B. Unless otherwise specified, tightness testing shall be performed after all pipe sleeves have been installed but before backfilling.

C. Paint that has been applied to piping, valves, or other items shall be permitted to dry in accordance with the paint manufacturer's instructions prior to introducing test water into the tank.

D. Exposed concrete surfaces of the structure, including the floor, shall be cleaned of all foreign material and debris prior to the test. Standing water in or outside the structure that would interfere with observation of the exposed concrete surfaces shall be removed. The concrete surfaces and concrete joints shall be thoroughly inspected for potential leakage points. Areas of potential leakage shall be repaired prior to filling the tank with water.

E. Adjacent structures having common walls shall be tested individually at different times to permit examination of the dividing walls for leaks.

F. Pipe connections or openings to structures, if not provided with drip tight valves, shall be temporarily plugged during testing. Where slide gates, sluice gates or similar devices are located, Contractor shall provide bulkheads or the means to make them drip tight, and measure any leakage.

G. Unless otherwise specified, each structure to be tested shall be filled with potable water at a uniform rate not to exceed a depth of 4 feet per hour to the level specified in the Tightness Testing of Structures schedule. The water shall be allowed to stand for at least three days prior to tightness testing in order to stabilize the absorption rate of the concrete and the water temperature. During this period, sufficient water shall be added to maintain the water level to the elevation specified.

H. Visual Inspection

1. All structures to be tested shall be free from visible leaks. Damp spots on exterior wall surfaces shall be considered visible leaks if moisture can be picked up on a dry hand. Damp spots on tops of wall footings will be permitted unless the water can be observed to be flowing. Repairs shall be made to visible leaks regardless of the water loss test results. All visible leaks which have not spontaneously plugged or demonstrated a definite decrease in the rate of leakage over a maximum period of 28 days shall be located and repaired by and at the expense of Contractor in accordance with the Concrete Crack Repair section. The structure shall be retested to confirm that the repairs are satisfactory.

I. Water Loss Measurement

1. Measurements of water level and loss will be taken by Engineer each day over the test period. If the measured drop in water level, adjusted for evaporation and precipitation when applicable, exceeds the allowable amount specified in the Tightness Testing of Structure schedule and does not show a definite decreasing trend during the following 7 day period, the structure shall be drained, repaired in accordance with the Concrete Crack Repair section, cleaned, refilled, and retested to the satisfaction of Engineer.

2. Testing shall be considered void and the basin shall be retested in the event of excessive evaporation or precipitation that results in an empty or overflowing pan.

J. Structure-Specific Requirements

1. Additional requirements with respect to specific structures are defined in the following subparagraphs.

2. Concrete Clearwell

   a. The clearwell shall not be tightness tested until the top slab is constructed and has reached its design strength. The clearwell shall be filled with potable water and tested separately.

K. Disposal of Test Water

1. Contractor shall confirm that Owner intends to dispose of the test water. If the water is to be disposed of, Contractor shall verify there is no residual chlorine or other undesirable product in the test water to be discharged. If necessary a neutralizing chemical treatment shall be provided to condition the water prior to disposal. Contractor shall be responsible to determine a suitable location and method for disposing of the used test water. Water discharged to overland disposal or to a sewer system shall be discharged at flow rates and locations acceptable to the local governing agencies and in compliance with applicable rules and regulations.

End of Section

SECTION 03 11 00 - CONCRETE FORMING

PART 1 - GENERAL

1.1 SCOPE

A. This section covers formwork for cast-in-place concrete.

B. Both inch-pound (English) and SI (metric) units of measurement are specified herein; the values expressed in inch-pound units shall govern.

1.2 GENERAL

A. All forms shall be accurately and properly placed so cast-in-place concrete may be placed as indicated on the Drawings and as specified. The forms shall produce a smooth concrete finish free from offsets or irregularities.

1.3 SUBMITTALS

A. All submittals shall be made in accordance with the Submittal Procedures section.

B. The following items shall be submitted, as a minimum.

Manufacturer's information for all products supplied under this section, in the form of technical data sheets, certificates of compliance, test data, or reports.

PART 2 - PRODUCTS

2.1 MATERIALS

Forms

Prefabricated	Simplex "Industrial Steel Frame Forms," Symons "Steel Ply," or Universal "Uni-form."
Plywood	Product Standard PS1, waterproof, resin-bonded, exterior type Douglas fir, face adjacent to concrete Grade B or better.
Fiberboard	ANSI/AHA A135.4, Class 1, tempered, water-resistant, concrete form hardboard.
Lumber	Straight, uniform width and thickness, and free from knots, offsets, holes, dents, and other surface defects.

Chamfer Strips	Clear white pine, surface against concrete planed.
Form Coating	Nonstaining and nontoxic after 30 days. Product shall not exceed VOC limits established by the federal, state, or local regulatory agency having jurisdiction over the project site. Coatings shall meet the applicable requirements of NSF/ANSI 61 and NSF/ANSI 600 for structures that are part of the treatment process for producing potable water.

2.2 FORMS

A. Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the Drawings. Forms shall conform to ACI 347R and the following additional requirements.

1. Stay-in-place metal formwork will not be permitted.

2. Form-facing materials shall be selected in accordance with ACI 347.3R, based upon the applicable formed concrete surface category. Formed concrete surface categories vary by structure and application, and shall be as indicated in the Concrete Finishing section. Other types of forming materials, such as steel or unlined wood, may be used where plywood or lined forms are not required, and may be used as backing for form linings. Forms for exposed surfaces shall be laid out in a regular and uniform pattern with the long dimension of panels vertical and all joints aligned. The forms shall produce finished surfaces that are free from offsets, ridges, waves, and concave or convex areas, within the tolerances specified herein.

3. All vertical concrete surfaces above footings shall be formed.

4. Flat segmented forms not more than 24 inches wide may be used for forming curved surfaces 25 feet in diameter or larger.

B. Design

1. Forms shall be substantial and sufficiently tight to prevent leakage of mortar. Forms shall be braced or tied to maintain the desired position, shape, and alignment during and after concrete placement. Walers, studs, internal ties, and other form supports shall be sized and spaced so that permissible working stresses are not exceeded.

2. Beams and slabs supported by concrete columns shall be formed so that the column forms may be removed without disturbing the supports for the beams or slabs.

3. Wherever the top of a wall will be exposed to weathering, the forms on at least one side shall not extend above the top of the wall and shall be brought to true line and grade. At other locations, forms shall be brought to a true line and grade, or a wooden guide strip shall be placed at the proper location on the forms so that the concrete surface can be finished with a screed or template to the specified elevation, slope, or contour. At

horizontal construction joints in walls, the forms on one side shall not extend more than 2 feet above the joint.

4. Temporary openings shall be provided at the bottom of column and wall forms and at other points where necessary to facilitate cleaning and inspection.

C. Form Ties

1. Form ties shall have removable end and permanently embedded body, and shall have sufficient strength and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders. Cones shall be provided on the outer ends of each tie, and the permanently embedded portion shall be at least 1 inch back from the concrete face. Form ties for walls with waterstops at joints shall be provided with water stop washers located on the permanently embedded portions of the ties at the approximate center of the wall. The ties shall be smooth at the location of the water stop washer; continuously threaded systems will not be acceptable. Permanently embedded portions of form ties without threaded ends shall be constructed so that the removable ends are readily broken off without damage to the concrete. Through-wall tapered removable ties will not be acceptable. The type of form ties used shall be acceptable to Engineer.

2. Form ties in exposed surfaces shall be uniformly spaced and aligned in horizontal and vertical rows.

D. Edges and Corners

1. Chamfer strips shall be placed in forms to bevel all salient edges and corners, except the top edges of walls and slabs which are to be tooled and edges which are to be buried. Equipment bases shall have formed beveled salient edges for all vertical and horizontal corners, unless specifically indicated otherwise on the Drawings. Unless otherwise noted, bevels shall be 3/4 inch wide.

PART 3 - EXECUTION

3.1 PLACEMENT

A. The limits of each concrete pour shall be determined by Contractor and shall be acceptable to Engineer.

B. Before concrete is placed, forms shall be rigidly secured in proper position; all dirt, mud, water, and debris shall be removed from the space to be occupied by concrete; all surfaces encrusted with dried concrete from previous placements shall be cleaned; and the entire installation shall be acceptable to Engineer. Remove all frost, ice, and snow from within the formwork before concrete is placed.

3.2 TOLERANCES

A. Tolerances for cast-in-place concrete work shall be as indicated in ACI 347.3R, based upon the relevant formed concrete surface category.

B. Formed concrete surfaces that are to have a face-mounted flat steel or FRP member attached, including but not limited to items such as weir plates or shelf angles, shall have more stringent flatness requirements. The surface profile shall permit the installation of the flat member without grinding the concrete surface (except for removal of fins), deforming the flat member, or requiring usage of backer rods or shims.

3.3 FORM COATING

A. All concrete forms shall have form release agent applied to them before placement of concrete.

3.4 FORM REMOVAL

A. Forms shall not be removed from structures until the concrete in the structures has sufficient strength to support the weight of the structure and any superimposed load, including loads from construction operations. Contractor shall be responsible for limiting any applied loadings. There shall be no evidence of damage to concrete and no excessive deflection or distortion of members due either to the removal of forms or to loss of support.

B. Supporting formwork (soffit material only) for horizontal members shall not be removed until the concrete has attained at least 75 percent of the specified 28 day compressive strength as determined by cylinders made and cured in the field. Shoring systems for horizontal members shall not be removed until the concrete has attained the full specified 28 day compressive strength, but may be temporarily removed for the purpose of removing the soffit material as permitted above. Shoring shall be left in place and reinforced as necessary to carry any construction equipment or materials placed thereon.

C. When forms are removed before the specified curing is completed, measures shall be taken to immediately continue curing and to provide adequate thermal protection for the concrete.

End of Section

SECTION 03 15 19 - CONCRETE JOINTS AND ACCESSORIES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers concrete accessories including construction, contraction and expansion joints for cast-in-place concrete.

B. Both inch-pound (English) and SI (metric) units of measurement are specified herein; the values expressed in inch-pound units shall govern.

1.2 GENERAL

A. All accessories shall be accurately placed and all joints shall be accurately and properly constructed so cast-in-place concrete can be placed as specified and as indicated on the Drawings.

1.3 SUBMITTALS

A. All submittals shall be made in accordance with the Submittal Procedures section.

B. The following items shall be submitted, as a minimum.

Manufacturer’s information for all products supplied under this section, in the form of technical data sheets, certificates of compliance, test data, or reports.

Drawings or figures indicating the location of all construction joints, expansion joints, and contraction joints.

Drawings or figures indicating the location of all waterstops including prefabricated or specialty pieces at turns, intersections, and changes of waterstop types.

PART 2 - PRODUCTS

2.1 MATERIALS

PVC Waterstops	Polyvinyl chloride material shall meet the requirements of CRD-C-572, shall be white (no pigment), ribbed, 3/8 inch min thick, size as indicated on the drawings. Reclaimed material will not be acceptable. Provide hog rings or grommets spaced at 12 inches on center entire length.

6 inches wide, at construction joints	Sika Greenstreak ”679”, JP Specialties “PVC637”, or Vinylex ”R638.”
9 inches wide, at construction joints	Sika Greenstreak ”646”, JP Specialties “PVC937”, or Vinylex ”R938.”
6 inches wide, at control joints	“O” bulb closed center section; Sika Greenstreak “732”, JP Spcialties “PVC638”, or Vinylex “RB638H.”
9 inches wide, at control joints	“O” bulb closed center section; Sika Greenstreak ”735”, JP Specialties “PVC938”, or Vinylex “RB938H.”
Expandable Waterstops, permitted only at locations indicated on Drawings	
For concrete sections that are at least 10 inches [300 mm] thick and 6 feet [1.8 m] high, and with at least two layers of reinforcement	Hydrophilic; bentonite free, chemically modified rubber. Adeka “Ultra Seal MC-2010MN” or Sika “Hydrotite CJ-1020-2K.” Adhesive and sealant as recommended by the manufacturer.
For other concrete sections	Hydrophilic; chemically modified rubber. Adeka “KBA-1510FP” or Sika “Swellstop.” Adhesive and sealant as recommended by the manufacturer.
Expansion joint materials	
Filler	Preformed sponge rubber, ASTM D1752, Type I.
Filler adhesive	As recommended by manufacturer.
Sealant	As specified in the Joint Sealants section.
Polyethylene film	NBS Product Standard PS17 or ASTM D4397, 6 mils or thicker.
Vapor retarder and seam tape	Polyolefin membrane, 15 mil min, ASTM E1745, Class A, with maximum water vapor permeance of 0.02 perms. Stego Industries “Stego Wrap 15 Mil,” Raven Industries “Vaporblock 15,” Reef Industries “Griffolyn 15 Mil Green,” W.R. Meadows “Perminator 15,” Insulation Solutions “Viper VaporCheck II.” Manufacturer recommended seam tape and pipe boots.
Bearing pads (dry environment)	Preformed cotton duck reinforced pads, at least 1/4 inch thick; JVI “Capralon” or Voss Engineering “Sorbtex.”
Bearing pads (damp or humid environment)	Neoprene, natural rubber, or PVC.

Neoprene	Minimum ultimate tensile strength of 1500 psi, minimum elongation of 500% (ASTM D412), and a maximum compressive set of 50% (ASTM D395 Method A), with hardness of 30 to 60 durometers (ASTM D2240, Type A Durometer). Neoprene shall contain only virgin, crystallization-resistant polychloroprene as the raw polymer, and physical properties shall be in accordance with ASTM D2000, Line Call-Out M2BC4105A14B14.
Natural rubber	Rubber shall contain only virgin natural polyisoprene as the raw polymer, and physical properties shall be in accordance with ASTM D2000, Line Call-Out M4AA41413.
PVC	PVC shall meet CRD-C-572.
Epoxy bonding agent	As specified in Concrete Placing section.
Grease for dowels at expansion joints	The lubricant shall be applied to the steel dowel as indicated on the drawings to reduce bond with the surrounding concrete. Grease shall meet the applicable requirements of NSF/ANSI 61 and NSF/ANSI 600 for structures that are part of the treatment process for producing potable water. At other locations, use all-purpose grease intended for greased dowels placed in expansion joints.

PART 3 - EXECUTION

3.1 CONSTRUCTION JOINTS

A. Construction joints shall be made at locations indicated on the Drawings or where specified. Construction joints shall not be made at other locations without the concurrence of Engineer.

B. Location

1. Construction joints shall be located as follows:

a. Bottom Slabs. Slabs with a transverse reinforcement pattern shall be divided into approximately square sections not to exceed 60 feet in their longest dimension. Slabs with a radial and circumferential reinforcement patter shall be divided into circular segments not to exceed 60 feet diameter, or into pie-shaped segments not to exceed 60 feet in the longest circumferential distance.

b. Columns. Provide joints at the underside of beams, girders, haunches, drop panels, and column capitals, and at floor levels. All haunches, drop panels, and column capitals shall be considered part of the supported floor or roof and shall be placed monolithically therewith. Column bases will not be required to be monolithic with the floor beneath.

c. Walls. Provide joints at the underside of beams, girders, haunches, drop panels, and at floor levels. All haunches and drop panels shall be considered part of the supported floor or roof and shall be placed monolithically therewith. Walls shall be divided into sections not to exceed 60 feet in length. Joints shall be located within 30 feet of corners for liquid-containing structures and within 40 feet of corners for non-liquid containing structures. Walls supporting beams shall have pockets blocked out so that the full beam cross section penetrates the full thickness of the wall. Where waterstops are required in the joint, the wall pocket shall be widened and deepened to prevent interference between the waterstop and the beam reinforcement.

d. Beams, Girders and Suspended Slabs. Provide joints within the middle third of the span, and as close as practicable to the 1/3 point of the span. If a beam intersects a girder, the joint in the girder shall be offset by at least twice the width of the beam. Integral beam and slab systems shall be monolithic and shall have identical joint locations within spans. Members shall be divided into pour sections not to exceed 60 feet in length.

2. Construction joints in all concrete elements shall be perpendicular to the planes of their surfaces.

C. Watertight Joints

1. Construction joints in the following locations shall be watertight and shall be provided with continuous waterstops.

a. For liquid-containing structures, provide in slabs below the liquid surface elevation, and in all perimeter walls to their full height.
b. For liquid-containing structures, provide in divider walls where it is possible for one side or “cell” to be out of service while the other remains liquid-containing.
c. For filters and clear water reservoirs, provide in all walls, base slabs, and top slabs.
d. Provide in other locations specifically indicated on the Drawings.

3.2 EXPANSION AND CONTRACTION JOINTS

A. Expansion joint filler shall be firmly bonded to the previously poured joint face with a suitable adhesive, and the new concrete shall be poured directly against the joint filler. Accessible edges of each expansion and contraction joint shall be sealed as specified in the Joint Sealants section.

3.3 WATERSTOPS

A. Placement

1. Each waterstop shall be continuous throughout the length of the joint in which it is installed. Waterstops shall be clean, free from coatings, and shall be maintained in proper position until surrounding concrete has been deposited and compacted. Waterstop embedment shall be equal on both sides of the joint.

2. Expandable waterstops shall be located as nearly as possible to the center of the joint and shall not be installed when air temperature falls outside the manufacturer's recommended range.

B. Storage and Handling

1. Expansion joint filler and elastomeric (PVC or TPV) waterstops shall be stored in a cool place protected from direct sunlight.

2. Metal waterstops shall be handled, transported, delivered, and stored in a manner which will prevent bends, dents, or corrosion.

C. Splices

1. Junctions between adjacent sections of metal waterstops shall be lapped 5 inches and securely bolted, screwed, or spot welded together.

2. Junctions between adjacent sections of elastomeric (PVC or TPV) waterstops shall be spliced in strict conformity with the recommendations of the manufacturer. Directional changes and intersections shall be factory fabricated by the waterstop manufacturer prior to delivery to the Site. Field splices will be acceptable only in straight sections.

3. Expandable waterstops shall be contact lapped a minimum distance of 8 inches . Voids shall be filled with sealant.

4. Where an expandable waterstop is used in combination with metal or PVC water stops, the expandable water stop shall be placed in contact and shall overlap a minimum distance of 12 inches . Voids shall be filled with sealant.

3.4 PLACEMENT

A. The limits of each concrete pour shall be determined by Contractor and shall be acceptable to Engineer.

3.5 EMBEDMENTS

A. Anchor bolts, castings, steel shapes, conduits, sleeves, masonry anchors, and other objects that are to be embedded in the concrete shall be accurately positioned in the forms and securely anchored.

B. Unless installed in pipe sleeves, anchor bolts shall have sufficient threads to permit a nut to be placed on the concrete side of the form or template. A second nut shall be placed on the other side of the form or template, and the two nuts shall be so adjusted that the bolt will be held rigidly in proper position.

3.6 DUCT BANK JOINTS

A. Hardened surfaces that are to receive additional concrete shall be prepared by removing all loose particles, scum, and laitance so that the aggregate is exposed. The hardened surface shall then be thoroughly wetted and a thin coating of neat cement mortar shall be spread over the entire surface just before the fresh concrete is placed. The fresh concrete shall be puddled and spaded to eliminate any honeycomb or lack of mortar near the joint.

3.7 PLACEMENT AGAINST SUBGRADE

A. Where concrete is placed against rock, all loose pieces of rock shall be removed and the exposed surface cleaned with a high-pressure water spray.

B. Polyethylene Film

1. Where concrete is placed against gravel or crushed rock which does not contain at least 25 percent material passing a No. 4 sieve, such surfaces shall be covered with polyethylene film. Joints in the film shall be lapped at least 6 inches and taped.

3.8 BEARING PADS

A. Wherever a concrete beam is supported by a concrete bracket, a bearing pad shall be placed in the joint between the beam and the bracket. Bearing pads for sliding joints shall be attached to the hardened surface to prevent uplift during subsequent placement of concrete. Nailing of pads shall not be permitted.

End of Section

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SCOPE

A. This section covers reinforcement for cast-in-place concrete.

B. Both inch-pound (English) and SI (metric) units of measurement are specified herein; the values expressed in inch-pound units shall govern.

1.2 SUBMITTALS

A. All submittals shall be made in accordance with the Submittal Procedures section.

B. The following items shall be submitted, as a minimum.

Manufacturer's information for all products supplied under this section, in the form of technical data sheets, certificates of compliance, test data, or reports.

Bar lists and drawings for the fabrication and placing of reinforcement, with sufficient plans, elevations, and sections to adequately detail and label all reinforcement. Bar drawings shall also include a reference to the structure where the reinforcement is to be installed and the relevant contract drawings showing the reinforcement.

C. Reinforcement fabrication drawings shall not be submitted until Engineer has reviewed and accepted submittals for the locations of construction joints and concrete placement sequences.

PART 2 - PRODUCTS

2.1 MATERIALS

Bars	ASTM A615, Grade 60, deformed.
Bars, Weldable	ASTM A706 or A615, Grade 60, deformed, with maximum carbon equivalent of 0.55%.
Ductile Reinforcing Bars	ASTM A706 or ASTM A615, Grade 60, if the actual yield strength based on mill tests does not exceed the specified yield strength by more than 18,000 psi (retests shall not exceed this value by more than an additional 3,000 psi) and the ratio of the actual ultimate tensile strength to the actual

	tensile yield strength is not less than 1.25.
Shear Bars	ASTM A615, Grade 60, smooth.
Column Spirals	ASTM A1064, cold drawn wire.
Welded Wire Fabric	ASTM A1064, Grade 70.
Bar Supports	CRSI Class 1, plastic protected; or Class 2, stainless steel protected. Precast concrete bricks shall not be used without approval of Engineer.
Mechanical Connectors	Splicing system meeting Type 2 tensile requirements of ACI 318. Products shall have a current evaluation report verifying testing per ICC-ES AC 133.
Threaded Type	Dayton Superior "DBDI Splice System," nVent "LENTON Mechanical Splicing Systems", or Barsplice Products "Grip-Twist" system.
Locking Type	Dayton Superior "Bar-Lock Coupler System", nVent "LENTON Connect System", or Barsplice Products "Zap Screwlock Type 2 Mechanical Connector" system.

2.2 REINFORCEMENT

A. Reinforcement shall be accurately formed and shall be free from loose rust, scale, concrete splatter, and contaminants which reduce bond. Unless otherwise indicated on the Drawings or specified herein, the details of fabrication shall conform to ACI SP-66 and ACI 318. Reinforcement shall not be bent in the field without approval of Engineer.

B. Splices

1. Splices shall conform to the details indicated on the Drawings. Splices at locations other than those indicated on the Drawings shall be submitted to Engineer for review and concurrence.

2. The reinforcement splice locations shall be coordinated with the construction joint locations and concrete placement sequence.

C. Mechanical Connectors

1. Mechanical connectors shall be used only as indicated on the Drawings. Connections in adjacent bars shall be spaced at least 30 inches apart.

D. Welding

1. Except where indicated on the Drawings, welding or tack welding of reinforcement is not permitted. Preheating and welding shall conform to AWS D1.4. Reinforcement which has been welded improperly or without Engineer's concurrence shall be removed and replaced.

PART 3 - EXECUTION

3.1 STORAGE AND HANDLING

A. Reinforcing steel shall be carefully handled and shall be stored on supports which prevent the steel from touching the ground.

3.2 PLACEMENT

A. Reinforcement shall be accurately positioned on supports, spacers, hangers, or other reinforcement, and shall be secured in place with wire ties or suitable clips. Tolerances shall be as stipulated in ACI 117 and ACI 318 unless otherwise indicated.

B. Reinforcement at the bottom of concrete slabs and mats shall not be supported from contact with subgrade by the use of metal supports or bent reinforcement.

C. Where reinforcement in beams is placed in two or more layers, the bars in the upper layer shall be placed directly above the bars in the lower layer.

D. Reinforcement for elevated beams or slabs shall not be installed until the concrete for the supporting wall or column system has been placed and compacted.

E. Before concrete is placed, reinforcement shall be rigidly secured in proper position. All surfaces encrusted with dried concrete from previous placements shall be cleaned and the entire installation shall be acceptable to Engineer. Remove all frost, ice, and snow before concrete is placed.

3.3 PLACING CONCRETE

A. Concrete shall be placed and compacted in wall or column forms before any reinforcement is placed in the system to be supported by such walls or columns.

3.4 DUCT BANKS

A. All reinforcement and other magnetic materials installed in duct banks shall be installed parallel to the individual ducts, unless they enclose all the ducts of the duct bank.

End of Section

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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SCOPE

A. This section covers procurement of all cast-in-place concrete, including concrete materials, limiting requirements, mixture design, and performance requirements, and delivery to the Site through discharge at the end of the delivery truck chute.

B. Pervious concrete, lightweight aggregate concrete, or lightweight cellular concrete shall not be used for any concrete covered by this section.

C. Work beyond the end of the delivery truck chute is covered in the Concrete Forming, Concrete Joints and Accessories, Concrete Reinforcing, Concrete Placing, Concrete Finishing, and Concrete Curing sections.

D. Both inch-pound (English) and SI (metric) units of measurement are specified herein; the values expressed in inch-pound units shall govern.

1.2 GENERAL

A. All cast-in-place concrete shall conform to the limiting requirements of this section including Table 1.

B. Concrete Classifications

1. Concrete classifications shall be defined and used as indicated for the following classes:

C. Concrete Classifications

Class	Class Description
A.	Structural Concrete
A1.	Concrete for Liquid-Containing Structures. Concrete for liquid-containing environmental structures, liquid-containing tanks, interior suspended slabs in high humidity areas, headwalls, chemical storage or containment areas, below grade structures exposed to groundwater under normal conditions, and all other concrete not otherwise indicated.
A2.	Small Aggregate Concrete; Congested Areas. Structural small aggregate concrete shall be used in all areas (including liquid-containing structures) where the clear distance between reinforcement, conduit, or embedded items is less than the largest dimension of coarse aggregate particles in the structural concrete.

Class	Class Description
A3.	Concrete for Non-Liquid-Containing Structures. Concrete for footings, foundations, manholes, catch basins, pan-formed joists, and all other structural concrete other than for liquid-containing structures.
A4.	Mortar Puddle. Placed in a lift 2 inches or more deep at the bottom of forms for walls and columns immediately before structural concrete is placed.

B. Exterior Flatwork Concrete. Concrete for exterior slabs on grade, plant pavement, sidewalks, curbs and gutters, and small equipment pads.

D. Miscellaneous Concrete

D1. Ductbanks, Pipe Blocking, Concrete Fill, and Pipe Encasement Concrete. Concrete used in ductbanks, pipe blocking, concrete fill and pipe encasements.

1.3 SUBMITTALS

A. All submittals shall be made in accordance with the Submittal Procedures section.

B. The required submittal data for each Class of concrete shall be as indicated in Tables 2A, 2B, and 2C. The sequencing of the submittal data shall be as follows.

C. Preliminary Review of Materials

1. Reports covering the source and quality of concrete materials proposed for the work shall be submitted to Engineer for review within 30 days after the preconstruction conference.

2. The submittal shall include Submittal Cover Page #1, provided in the Appendix of this section. The cover page shall indicate the page numbers in the submittal where the respective data may be found during Engineer review.

3. Manufacturer's information shall be submitted for all concrete ingredients, in the form of technical data sheets, certificates of compliance, test data, or reports for the following materials:

a. Cement
b. Aggregates
c. Admixtures
d. Fly Ash
e. Slag Cement

D. Proposed Mixture Proportions

1. Data indicating the proposed material quantities in each Class of concrete shall be submitted to Engineer for review within 30 days after the preconstruction conference.

2. The submittal shall include Submittal Cover Page #2, provided in the Appendix of this section. The cover page shall indicate the page numbers in the submittal where the respective data may be found during Engineer review.

E. Mixture Test Results

1. Concrete mixture test results shall be submitted to Engineer for review and acceptance.

2. The submittal shall include Submittal Cover Page #3, provided in the Appendix of this section. The cover page shall indicate the page numbers in the submittal where the respective data may be found during Engineer review.

3. Compressive strength shall be qualified by field test record data only for the Classes of concrete indicated as such in Table 2C. Compressive strength shall be qualified by laboratory testing for other Classes.

4. Laboratory trial mixture testing shall not begin until materials and proposed mixture proportions have been reviewed and are acceptable to Engineer.

1.4 STORAGE AND HANDLING

A. Cement, slag cement and fly ash shall be stored in suitable moistureproof enclosures. Cement, slag cement and fly ash which have become caked or lumpy shall not be used.

B. Aggregates shall be stored so that segregation and the inclusion of foreign materials are prevented. The bottom 6 inches of aggregate piles in contact with the ground shall not be used.

PART 2 - PRODUCTS

2.1 LIMITING REQUIREMENTS

A. Unless otherwise specified, each concrete mixture shall be designed and controlled, within the following limits, to provide a dense, durable concrete suitable for the expected service conditions.

B. Concrete materials shall be selected and concrete shall be proportioned, batched, mixed, and delivered in a manner that will minimize shrinkage and cracking as specified herein, and in accordance with Chapters 3 and 8 of ACI 224R. Concrete temperatures shall be controlled before and until delivery at the end of the delivery truck chute to minimize cracking. Any rise in concrete temperature caused by environmental conditions that will be conducive to excessive shrinkage shall be controlled.

C. For each class of concrete, each concrete mixture shall be designed and concrete shall be controlled within the limits in the specification and in Table 1.

D. Cementitious Material Content Limits

1. The cementitious material content shall be suitable for meeting the performance requirements of this section.

2. Contractor may substitute fly ash for cement within the percentage ranges indicated in Table 1, on the basis of 1.0 lbs of fly ash added for each lb of cement reduction.

3. Contractor may substitute slag cement for cement within the percentage ranges indicted in Table 1 on the basis of 1.0 lbs of slag cement added for each lb of cement reduction.

E. Maximum Water-Cementitious Material Ratio

1. The maximum water-cementitious material ratio shall be on a cement mass basis, or, if fly ash or slag cement is used, the combined mass of cement plus fly ash or slag cement shall be used to determine the water-cementitious materials ratio. Limiting maximum water-cementitious material ratios are indicated in Table 1.

F. Aggregates

1. Aggregates shall comply with ASTM C33 except as specified herein. Recycled aggregates, or aggregates created from crushed concrete, will not be acceptable. Fine aggregate shall be clean natural sand. Artificial or manufactured sand shall not be used unless acceptable to Engineer. Coarse aggregate shall be crushed rock, washed gravel, or other inert granular material, meeting Class 4S requirements, except that clay and shale particles shall not exceed values indicated in Table 1.

2. Gradation of coarse aggregate shall conform to maximum nominal size grading requirements of ASTM C33. When a combination of two or more sizes is used, the combined gradation shall meet ASTM C33 requirements.

3. Aggregates used in concrete shall have a combined aggregate distribution similar to the aggregates used in the concrete trial mixtures. Reports of individual aggregates shall include sieve sizes 1-1/2 inch, 1 inch, 3/4 inch, 1/2 inch, 3/8 inch, No. 4, No. 8, No. 16, No. 30, and No. 50 in accordance with ASTM E11.

4. Specified sand equivalent for fine aggregate shall be not less than indicated in Table 1 for an average of 3 samples tested in accordance with ASTM D2419.

5. To comply with the specified concrete shrinkage test requirements, the clay and shale content of the aggregates may need to be reduced by washing the aggregate.

G. Ratio of Fine to Total Aggregates

1. The ratio of fine to total aggregates, based on solid volumes (not weights), shall be as follows:

Maximum Nominal Coarse Aggregate Size	Minimum Ratio	Maximum Ratio
3/8 inch	0.45	0.60
1/2 inch	0.40	0.55
3/4 inch	0.35	0.50

Maximum Nominal Coarse Aggregate Size	Minimum Ratio	Maximum Ratio
1 inch	0.30	0.46
1-1/2 inch	0.25	0.40

H. Slump

1. Concrete slump shall be kept as low as possible, consistent with proper handling and thorough consolidation. Prior to the addition of admixtures, slump shall be at least 2 inches and shall not exceed the maximum slump as indicated in Table 1.

2. When superplasticizer is dispensed at the ready-mix plant, the concrete mixture design shall be based on a maximum slump as indicated in Table 1. When superplasticizer is dispensed at the Site, the slump of the concrete delivered shall not exceed the maximum slump as indicated in Table 1 before superplasticizer is added.

I. Initial Set

1. The initial set, as determined by ASTM C403, shall be attained 5-1/2 hours ±1 hour after the water and cementitious materials are added to the aggregates for each concrete mixture. The quantity of retarding admixture shall be adjusted to compensate for variations in temperature and job conditions.

J. Total Air Content

1. The total volumetric air content of concrete after placement shall be as indicated in Table 1, and within ±1.5 percent. Air-entraining admixture may be omitted from concrete for interior floor surfaces which are to be steel trowel finished.

K. Admixtures

1. Only approved or specified admixtures shall be used.

2. Unless otherwise acceptable to Engineer, all admixtures shall be from one manufacturer and shall be compatible. Admixtures that are compatible with other admixtures and concrete materials shall not have an adverse effect on the required properties of the concrete nor the specified limiting requirements. The admixture content, batching method, and time of introduction to the mixture shall comply with these specifications and with the manufacturer's recommendations for minimum shrinkage. The admixture manufacturer shall provide qualified field services as necessary, at no additional cost to Owner.

3. Admixtures used in the concrete shall be reviewed and accepted by Engineer prior to conducting the laboratory trial mixture testing and the shrinkage testing. No calcium chloride nor admixture containing chloride from sources other than residual impurities in admixture ingredients will be permitted.

4. Combination of admixtures which cause premature or local dehydration or post-compaction settlement of the concrete surface shall not be used. If any such undesirable characteristics are observed, the use of the mixture shall be discontinued and an alternate mixture design used.

5. All liquid-containing (Class A1) concrete, and small aggregate (Class A2) concrete that is placed in liquid-containing structures, shall include a high-range water reducing admixture (superplasticizer). Water-reducing admixtures are not required for Classes D1 and D7, but may be included at Contractor's option. For all other non-liquid-containing concrete, a water-reducing admixture shall be used.

6. Superplasticizer may be dispensed into the concrete at the plant or on the Site and shall be mixed in accordance with the admixture manufacturer's recommendations. Each superplasticizer dose, when dispensed at the Site, shall be easily verifiable and recorded on the delivery ticket. The superplasticizer for each load shall be accurately proportioned into a separate container prior to dispensing the admixture into the concrete. When truck-mounted dispensers are used, the system shall not be flushed or cleaned with water until after the entire load of concrete has been discharged. When permitted by Engineer, redosing of concrete with superplasticizer shall be done only once. Redosing procedures shall be as recommended by the admixture manufacturer.

7. A shrinkage reducing admixture may be added to Class A1 concrete. It shall replace an equal volume of mixing water or as otherwise recommended by the admixture manufacturer. The quantity of air entrainment admixture shall be adjusted as required by the admixture manufacturer to keep mixture air content within specified limits.

L. Strength

1. In addition to the other limiting requirements to achieve durability and minimize shrinkage, the minimum acceptable compressive strengths of concrete tested at the end of the delivery truck chute, as determined by ASTM C39, shall be as indicated in Table 1.

2. Adequate test cylinders taken at the point of placement shall also be made to verify that Contractor's concreting procedures comply with applicable industry standard procedures.

M. Pumped Concrete

1. Coarse aggregate size for pumped concrete mixtures shall be limited to a nominal maximum of 1-1/2 inch .

N. Water-Soluble Chloride

1. Maximum water-soluble chloride ion concentrations in hardened concrete at an age of 28 days shall not exceed the limits expressed as a percentage of mass of cementitious materials as indicated in Table 1.

2. Test results shall be reported as the percentage of water-soluble chloride ions in the concrete and as a percentage of chloride ion relative to the mass of cementitious materials in the concrete.

3. Testing of the concrete components for water-soluble chloride ions may be done at the discretion of Contractor. Copies of the reports on such tests shall be furnished to Engineer.

4. The hardened concrete and each gradation of aggregate used in the concrete shall be tested each time a chloride ion test is conducted on a concrete mixture.

O. Laboratory Shrinkage Limits

1. Based on the modified ASTM C157 test procedures as specified herein, the shrinkage limits of concrete shall be the average drying shrinkage of each set of three test specimens cast in the laboratory from a trial mixture as measured at the 21 days drying age, and shall not exceed the values in Table 1.

P. NSF/ANSI 61 and NSF/ANSI 600 Compliance

1. All liquid-containing (Class A1) concrete, small aggregate (Class A2) concrete, and concrete fill (Class D1) that is used in structures that are part of the treatment process for producing potable water shall have all admixtures compliant with NSF/ANSI 61 and NSF/ANSI 600.

Q. Cold Weather Concrete

1. Except as modified herein, cold weather concrete shall comply with ACI 306.1. The temperature of concrete at the point of delivery at the end of the delivery truck chute shall be not less than that indicated in ACI 306.1 for corresponding outdoor temperature (in shade) at the time of placement.

2. When delivered, heated concrete shall be not warmer than 80°F .

R. Hot Weather Concrete

1. Except as modified herein, hot weather concrete shall comply with ACI 305.1. At air temperatures of 90° F or above, concrete shall be kept as cool as possible before and during delivery. The temperature of the concrete at the time of delivery at the end of the delivery truck chute shall not exceed the values indicated in Table 1.

2.2 MATERIALS

Cement	ASTM C150 Type II or I/II, or ASTM C595 Type IL(MS). ASTM C595 cements that incorporate ASTM C1157 cements will not be acceptable.
Fly Ash	ASTM C618, except that loss on ignition shall not exceed 4 percent. Class F or Class C are acceptable, but Class C shall also be qualified for moderate sulfate resistance as described in ASTM C618, Table 3, Procedure A. The test for sulfate resistance shall be in accordance with ASTM C1012.
Slag Cement	ASTM C989, Grade 100 or Grade 120.
Aggregates, Fine and Coarse	As specified in Limiting Requirements paragraph.
Water	Potable. Water from concrete production operations shall not be used.

Admixtures

Water Reducing/Normal Set	ASTM C494, Type A, except as otherwise specified herein.
Water Reducing/Retarding	ASTM C494, Type D, except as otherwise specified herein.
Air-Entraining	ASTM C260.
High Range Water Reducing/Normal Set	ASTM C494, Type F, extended slump life type, except as otherwise specified herein.
High Range Water Reducing/Retarding	ASTM C494, Type G, extended slump life type, except as otherwise specified herein.
Shrinkage Reducing Admixture	GCP Applied Technologies (Grace) “Eclipse 4500,” Euclid “Eucon SRA,” or Master Builders Solutions “MasterLife SRA 035.” These admixtures shall not be used when NSF/ANSI 61 and NSF/ANSI 600 certification is required.

2.3 MIXTURE DESIGN AND TESTING

A. As stipulated in the Quality Control section, all reports and tests required for preliminary review of materials and for laboratory trial mixtures shall be made by an independent testing laboratory at the expense of Contractor. Mixtures shall be adjusted in the field as necessary, within the limits specified, to meet the requirements of these specifications. If the source of any concrete materials is changed during the contract, concrete work shall pause until the new materials and the new mixture design are tested in accordance with the specified requirements.

B. Preliminary Review of Materials

1. The tests and reports required shall be as indicated in Table 2A. Review of these reports shall be for general acceptability only, and continued compliance with all contract provisions shall be required.

2. Aggregate reports shall be no more than 90 days old at time of submittal.

3. Alkali-aggregate reactivity potential shall be determined by one of the following procedures. Field performance history as described in ASTM C1778 will not be an acceptable method for qualifying aggregates.

   a. Test fine and coarse aggregates in accordance with ASTM C1260. Aggregates which are classified as innocuous may be used without further testing.
   b. Test fine and coarse aggregates in accordance with ASTM C1567, using a single aggregate with all cementitious materials selected for the Project. The fine and coarse aggregates shall not be combined and used in a single test. This test may only be used for mixtures that contain slag cement or fly ash, and those products shall not have an alkali content greater than 4.0 percent sodium oxide equivalent.

Combinations of cementitious materials and aggregate which do not indicate a potential for alkali reactivity may be used without further testing. Mixture combinations which indicate a potential for alkali reactivity shall have the ingredients and/or proportions modified and then the test shall be repeated.

c. Test fine and coarse aggregates in accordance with ASTM C1293. Concrete mixtures containing only cement (without pozzolan or slag cement) shall be tested accordingly and have a measured expansion of 0.04 percent or less at one year duration. Concrete mixtures containing pozzolan or slag cement shall be tested with those ingredients in proportions matching that of the proposed mixture, and shall have a measured expansion of 0.04 percent or less at two years duration.

4. At the discretion of Engineer, testing in addition to that indicated herein or in ASTM C1778 may be performed on potentially reactive aggregates. Nonreactive aggregates shall be imported if, in the opinion of Engineer, local aggregates exhibit unacceptable potential reactivity.

C. Proposed Mixture Proportions

1. Proposed proportions for each Class of concrete shall meet the limiting requirements indicated herein.

D. Mixture Testing

1. Test results on each Class of concrete shall be submitted for review and shall be acceptable to Engineer before concrete work is started. The reports shall include the information indicated in Table 2C.

2. Field Test Record Data

a. If indicated as acceptable in Table 2C, concrete mixtures may be qualified based upon field test record performance data in lieu of laboratory trial mixtures. Field test data records shall be from the production facility being used on the current Project and shall have been performed in the past 24 months. Field test records shall represent a single group of at least 10 consecutive strength tests for one mixture, using the same materials, under the same conditions, and encompassing a period of not less than 45 days.

3. Laboratory Trial Mixture Testing

a. Trial mixtures shall be tested in the laboratory for each size and combined gradation of aggregates and for each consistency as indicated and intended for use on the work and as specified.

b. Concrete ingredients shall be measured and mixed in the laboratory. Concrete test specimens shall be made, cured, and stored in accordance with ASTM C192 and tested in accordance with ASTM C39.

c. Concrete proportions shall be established based on laboratory trial mixtures that meet the following requirements:

1) The combination of materials shall be as proposed for use in the work.

2) Mixtures shall conform with the limiting requirements specified herein.

3) The required average compressive strength, f'_{cr}, of the trial mixture shall exceed the specified minimum acceptable compressive strength, f'_{cr}, as required in Table 1.
4) Trial mixtures of the proportions and consistencies specified for the work shall be prepared. When a three point curve is required by Table 2C, the three concrete trial mixtures shall reflect the cement content proposed for the Project and for the indicated concrete class at three water-cementitious material ratio contents at or lower than indicated in Table 1. The compressive strength of the cylinders made from the three trial mixtures shall produce a range of compressive strengths exceeding or encompassing the f'_{cr} required for the work.
5) For each proposed concrete mixture that is required to be tested as indicated in Table 2C, compressive strength test cylinders shall be made for each testing age. Each change in the water-cementitious materials ratio shall be considered a new concrete mixture. Each mixture shall be tested at the ages of 7 days and 28 days.
6) When a three point curve is required in Table 2C, the results of the cylinder tests for each water-cementitious materials ratio at each age shall be plotted as a curve showing the relationship between compressive strength (along y-axis) and the water-cementitious materials ratio (along x-axis). The water-cementitious materials ratio and the associated average compressive strength for the Project concrete mixture shall be selected from the 28 day curve. The maximum water-cementitious materials ratio specified in the limiting requirements shall still apply even if the curve indicates that the concrete strength would be adequate at a higher ratio. The cement content and mixture proportions to be used shall be such that the selected water-cementitious materials ratio will not be exceeded at specified maximum slump. These concrete mixture proportions shall be submitted for review in accordance with the Submittals Procedures section.
7) When a shrinkage reducing admixture is proposed, trial mixtures shall be prepared with and without the shrinkage reducing admixture.

4. Testing Procedures

a. Concrete mixture testing procedures shall be as specifier herein, and reports for these tests shall be prepared specifically for this Project.
b. Aggregates shall be sampled and tested in accordance with ASTM C33. The bulk specific gravity of each aggregate shall be determined in accordance with ASTM C127 and ASTM C128.
c. Slump shall be determined in accordance with ASTM C143. Unit weight (mass) shall be determined in accordance with ASTM C138. Total air content shall be determined in accordance with ASTM C231 and verified in accordance with ASTM C138. Concrete temperature shall be determined in accordance with ASTM C1064.
d. Initial set tests shall be made at ambient temperatures of 70° F and 90° F to determine compliance with the specified time for initial set. The test at 70° F shall be made using concrete containing the specified normal set/water-reducing admixture and, when required, air-entraining admixture. The test at 90° F shall be made using concrete containing the specified retarding/water-reducing admixture

and, when required, air-entraining admixture. Initial set shall be determined in accordance with ASTM C403.

e. Cylinders shall be 6 inches diameter by 12 inches high for concrete mixes using a maximum nominal aggregate size of 1 inch or larger. Cylinders may be either 6 inches diameter by 12 inches high, or 4 inches diameter by 8 inches high for concrete mixes using a maximum nominal aggregate size of less than 1 inch . The average compressive strength shall be determined from the results of at least three cylinders when using 4 inch diameter cylinders, and at least two cylinders when using 6 inch diameter cylinders. All tests for a particular class of concrete shall be performed using the same sized cylinders for the duration of the work.

f. Water-soluble chloride ion shall be determined in accordance with ASTM C1218.

g. A drying shrinkage test shall be conducted on the trial mixture with the maximum water-cementitious materials ratio used to qualify each proposed concrete mixture design using the concrete materials, including admixtures, that are proposed for the Project. Three test specimens shall be prepared for each test. Drying shrinkage specimens shall be 4 inch by 4 inch by 11 inch prisms with an effective gauge length of 10 inches , fabricated, cured, dried, and measured in accordance with ASTM C157 except with the following modifications:

1) Specimens shall be removed from the molds at an age of 23 hours ±1 hour after batching, shall be placed immediately in water at 73°F ±3°F for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in lime-saturated water as specified in ASTM C157. Measurement to determine expansion expressed as a percentage of original length shall be taken at age 7 days. The length at 7 days shall be the base length for drying shrinkage calculations (“zero” days drying age). Specimens then shall be stored immediately in a humidity controlled room maintained at 73°F ±3°F and 50 percent ±4 percent relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as a percentage of the base length shall be reported separately for 7, 14, and 21 days ±4 hours of drying from “zero” days after 7 days of moist curing for a total of 28 days from the date of casting.

2) Drying shrinkage deformation for each specimen shall be computed as the difference between the base length (at “zero” days drying age) and the length after drying at each test age. Results of the shrinkage test shall be reported to the nearest 0.001 percent. If drying shrinkage of any specimen deviates from the average for that test age by more than 0.004 percent, the results for that specimen shall be disregarded.

3) The average drying shrinkage of each set of 4 inch by 4 inch by 11 inch test specimens made in the laboratory from a trial mixture shall not exceed the values required in Table 1.

PART 3 - EXECUTION

3.1 BATCHING, MIXING, AND DELIVERY

A. Concrete shall be furnished by a ready-mixed concrete manufacturer (plant) and trucks which are certified by the National Ready Mixed Concrete Association’s (NRMCA) Plant and Truck Certification Program, and shall conform to ASTM C94 except as indicated otherwise in this

section. The time from start of concrete mixing to completion of discharge from the truck shall not exceed 1-1/2 hours.

B. Delivery Tickets

1. A delivery ticket shall be prepared for each load of ready-mixed concrete and a copy of the ticket shall be handed to Engineer by the truck operator at the time of delivery. Tickets shall indicate the name and location of Contractor, the project name, the mixture identification, the quantity of concrete delivered, the quantity of each material in the batch, the outdoor temperature in the shade, the time at which the cementitious materials were added, and the numerical sequence of the delivery.

C. Mixing Water

1. Mixing water shall not be added in transit. Any amount of water withheld from the truck mixer shall be clearly indicated on the delivery ticket. Water added at the site shall not exceed the amount withheld, and shall not be added without oversight by Owner's on site inspector.

D. Consistency

1. The consistency of concrete shall be suitable for the placement conditions. Aggregates shall flow uniformly throughout the mass, and the concrete shall flow sluggishly when vibrated or spaded. The slump shall be kept uniform.

3.2 CONTRACTOR'S ON GOING MATERIAL CONTROL TESTING

A. The following tests and test reports are required during the progress of the work and shall be made at the expense of Contractor. The frequency specified herein for each field control test is approximate and subject to change as determined by Engineer.

B. Aggregate Gradation

1. Each 200 tons of fine aggregate and each 400 tons of coarse aggregate shall be sampled and tested in accordance with ASTM D75 and C136, for verification that the gradations continue to meet ASTM C33 requirements. If lesser quantities of aggregates are used, the sampling and testing shall occur at least once every 6 months.

C. Sand Equivalent

1. The sand equivalent test shall be conducted each time the sand gradation tests are conducted.

D. Fly Ash

1. Each 400 tons of fly ash shall be sampled and tested in accordance with ASTM C618 and C311. Contractor shall supply Engineer with certified copies of supplier's (source) test reports showing chemical composition and physical analysis for each shipment delivered

to Contractor and certifying that the fly ash complies with the specifications. The certificate shall be signed by the fly ash supplier.

E. Cement

1. Each 1500 tons of cement shall be sampled and tested in accordance with ASTM C150. Contractor shall supply Engineer with certified copies of supplier's (source) test reports showing chemical composition and physical analysis, and certifying that the cement complies with ASTM C150 and these specifications. The certificate shall be signed by the cement manufacturer.

F. Slag Cement

1. Each 800 tons of slag cement shall be sampled and tested in accordance with ASTM C989. Contractor shall supply Engineer with certified copies of supplier's (source) test reports showing chemical composition and physical analysis, and certifying that the slag cement complies with ASTM C989 and these specifications. The certificate shall be signed by the slag cement manufacturer.

3.3 OWNER'S FIELD CONTROL TESTING

A. Field control tests, including slump, air content, and making compression test cylinders, shall be performed by Engineer or Owner's testing laboratory personnel, at the expense of Owner. Contractor shall provide access to all facilities and the services of one or more employees as necessary to assist with the field control testing.

B. The frequency specified herein for each field control test is approximate and subject to change as determined by Engineer.

C. Field control testing will not be performed for Classes D1, D4, or D7, unless Owner specifically requests and schedules such testing. Other special inspection requirements applicable for these classes of concrete will still be performed.

D. Engineer may require field testing prior to the addition of superplasticizer at the Site to determine compliance with the specifications. Field testing after the addition of superplasticizer shall be conducted as specified and as needed to determine that the concrete is in compliance with the specifications. Air content tests shall be conducted whenever field tests are conducted.

E. Slump

1. A slump test shall be made for each 100 cubic yards of concrete. Slump shall be determined in accordance with ASTM C143.

F. Air Content

1. An air content test shall be made on concrete from one of the first three batches mixed each day and on concrete from each batch of concrete from which concrete compression test cylinders are made. Air content shall be determined in accordance with ASTM C231 and verified in accordance with ASTM C138.

G. Unit Weight

1. A unit weight test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Unit weight shall be determined in accordance with ASTM C138.

H. Concrete Temperature

1. A concrete temperature test shall be made on concrete from the first batch of concrete mixed each day and on concrete from each batch of concrete from which concrete compression test cylinders are made. During hot or cold weather concreting operations, temperature shall be checked not less than once per hour. Concrete temperature shall be determined in accordance with ASTM C1064.

I. Water-Soluble Chloride Ion

1. Water-soluble chloride ion testing shall be performed once for each 1,000 cubic yards of concrete in accordance with ASTM C1218

J. Compression Tests

1. One set of concrete compression test cylinders shall be made not less than once each day concrete is placed, not less than once for each 100 cubic yards of each class of concrete, and not less than once for each 5000 square feet of surface area for slabs or walls. Half of the cylinders of each set shall be tested at an age of 7 days and the remaining cylinders shall be tested at an age of 28 days.

2. Test cylinders shall be made, cured (standard curing method), stored, and delivered to the laboratory in accordance with ASTM C31 and tested in accordance with ASTM C39.

3. Cylinders shall be 6 inches diameter by 12 inches high for concrete mixes using a maximum nominal aggregate size of 1 inch or larger. Cylinders may be either 6 inches diameter by 12 inches high, or 4 inches diameter by 8 inches high for concrete mixes using a maximum nominal aggregate size of less than 1 inch . The average compressive strength shall be determined from the results of at least three cylinders when using 4 inch diameter cylinders, and at least two cylinders when using 6 inch diameter cylinders. All tests for a particular mixture class shall be performed using the same sized cylinders for the duration of the work and shall match the cylinder size used for the trial mixtures.

4. Each set of compression test cylinders shall be marked or tagged with the date and time of day the cylinders were made, the location in the work where the concrete represented by the cylinders was placed, the number of the delivery truck or batch, the air content, the slump, the unit weight, and the concrete temperature.

K. Shrinkage Tests

1. Concrete shrinkage tests shall be performed once for each 1,000 cubic yards of concrete with controlled shrinkage that is placed and shall be made on concrete from a batch of concrete from which concrete compression test cylinders are made. Shrinkage testing shall be conducted as specified for the preliminary trial mixtures.

2. The average drying shrinkage of each set of test specimens cast in the field from concrete delivered to the Site and sampled at the end of the delivery truck chute, as measured at the 21 days drying age, shall not exceed the values indicated in Table 1.

L. Test Reports

1. Five copies of each test report shall be prepared and distributed by the testing laboratory to the Owner, Resident Project Representative (two copies), Engineer, and Contractor, in accordance with the Quality Control section.

3.4 EVALUATION AND ACCEPTANCE OF CONCRETE

A. Concrete will be evaluated for compliance with all requirements of the specifications. Concrete strength will be only one of the criteria used for evaluation and acceptance of the concrete. The results of all tests performed on the concrete and other data and information concerning the procedures for handling, placing, and curing concrete will be used to evaluate the concrete for compliance with the specified requirements.

B. Compression tests will be evaluated in accordance with ACI 318 and as specified herein. A strength test shall be the average of the compressive strengths of two 6 inch diameter cylinders or three 4 inch diameter cylinders, made from the same concrete sample tested at 28 days.

C. Compression Test Evaluation

1. Compressive strength test results will be evaluated for compliance with the specified strength requirements. The strength level of the concrete will be considered satisfactory when the averages of all sets of three consecutive strength tests equal or exceed the specified compressive strength, f'_c, and no individual strength test result falls below the specified compressive strength by more than 500 psi .

D. Inspection of Concrete Supplier

1. Both scheduled and unscheduled visits by inspectors on days of concrete pours shall be accommodated. Inspectors shall be allowed access to delivery tickets and mixture proportions.

TABLE 1 – LIMITING REQUIREMENTS														
	Concrete Class	**A1**	**A2**	**A3**	**A4**	**A5**	**B**	**C**	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**
1.	Compressive Strength, minimum; psi														
	Field, 7 days;	3375	3375	3375	3000	3000	3000	3000	2250	3000	**	3000	3000	3000	1500
	Field, 28 days; f'_c	4500	4500	4500	4000	4000	4000	4000	3000	4000	**	3000	4000	4000	2000
	Laboratory, 28 days; f'_{cr}	5700	5700	5700	5200	5200	5200	5200	3200	5200	**	4200	5200	5200	2000
2.	Maximum water-cementitious material ratio	0.42	0.42	0.45	0.45	0.45	0.48	0.45	0.65	0.45	**	0.45	0.45 0.40[a]	0.42	0.75
3.	Maximum nominal coarse aggregate size, inches	1	1/2	1-1/2	Sand	1-1/2	1-1/2	1	1	1-1/2	**	3/8	1/2	3/4	1-1/2
4.	Maximum slump, inches														
	Slump before super-plasticizer added	3	3	4	6	6	4	3	5	6	**	4	4	4	6
	Slump after adding superplasticizer	8	8	8	8	8	8	8	8	9	**	8	8	8	10
5.	Total air content, percent, (± 1.5 %)	6	7.5	6	6	6	6	6	---	---	**	---	6	6	---
6.	Fly ash replacement, percent range	15-25	15-25	15-25	15-25	15-30	15-25	15-25	15-30	15-25	**	15-30	15-35	15-25	15-30
7.	Slag cement replacement, percent range	25-50	25-50	25-50	0	25-50	25-30	0	25-50	0	**	0	0	25-50	25-50
8	Testing limits														
	Sand equivalent, min. percent	75	75	75	75	75	75	75	---	75	**	75	75	75	---
	Chloride ion, max. percent	0.08	0.08	0.15	0.08	0.30	0.15	0.10	0.30	0.30	**	---	0.15	0.15	---
	Shrinkage, max. percent; based 4 x 4 x 11 inch specimen														
	Laboratory	0.036	0.036	0.048	---	---	0.048	0.048	---	0.048	**	---	---	0.048	---
	Field	0.048	0.048	0.064	---	---	0.064	0.064	---	0.064	**	---	---	0.064	---

TABLE 1 – LIMITING REQUIREMENTS														
	Concrete Class	**A1**	**A2**	**A3**	**A4**	**A5**	**B**	**C**	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**
	Coarse Aggregate: Clay and shale combined particles shall not exceed, max. percent	1	1	1	1	1	3	2	10	1	**	3	1	2	3
9	Concrete temperature at time of delivery and placement, max. ° F	85	85	90	85	90	95	85	95	95	**	90	85	85	95

NOTES:

* "D2" (Underwater concrete) - Limit aggregate to 3/4" for reinforced concrete, up to 1-1/2" for unreinforced concrete.

** "D3" (Mass Concrete) limiting requirements shall be as indicated in the Mass Concrete section.

[a] "D5" Wash water trough top edge water-cementitious ratio, 100 percent sand passing No. 8 sieve.

TABLE 2A – SUBMITTAL REQUIREMENTS (PRELIMINARY REVIEW OF MATERIALS)														
	Concrete Class	**A1**	**A2**	**A3**	**A4**	**A5**	**B**	**C**	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**
1	Aggregate reports														
	Fine aggregate														
	Source and type	X	X	X	X	X	X	X	X	X	**	---	X	X	---
	Gradation	X	X	X	X	X	X	X	X	X	**	---	X	X	---
	Deleterious materials	X	X	X	X	X	X	X	X	X	**	---	X	X	---
	Fineness modulus	X	X	X	X	X	X	X	---	X	**	X	X	X	---
	Alkali-aggregate reactivity	X	X	X	X	X	X	X	X	X	**	---	X	X	X
	Sand equivalent	X	X	X	X	X	X	X	---	X	**	X	X	X	---
	Coarse aggregate														
	Source and type	X	X	X	---	X	X	X	X	X	**	X	X	X	X
	Gradation	X	X	X	---	X	X	X	X	X	**	X	X	X	X
	Deleterious materials	X	X	X	---	X	X	X	X	X	**	X	X	X	---
	Abrasion loss	X	X	X	---	X	X	X	---	X	**	---	X	X	---
	Soundness test	X	X	X	---	X	X	X	---	X	**	X	X	X	---
	Alkali-aggregate reactivity	X	X	X	---	X	X	X	X	X	**	---	X	X	X
	Combined aggregate gradation	X	X	X	---	X	X	X	X	---	**	X	---	---	---
2	Cement, mill report	X	X	X	X	X	X	X	X	X	**	X	X	X	X
3	Cementitious material, type, data sheet, and test report (fly ash, slag cement)	X	X	X	X	X	X	X	X	X	**	X	X	X	X
4	Admixtures														
	Data sheets and certifications	X	X	X	X	X	X	X	X	X	**	X	X	X	X
	Manufacturer’s approval letter	X	X	X	X	X	X	X	X	X	**	X	X	X	X
5	NSF/ANSI 61 and NSF/ANSI 600 compliance, for each proposed admixture, where applicable	X	X	---	---	---	---	---	X	---	**	---	---	---	---

TABLE 2B – SUBMITTAL REQUIREMENTS (PROPOSED MIXTURE PROPORTIONS)														
	Concrete Class	**A1**	**A2**	**A3**	**A4**	**A5**	**B**	**C**	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**
6	Mixture proportions, reports	X	X	X	X	X	X	X	X	X	**	X	X	X	X

TABLE 2C – SUBMITTAL REQUIREMENTS (MIXTURE TESTING)															
	Concrete Class	**A1**	**A2**	**A3**	**A4**	**A5**	**B**	**C**	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**
7	Type of testing														
	Field test records acceptable	---	---	---	---	---	---	---	X	---	**	X	X	X	X
	Trial mixtures required	X	X	X	X	X	X	X	---	X	**	---	---	---	---
8	Test Reports Required														
	Confirmation of materials tested														
	Cement brand, type, composition, quantity	X	X	X	X	X	X	X	X	X	**	X	X	X	---
	Fly ash brand, type, composition, quantity	X	X	X	X	X	X	X	X	X	**	X	X	X	X
	Specific gravity of each aggregate	X	X	X	X	X	X	X	X	X	**	X	X	X	X
	Ratio of fine to total aggregates	X	X	X	---	X	X	X	---	---	**	---	X	X	---
	Water content	X	X	X	X	X	X	X	X	X	**	X	X	X	---
	Water-cementitious materials ratio	X	X	X	X	X	X	X	X	X	**	X	X	X	---
	Slump	X	X	X	X	X	X	X	---	X	**	X	X	X	---
	Unit weight	X	X	X	---	X	X	X	---	X	**	---	X	X	---
	Air content	X	X	X	---	X	X	X	---	---	**	---	X	X	---
	Temperature	X	X	X	X	X	X	X	---	X	**	---	---	---	---
	Time of initial set at 70° F and 90° F.	X	X	X	X	X	X	X	---	X	**	---	---	---	---
	Three point curves	X	X	X	---	---	---	X	---	X	**	---	---	---	---
	Compressive strength at 7 and 28 days	X	X	X	X	X	X	X	X	X	**	X	X	X	X
	Water-soluble chloride ion	X	X	X	X	X	X	X	X	X	**	---	X	X	---

TABLE 2C – SUBMITTAL REQUIREMENTS (MIXTURE TESTING)														
	Concrete Class	**A1**	**A2**	**A3**	**A4**	**A5**	**B**	**C**	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**
	Drying shrinkage	X	X	X	---	---	X	X	---	X	**	---	---	X	---

NOTES:

** "D3" (Mass Concrete) submittal requirements shall be as indicated in the Mass Concrete section.

Appendix – Submittal Cover Pages

Submittal Cover Page #1 – Preliminary Review of Materials	
Subject	Insert Submittal Page Number(s)
FINE AGGREGATE REPORTS	
Source and Type	
Gradation	
Deleterious Materials	
Fineness Modulus	
Alkali-Aggregate Reactivity	
Sand Equivalent	
COARSE AGGREGATE REPORTS	
Source and Type	
Gradation	
Deleterious Materials	
Abrasion Loss	
Soundness Test	
Alkali-Aggregate Reactivity	
Combined Aggregate Gradation	
CEMENTITIOUS MATERIAL REPORTS	
Cement Mill Report	
Fly Ash Report	
Slag Report	
ADMIXTURES	
Data Sheets and Certifications	
Manufacturer’s Approval Letter	

Submittal Cover Page #2 – Proposed Mixture Proportions																
	Insert Submittal Page Number(s)															
Subject	A1	A2	A3	A4	A5	A6	A7	B	C	D1	D2	D3	D4	D5	D6	D7
Water-Cementitious Material Ratio																---
Ratio of Fine-to-Total Aggregates				---						---	---		---			---

Submittal Cover Page #3 – Mixture Test Results														
	Insert Submittal Page Number(s)													
Subject	A1	A2	A3	A4	A5	B	C	D1	D2	D3	D4	D5	D6	D7
Slump (pre HRWR)								---						---
Slump (after HRWR)								---						---
Unit Weight				---				---			---			---
Air Content				---				---			---			---
Temperature								---			---	---	---	---
Time of Set								---			---	---	---	---
Lab Compressive Strength (7 days)								---			---	---	---	---
Lab Compressive Strength (28 days)								---			---	---	---	---
Three point curves				---	---	---		---			---	---	---	---
Field Compressive Strength (28 days)	---	---	---	---	---	---	---		---	---				
Water-soluble chloride											---			---
Shrinkage				---	---			---			---	---		---
ANSI/NSF 61 and 600			---	---	---	---	---		---		---	---	---	---

End of Section

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SECTION 03 30 13 - CONCRETE PLACING

PART 1 - GENERAL

1.1 SCOPE

A. This section covers placing of cast-in-place concrete.

B. Both inch-pound (English) and SI (metric) units of measurement are specified herein; the values in inch-pound units govern.

1.2 GENERAL

A. All cast-in-place concrete shall be properly placed as indicated on the Drawings and as specified herein.

1.3 SUBMITTALS

A. All submittals shall be made in accordance with the Submittal Procedures section.

B. The following items shall be submitted, as a minimum.

Manufacturer's information for all products supplied under this section, in the form of technical data sheets, certificates of compliance, test data, or reports.

Concrete placing sequence, when required for any specific structures.

PART 2 - PRODUCTS

2.1 LIMITING REQUIREMENTS

A. Concrete shall be handled and placed in a manner that will minimize shrinkage and cracking as specified herein. Concrete temperatures shall be controlled both before and after placement to minimize cracking.

2.2 MATERIALS

Epoxy Bonding Agent	ASTM C881, Type V, moisture insensitive, 100 percent solids; Dayton Superior "Sure Bond J58," Euclid "Dural 452 MV," Prime Resins "Prime Bond 3900 High Mod LPL," or SpecChem "SpecPoxy 2000."

PART 3 - EXECUTION

3.1 RECEIVING

A. Contractor shall check each delivery ticket to verify the concrete class delivered to the jobsite is in compliance with the concrete requested and is suitable for Contractor's handling, placing, finishing, and curing procedures. Engineer will collect the delivery tickets from the truck operator.

3.2 PLACEMENT

A. The limits of each concrete pour shall be determined by Contractor and shall be acceptable to Engineer. All concrete within the predetermined limits shall be placed in one continuous operation.

B. Before concrete is placed, forms, reinforcement, water stops, anchor bolts, and embedments shall be rigidly secured in proper position; all dirt, mud, water, and debris shall be removed from the space to be occupied by concrete; all surfaces encrusted with dried concrete from previous placements shall be cleaned; and the entire installation shall be acceptable to Engineer. Remove all frost, ice, and snow from within the formwork before concrete is placed.

C. Contractor shall inform Engineer at least 24 hours in advance of any concrete placement.

D. Bonding to Hardened Concrete

1. The surface of hardened concrete upon which fresh concrete is to be placed shall be rough, clean, sound, and damp. Before placement of plastic concrete, the hardened surface shall be cleaned of all laitance and foreign substances (including curing compound), washed with clean water, wetted thoroughly, and the surface made free of standing water. Surface profile of the hardened concrete after surface preparation shall be as required for good bond.

2. Epoxy bonding agent shall only be required where specifically indicated on the project drawings or specifications. Fresh concrete shall be applied when bonding agent is still tacky. Bonding agent material that has exceeded the manufacturer’s recommended pot life shall be removed.

3. Coarse aggregate shall be omitted from the first batch or batches of concrete placed on hardened concrete in wall or column forms. The mortar puddle, Class A4 concrete, shall cover the hardened concrete by at least 2 inches at every point.

E. Conveying Concrete

1. Methods of conveying concrete to the point of final deposit shall prevent segregation or loss of ingredients. After placement in the forms, concrete shall not be moved laterally more than 5 feet . Concrete's free fall should not exceed 4 feet .

F. Pumping Concrete

1. The slump of concrete, with or without a superplasticizer, which is discharged into the pump may exceed the specified maximum slump value by the amount of slump loss in the pumping system, up to a maximum of 1 inch . The slump loss shall be determined by tests made at each end of the pumping system. If tests indicate a slump loss greater than 1 inch in the pumping system, Contractor shall modify the pumping system as required to reduce the slump loss to 1 inch or less.

G. Placing Concrete

1. For proper compaction, concrete shall be placed in approximately horizontal layers not to exceed 24 inches . Each layer of concrete shall be plastic when covered with the following layer, and the rate of vertical rise of the concrete in the forms shall not be less than 24 inches per hour. Vertical construction joints shall be provided as necessary to comply with these requirements.

2. The height of any portion of a wall or column placed monolithically with a floor or roof slab shall not exceed 6 feet . Concrete in walls or columns shall have achieved initial set before concrete is placed in the structural systems to be supported by such walls or columns.

3. Concrete shall be thoroughly settled in wall forms before top finishing. All laitance, debris, and surplus water shall be removed from concrete surfaces at tops of forms by screeding, scraping, or other effective means. Wherever the top of a wall will be exposed to weathering, the forms shall be overfilled and after the concrete has settled, the excess shall be screeded off.

H. Compaction

1. During and immediately after placement, concrete shall be thoroughly compacted and worked around all reinforcement and embedments and into the corners of the forms. Mechanical vibrators shall maintain at least 14,000 cycles per minute when immersed in the concrete. The number and type of vibrators shall be acceptable to Engineer. The use of “jitterbug” tampers to compact concrete flatwork will not be permitted.

I. Cold Weather Concreting

1. Except as modified herein, cold weather concreting shall comply with ACI 306.1.

2. When placed, heated concrete shall not be warmer than 80° F .

J. Hot Weather Concreting

1. Except as modified herein, hot weather concreting shall comply with ACI 305.1.

2. At air temperatures of 90° F or above, concrete shall be kept as cool as practicable during placement. The temperature of the concrete when placed in the work shall not exceed the values indicated in the Cast-in-Place Concrete section.

3. Plastic shrinkage cracking due to rapid evaporation of moisture shall be prevented. Concrete shall not be placed when the evaporation rate (actual or anticipated) equals or

exceeds 0.2 lb per square foot per hour , as determined using the nomograph in Appendix A of ACI 305.1.

K. Placement Sequence

1. The following structures shall be constructed using a placement sequence:

   a. Clearwell

2. For these structures, concrete shall be placed as follows:

   a. Bottom Slab. Bottom slabs shall be divided into sections of the sizes and shapes indicated on the drawings or in the Concrete Joints and Accessories section. A section near the center of each structure shall be placed first. Sections shall be placed alternately, first on one side and then on the other side of previously placed sections. Placement shall be scheduled so that two adjacent sides of each section are free, except at closures.
   b. Walls. Walls shall be divided into sections of the sizes and shapes indicated on the drawings or in the Concrete Joints and Accessories section. A section near the center of each wall shall be placed first. Sections shall be placed alternately, first on one side and then on the other side of the previously placed section. Placement shall be scheduled so that one end of each section is free, except at corner closures.
   c. Top Slab. Each top slab shall be placed in the manner described for the bottom slab.

3. No two abutting sections shall be placed within a period of 48 hours, unless otherwise authorized by Engineer.

L. Duct Banks

1. Duct bank concrete shall be compacted by rodding or spading only. Mechanical vibrators shall not be used. Concrete shall be worked around reinforcement and embedments and into the corners of the forms.

3.3 CLEANING EMBEDMENTS

A. Embedments shall be clean when installed.

End of Section

SECTION 03 35 00 - CONCRETE FINISHING

PART 1 - GENERAL

1.1 SCOPE

A. This section covers finishing of cast-in-place concrete.

B. Both inch-pound (English) and SI (metric) units of measurement are specified herein; the values in inch-pound units govern.

1.2 GENERAL

A. All cast-in-place concrete shall be properly finished as indicated on the Drawings and as specified herein.

1.3 SUBMITTALS

A. All submittals shall be made in accordance with the Submittal Procedures section.

B. The following items shall be submitted, as a minimum.

Manufacturer's information for all products and concrete ingredients supplied under this section, in the form of technical data sheets, certificates of compliance, test data, or reports.

Proposed repair materials and procedures for defects in concrete that are more than 3 inches deep, submitted only after such repairs are found to be necessary.

PART 2 - PRODUCTS

2.1 MATERIALS

Concrete Surface Coloring/Hardener	Mineral aggregate dry-shake colored hardener for concrete flatwork. ChemSystems, Inc. "CSI Color Hardener," Euclid "Surflex," or Dayton Superior "Quartz Tuff."
Evaporation Reducer	Dayton Superior "AquaFilm Concentrate J74," Euclid "Eucobar," L&M Chemical "E-Con," Master Builders Solutions "MasterKure ER50," or Sika "SikaFilm."
Nonslip Aggregate	Aluminum oxide aggregate, L&M Chemical "Grip It," Master Builders Solutions "MasterTop 120SR," or Dayton Superior "Emery Non-Slip."

Floor Sealer	ASTM C1315, Type I, Class A, minimum 25 percent solids, acrylic, non-yellowing, unit moisture loss 0.40 kg/m^2 maximum in 72 hours. Product shall not exceed VOC limits established by the federal, state, or local regulatory agency having jurisdiction over the project site.

PART 3 - EXECUTION

3.1 FINISHING UNFORMED SURFACES

A. Buried and permanently submerged concrete blocking and encasement will require no finishing except as necessary to obtain the required surface elevations or contours. The unformed surfaces of all other concrete shall be screeded and given an initial float finish followed by additional floating, and troweling where required.

B. Screeding

1. Screeding shall produce a concrete surface conforming to the proper elevation and contour, with all aggregates completely embedded in mortar.

C. Application of Evaporation Reducer

1. Concrete flatwork subject to rapid evaporation due to hot weather, drying winds, and sunlight shall be protected with an evaporation reducer. The evaporation reducer shall form a continuous film on the surface of fresh, plastic concrete to reduce evaporation.

2. Immediately following screeding, evaporation reducer shall be sprayed over the entire surface of fresh, plastic concrete flatwork at a rate of not less than 200 square feet per gallon , in accordance with the manufacturer’s recommendations. The spray equipment shall have sufficient capacity to continuously spray the product at approximately 40 psi with a suitable nozzle as recommended by the manufacturer.

3. The sprayable solution shall be prepared as recommended by the manufacturer.

4. Under severe drying conditions, additional applications of evaporation reducer may be required following each floating or troweling, except the last finishing operation.

D. Floating

1. Screeded surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance, with no unnecessary working of the surface.

2. Initial floating shall be followed by a second floating at the time of initial set. The second floating shall produce a finish of uniform texture and color, and unless additional

finishing is specifically required, shall produce the completed finish for unformed surfaces.

3. Floating shall be done with hand floats or suitable mechanical compactor-floats.

E. Finishing Surfaces for Bonding

1. All surfaces to be covered with concrete or topping shall be float finished. All laitance, surface mortar, and unsound material shall be removed by brushing or air blasting at the time of initial set. Surfaces shall be rough, clean, and sound. Floors and other flat surfaces to receive composite topping (Class D6) shall be given a broom finish or raked finish with at least a 1/4 inch profile.

F. Troweling

1. Interior floor surfaces which will be exposed after construction is completed; surfaces to be covered with resilient floor coverings, thinset terrazzo, or seamless floor covering; exposed top surfaces of equipment bases and interior curbs; and other surfaces designated on the Drawings shall be steel trowel finished. Surfaces to be covered with elastomeric deck covering shall be lightly troweled but not burnished. Trowel finishing will not be required for floors which are normally submerged. Troweling shall be performed after the second floating when the surface has hardened sufficiently to prevent an excess of fines being drawn to the surface. Troweling shall produce a dense, smooth, uniform surface free from blemishes and trowel marks.

2. Air-entraining admixture may be omitted from concrete for interior floor surfaces which are to be steel trowel finished.

G. Edging

1. Unless specified to be beveled, exposed edges of floated or troweled surfaces shall be edged with a tool having at least a 1/8 inch corner radius.

H. Broom Finish

1. Concrete surfaces indicated below shall be given a light broom finish to produce a nonslip surface. Brooming shall be done after the second floating and at right angles to the normal direction of traffic.

2. Broom finish shall be provided at the following locations:

a. Walking surfaces such as sidewalks and surface ductbanks.

I. Sidewalk and Surface Ductbank Finishing

1. Concrete surfaces shall be screeded to the proper elevation and contour. All aggregates shall be completely embedded in mortar. Screeded surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of

uniform texture and appearance, with no unnecessary working of the surface. Initial floating shall be followed by a second floating at the time of initial set.

2. Floated surfaces shall be given a light broom finish, using a horsehair broom, to provide a nonslip surface. Brooming shall be done at right angles to the length of the walk.

3. Sidewalks and surface ductbank shall be edged using a 3 or 4 inch wide edging tool with a 1/8 inch corner radius. Edger lap marks at corners of each slab shall be carefully removed. False joints shall be provided at right angles to the length of the walk, using a grooving tool with 1/8 inch radius. The finished edge on each side of the joint shall be the same width as the edging tool used. False joints shall divide each sidewalk into square sections.

4. The finished surface of all sidewalks and surface ductbank shall be neat in appearance, shall be sloped to drain, and shall not pond water.

3.2 REPAIRING DEFECTIVE CONCRETE

A. Defective concrete shall be defined as any surface with undesirable visible effects in excess of that permitted by the relevant formed concrete surface category (CSC), except as indicated otherwise herein.

B. Defects in formed concrete surfaces shall be repaired to the satisfaction of Engineer within 24 hours of form removal. Surface repair work shall conform to Article 5.3.7 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing of the surrounding concrete. Surface repair material shall be adequately cured.

C. Defects in concrete that are more than 3 inches deep shall be brought to the attention of Engineer prior to any repair work. Contractor shall submit a proposed repair material and procedure for review by Engineer. The repair material and procedure required by Engineer may be more extensive than the process described in Article 5.3.7 of ACI 301.

3.3 FINISHING FORMED SURFACES

A. Formed concrete surfaces shall meet all criteria of the relevant formed concrete surface category (CSC), as defined in ACI 347.3R, except as indicated otherwise herein. Surfaces shall be assigned to CSCs as indicated.

B.

Formed Concrete Surface Category	**Applicable Surfaces**	**Mockup Required**
CSC1	Formed concrete surfaces that will be in permanent contact with earth backfill.	No
CSC2	All other formed concrete surfaces not designated otherwise.	No
CSC3	None.	Yes

Formed Concrete Surface Category	Applicable Surfaces	Mockup Required
CSC4	None.	Yes

C. Fins, form seams, and construction joints shall be ground flush on all surfaces in formed concrete surface categories CSC2, CSC3, and CSC4, and in CSC1 surfaces that are required to be dampproofed.

D. All tie holes in formed surfaces, regardless of the relevant CSC, shall be cleaned, wetted, and filled with patching mortar. The patches shall be finished flush and cured and shall match the texture and color of the adjacent concrete.

E. Concrete surfaces to be dampproofed shall have fins removed and tie holes filled, but no additional finishing will be required.

F. Concrete surfaces to be painted or grout cleaned shall have sharp edges and projections removed to provide an acceptable condition for painting or grout cleaning. The concrete surfaces shall have bug holes filled per the Protective Coatings section.

3.4 TOLERANCES

A. Tolerances for cast-in-place concrete work shall be as stipulated in ACI 117, unless otherwise indicated.

3.5 CLEANING EMBEDMENTS

A. After placement of concrete, surfaces of embedments not in contact with concrete shall be cleaned of concrete spatter and other foreign substances.

End of Section

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SECTION 03 39 00 - CONCRETE CURING

PART 1 - GENERAL

1.1 SCOPE

A. This section covers curing of cast-in-place concrete.

B. Both inch-pound (English) and SI (metric) units of measurement are specified herein; the values in inch-pound units govern.

1.2 GENERAL

A. All cast-in-place concrete shall be properly cured as indicated on the Drawings and as specified herein.

1.3 SUBMITTALS

A. All submittals shall be made in accordance with the Submittal Procedures section.

B. The following items shall be submitted, as a minimum.

Manufacturer's information for all products supplied under this section, in the form of technical data sheets, certificates of compliance, test data, or reports.

A curing plan, indicating the planned method and duration of curing for each individual structure on the project.

PART 2 - PRODUCTS

2.1 LIMITING REQUIREMENTS

A. Concrete shall be cured in a manner that will minimize shrinkage and cracking as specified herein.

2.2 MATERIALS

Membrane Curing Compound	ASTM C1315, Type I, Class A, minimum 25 percent solids, acrylic, non-yellowing, unit moisture loss 0.40 kg/m^2 maximum in 72 hours. Product shall not exceed VOC limits established by the federal, state, or local regulatory agency having jurisdiction over the project site.

PART 3 - EXECUTION

3.1 GENERAL

A. Cold Weather Concreting

1. Except as modified herein, cold weather concreting shall comply with ACI 306.1.

2. The concrete surface shall be maintained at a temperature of at least 50° F for 5 days or 70° F for 3 days, after placement. Concrete temperature shall be recorded at least six times for each 24 hour period. Concrete and adjacent form surfaces shall be kept continuously moist. Sudden cooling of concrete shall not be permitted.

B. Hot Weather Concreting

1. Except as modified herein, hot weather concreting shall comply with ACI 305.1.

2. At air temperatures of 90° F or above, concrete shall be kept as cool as practicable during curing.

3. Plastic shrinkage cracking due to rapid evaporation of moisture shall be prevented.

3.2 CURING

A. Concrete shall be protected from loss of moisture for at least 7 days after placement unless indicated otherwise. Curing of concrete shall be done by methods which will keep the concrete surfaces adequately wet for the specified curing period.

B. Water Curing

1. Water curing shall be performed for concrete in liquid-containing structures and for all concrete containing slag cement. Other forms of curing will not be acceptable in these applications. Water curing shall be in accordance with ACI 308.1 except as modified herein.

2. Water saturation of concrete surfaces shall begin as soon as possible after initial set. The rate of water application shall be regulated to provide complete surface coverage with a minimum of runoff. The application of water to walls may be interrupted for grout cleaning only over the areas being cleaned at the time, and the concrete surface shall not be permitted to become dry during such interruption.

3. Water curing shall continue for 14 days for concrete containing slag cement, and for 7 days for other types of concrete. However, when concrete is being protected from low temperatures, the duration of water curing may be shortened to 1 day less than the duration of cold weather protection.

4. When forms are removed before the specified curing duration is completed, measures shall be taken to immediately continue water curing and to provide adequate thermal protection for the concrete.

C. Membrane Curing

1. Unless otherwise specified, membrane curing compound may be used instead of water curing on concrete in non-liquid-containing structures which will not be stained or etched, covered with chemical resistant linings, covered with additional concrete, or indicated in the Architectural drawings to be covered with a finish flooring material.

2. Membrane curing compound shall be evenly sprayed at a coverage rate of not more than 300 square feet per gallon . The spray equipment shall have sufficient capacity to continuously spray curing compound at approximately 40 psi with a suitable nozzle as recommended by the manufacturer. Unformed surfaces shall be covered with the first coat of curing compound within 30 minutes after final finishing. A second coat of curing compound shall be applied when the first coat has become tacky to the touch and shall be applied at right angles to the first coat.

3. Curing compound shall be suitably protected against abrasion during the curing period.

D. Film Curing

1. Unless otherwise specified, film curing with white polyethylene sheeting may be used instead of water curing on concrete in nonliquid-containing structures which will be covered later with mortar or additional concrete, or which will otherwise not be exposed to view.

2. Film curing shall begin as soon as possible after initial set of the concrete. The concrete surfaces shall be completely covered with polyethylene sheeting. Sheeting shall overlap the edges of the concrete for proper sealing and anchorage, and joints between sheets shall be sealed. All tears, holes, and other damage shall be promptly repaired. Covering shall be anchored continuously at edges and as necessary to prevent billowing on the surface.

End of Section

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SECTION 03 60 00 – GROUTING

PART 1 - GENERAL

1.1 SCOPE

A. This section covers procurement and installation of grout. Unless otherwise specified, only nonshrink grout shall be furnished.

B. Epoxy grouting and adhesive anchoring of anchor bolts, threaded rod anchors, and reinforcing bars is covered in the Anchorage in Concrete and Masonry section.

1.2 SUBMITTALS

A. All submittals shall be made in accordance with the Submittal Procedures section.

B. The following items shall be submitted, as a minimum.

Manufacturer’s information for all products and concrete ingredients supplied under this section, in the form of technical data sheets, certificates of compliance, test data, or reports.

The intended location for use of each differing grout type.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be handled, transported, and delivered in a manner which will prevent damage of any kind. Materials shall be protected from moisture.

PART 2 - PRODUCTS

2.1 MATERIALS

Nonshrink Grout	Precision cementitious grout with demonstrated non-shrinking properties, minimum 28 day compressive strength of 8000 psi; L&M "Crystex,” Master Builders Solutions "Masterflow 928,” Sika “SikaGrout 328,” Euclid “Hi-Flow Grout,” Dayton Superior "Sure-Grip High Performance Grout,” or SpecChem “SC Precision Grout.” Grout selected shall be consistent with intended use as stated in manfacturer’s product data sheets.
Water	Clean and free from deleterious substances.

2.2 CEMENTITIOUS GROUT

A. Cementitious grout shall be furnished factory premixed so that only water is added at the jobsite.

2.3 EPOXY GROUT

A. Epoxy grout shall be used in lieu of cementitious grout when required by the equipment manufacturer for performance or warranty requirements. Epoxy grout shall be a three component system consisting of a Part A (resin), Part B (hardener) and Part C (aggregate). All three components shall be products of the same manufacturer and be compatible. Epoxy grout products and installation procedures shall be submitted to Engineer for approval.

PART 3 - EXECUTION

3.1 CEMENTITIOUS GROUT INSTALLATION

A. Preparation

1. The concrete foundation to receive cementitious grout shall be saturated with water for at least 12 hours preceding grouting unless additional time is required by the grout manufacturer.

B. Mixing

1. Grout shall be mixed in a mechanical mixer. No more water shall be used than is necessary to produce a flowable grout, nor shall water content exceed the amount recommended by the manufacturer.

C. Temperature Restrictions

1. Grout shall be placed in accordance with the manufacturer’s published temperature restrictions. Ambient temperature and grout temperature shall be a minimum of 40°F and rising at time of placement. Grout shall not be placed on frost covered surfaces. Grout shall be protected from freezing until it has reached a minimum strength of 4,000 psi. Grout shall not be placed when the ambient or grout temperature exceeds 90°F.

D. Placement

1. Unless otherwise specified or indicated on the Drawings, grout under baseplates shall be 1-1/2 inches thick. Grout shall be placed in strict accordance with the directions of the manufacturer so that all spaces and cavities below the baseplates are completely filled without voids. Forms shall be provided where structural components of baseplates will not confine the grout.

E. Edge Finishing

1. In all locations where the edge of the grout will be exposed to view, the grout shall be finished smooth after it has reached its initial set. Except where shown to be finished on a slope, the edges of grout shall be cut off flush at the baseplate.

F. Curing

1. Grout shall be protected against rapid loss of moisture by covering with wet cloths or polyethylene sheets. After edge finishing is completed, the grout shall be wet cured for at least 3 days and then an acceptable membrane curing compound shall be applied.

3.2 EPOXY GROUT INSTALLATION

A. Epoxy grout shall be installed in accordance with ACI 351.5.

End of Section

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SECTION 05 50 00 - MISCELLANEOUS METAL FABRICATIONS

PART 1 - GENERAL

1.1 SCOPE.

A. This section covers the fabrication and erection of miscellaneous metal items not covered in other sections.

B. The items covered by this section include, but are not limited to, the following:

1. Metal ladders and fall protection safety systems.

2. Metal floor plate (checkered plate).

C. Both inch-pound (English) and SI (metric) units of measurement are specified herein; the values expressed in inch-pound units shall govern.

1.2 SUBMITTALS.

A. All submittals shall be made in accordance with the Submittal Procedures section.

B. The following items shall be submitted, as a minimum.

1. Manufacturer’s information for all products supplied under this section, in the form of technical data sheets, certificates of compliance, test data, or reports.

2. Fabrication, setting, and erection drawings, identifying all bolted and welded connections.

3. For ladders, drawings sealed by a professional engineer registered in the state of the project. Data shall include confirmation that the design meets all applicable code requirements. Calculations shall be submitted when requested by Engineer.

C. Drawings and Data

1. Complete data, fabrication drawings, and setting or erection drawings covering all miscellaneous metal items shall be submitted in accordance with the Submittal Procedures section.

D. Connection and Welding Details

1. All bolted connections and welds shall be properly identified on the shop drawings. Welding procedures, welding procedure qualification records and welder qualifications shall be submitted.

E. Ladder Data and Calculations

1. Submittals for ladders that are designed by the fabricator shall include drawings sealed by a professional engineer registered in the state of the project. Data shall include confirmation that the design meets all applicable code requirements. Calculations shall be submitted when requested by Engineer.

1.3 DELIVERY, STORAGE, AND HANDLING.

A. Materials shall be handled, transported, and delivered in a manner which will prevent bends, dents, significant coating damage, or corrosion. Damaged materials shall be promptly replaced. Miscellaneous metal work shall be stored on blocking so that no metal touches the ground and water cannot collect thereon. The material shall be protected against bending under its own weight or superimposed loads.

PART 2 - PRODUCTS

2.1 GENERAL.

A. All miscellaneous metals shall be detailed and fabricated to facilitate installation as indicated on the drawings. All required field connection materials shall be furnished.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS.

A. Ladders, and their anchors to the supporting structure, shall be designed by a professional engineer registered in the state of the project. The ladder design shall meet the requirements of OSHA Section 1910.27 and ANSI A14.3. Design of anchorage into concrete or masonry structural elements shall be as indicated in the Anchorage in Concrete and Masonry section. Ladders with climbing heights greater than 24 feet, or where the length of climb is less than 24 feet but the top of the ladder is more than 24 feet above the ground, floor, or roof level, shall be provided with a fall protection safety system as indicated on the Drawings. Ladders with fall protection safety systems shall have the ladder and anchorage designed to resist the associated design level impact forces. Rest platforms shall be provided to limit straight climb lengths to 30 feet.

2.3 MATERIALS.

Steel

Shapes, Plates, and Bars	ASTM A36.
Sheets	ASTM A1008 CS Type B or A1011 CS Type B.

Miscellaneous Metal Fabrications

Pipe	ASTM A53, Type E or S, Grade B (F_y = 35 ksi).
Round Structural Tubing	ASTM A500, Grade C (F_y = 46 ksi).
Square and Rectangular Structural Tubing	ASTM A500, Grade C (F_y = 50 ksi).
Fasteners	
Bolts, Unfinished	ASTM A307.
Nuts, Heavy-Hex	ASTM A563, grade and finish compatible with bolts.
Washers	Flat, hardened, ASTM F436, Type 1.
Forged Steel Clevises and Turnbuckles	AISI C-1035.
Forged Steel Eyebolts and Eyenuts	AISI C-1030, ANSI B 18.15 Type 2 shoulder pattern unless otherwise required.

Stainless Steel

Shapes	ASTM A1069 or A276, Type 316L.
Plates	ASTM A240, Type 316L.
Pipe	ASTM A312, Grade TP316L.
Tube	ASTM A269, Grade TP316L.
Fasteners	
Bolts	ASTM F593, Alloy Group 1 or 2, minimum yield strength of 45 ksi.
Nuts	ASTM F594, Alloy Group shall match that of the bolts. Nuts shall have a minimum proof stress equal to or greater than the minimum full-size tensile strength of the bolts
Washers	Flat, ANSI/ASME B18.22.1, Type 316.

Aluminum

Miscellaneous Metal Fabrications

Sheet and Plate	ASTM B209, Alloy 6061-T6.
Rolled Sections	ASTM B308, Alloy 6061-T6.
Rod and Bar (Rolled or Drawn)	ASTM B211, Alloy 6061-T6 or 2017-T4.
Extrusions	ASTM B221, Alloy 6063-T5 or T6.
Pipe	ASTM B429, Alloy 6061-T6.
Castings	ASTM B26 or B85.
Weld Metal (Steel Connections)	ANSI/AWS D1.1, Table 3.1, filler metal with minimum 70 ksi tensile strength unless otherwise required.

Ladders

Aluminum	Siderails shall be continuous and spaced as indicated on the Drawings. Rungs shall be extruded aluminum tubes, with shape and minimum size as indicated on the Drawings.
Anchors into Concrete or Masonry Elements	As indicated in the Anchorage in Concrete and Masonry section.
Extending Ladder Safety Post	Bilco Ladder Safety Post or approved equal.
Fall Protection Safety System	OSHA approved system consisting of a carrier, safety sleeve, lanyard, and connectors. The same fall protection system shall be used for all ladders on the project. The system shall be suitable for operation with a body harness. Body harness provided by Owner. Miller Saf-T-Climb with Removable Hatch Dismount or equal.
Fall Protection Safety System Telescoping Anchor Extension	3M Lad-Saf Telescoping Single Point Anchor (SPA) Extension or approved equal.

Floor Plate

Steel	ASTM A786, carbon steel, manufacturer's standard skid resistant pattern.
Stainless Steel	ASTM A793, Type 316L, raised pattern A.

Miscellaneous Metal Fabrications

Aluminum	ASTM B632, Type 6061-T6, with raised pattern on one side.
Fasteners	3/8 inch stainless steel slotted flathead machine screws.

Shop Coatings

Universal Primer	As indicated in the Protective Coatings section.
Galvanizing	ASTM A123, A153, A385, and F2329 as applicable.

2.4 FABRICATION.

A. General.

1. Items shall be preassembled in the shop to greatest extent possible. Metals shall be cut, drilled, and punched cleanly and accurately. Sharp or rough edges on exposed surfaces shall be removed.

B. Fasteners.

1. Unless indicated otherwise on the Drawings, stainless steel fasteners shall be used for fastening aluminum or stainless steel, steel fasteners shall be used for fastening steel, and bronze fasteners shall be used for fastening bronze.

C. Ladders.

1. Unless otherwise indicated on the Drawings, all ladders provided under this section shall be of the same type and design.

2. Ladders, fall protection safety systems, and rest platforms shall be provided as indicated on the Drawings. Ladder rails intersecting guardrailing shall be configured to provide an aesthetically pleasing transition, although ladder rails need not be physically attached to the guardrailing. There shall be no gaps between ladder rails and adjacent guardrailing that would allow passage of a sphere greater than 4 inches in diameter.

3. Ladders that terminate below an access hatch and do not require a fall protection safety system shall be furnished with extending ladder safety posts.

4. Ladders that terminate below an access hatch and also require a fall protection safety system shall incorporate a telescoping anchor extension that is integral with the safety system. The telescoping anchor system shall replace the requirement for the extending ladder safety post.

D. Metal Floor Plates.

1. Shop welded stiffeners or grating backup shall be provided when indicated on the Drawings. Stiffeners and grating backup shall be of the same material as the floor plate.

2. Warped or bent plates shall be straightened so they will lie perfectly flat.

3. Floor plates shall be secured to supports at 12 inch centers. Connection devices shall not protrude above the plate surface. Floor plate with grating backup shall include access holes to allow access to grating hold-down devices beneath the plate.

4. Floor plates which are indicated to be removable shall be detailed and fabricated in sections which weigh no more than 100 lb . At least one flush bar drop handle shall be included at each end of the removable section.

2.5 SHOP COATING.

A. All miscellaneous metal items shall be shop coated as specified herein, except as otherwise indicated. The requirements for field painting are covered in the Protective Coatings section.

B. Contact surfaces of miscellaneous metals that are to be field welded shall be masked so that no shop primer or galvanizing will be applied in the vicinity of the weld.

C. Cleaning.

1. Surfaces shall be dry and of proper temperature when coated, and shall be free of grease, oil, dirt, dust, grit, rust, loose mill scale, weld flux, slag, weld spatter, and other objectionable substances. Articles to be galvanized shall be pickled before galvanizing. All other ferrous metal surfaces shall be cleaned by solvent, high-speed power wire brushing or by blasting to the extent recommended by the shop coating manufacturer.

D. Edge Grinding.

1. Sharp projections of cut or sheared edges of ferrous metals shall be ground to a radius as needed to ensure satisfactory shop coating adherence.

E. Galvanizing.

1. Unless otherwise indicated herein or on the Drawings, all steel in exterior locations shall be galvanized. All galvanizing shall be done by the hot-dip process after fabrication. An approved zinc-rich paint shall be used to touch up minor coating damage, in accordance with ASTM A780. Materials with significant coating damage shall be regalvanized or replaced.

2. Bolts, nuts, and washers shall be galvanized when connected materials are galvanized or where indicated on the Drawings. The use of zinc-plated bolts will not be acceptable.

F. Prime Painted Steel.

1. Unless otherwise specified or indicated on the Drawings, all ungalvanized steel shall be given a shop coat of universal primer after fabrication. The dry film thickness of the universal primer shall be at least 5 mils . Steel surfaces shall be coated as soon as practicable after cleaning. Steel shall not be moved or handled until the shop coat is dry and hard.

G. Stainless Steel.

1. Unless otherwise specified, all items fabricated from stainless steel shall be thoroughly cleaned and degreased after fabrication. Pickling or a light blast cleaning shall produce a modest etch and remove all embedded iron and heat tint. Surfaces shall be subjected to a 24 hour water test or a ferroxyl test to detect the presence of residual embedded iron and shall be retreated as needed to remove all traces of iron contamination. Surfaces shall be adequately protected during shipping and handling to prevent contact with iron or steel objects or surfaces.

H. Aluminum.

1. All surfaces of aluminum which will be in contact with concrete, mortar, or dissimilar metals shall be given a coat of bituminous paint.

I. Other Surfaces.

1. Painting of zinc coated steel or bronze surfaces will not be required.

PART 3 - EXECUTION

3.1 GENERAL.

A. Miscellaneous metals shall be placed in accurate location, alignment, and elevation. Edges and surfaces shall be free of warps, local deformations, and unauthorized bends. Connections shall be accurately fitted.

B. Field welding or cutting shall not be performed on galvanized or primed surfaces.

3.2 BOLTED CONNECTIONS.

A. Unless otherwise indicated on the Drawings all bolted connections shall be snug tight.

3.3 WELDING.

A. Welds that are exposed to view shall be ground smooth. Intermittent welds shall have an effective length of at least 2 inches and shall be spaced not more than 6 inches apart.

B. Surfaces within 2 inches of a weld shall be free from loose or thick scale, slag, rust, moisture, grease, paint and other foreign materials that would prevent proper welding or release objectionable fumes.

C. Deformed bar anchors, headed concrete anchors, and shear connectors shall be welded with an automatic stud welding gun per the manufacturer's recommendation. Hand welding will not be acceptable.

End of Section

SECTION 05 50 13 - STRUCTURAL METALS

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the fabrication and erection of structural metal items.

B. Except as otherwise specified or indicated on the Drawings, all work shall conform to the applicable provisions of the AISC “Steel Construction Manual” (14th edition) with the exception of the “Code of Standard Practice for Steel Buildings and Bridges”; and the Aluminum Association “Specification for Aluminum Structures.”

C. Special inspection during the fabrication and erection of structural steel, if required by the local building code, is addressed in the Code-Required Special Inspections and Procedures section.

D. Both inch-pound (English) and SI (metric) units of measurement are specified herein; the values expressed in inch-pound units shall govern.

1.2 SUBMITTALS

A. All submittals shall be made in accordance with the Submittal Procedures section.

B. The following items shall be submitted, as a minimum.

1. Manufacturer’s information for all products supplied under this section, in the form of technical data sheets, certificates of compliance, test data, or reports.

2. Fabrication, setting, and erection drawings, identifying all bolted and welded connections.

3. Welding procedures, welding procedure qualification records, and welder qualifications.

4. For items designed by the fabricator, drawings shall be sealed by a professional engineer registered in the state of the project. Data shall include confirmation that the design meets all applicable code requirements. Calculations shall be submitted when requested by Engineer.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be handled, transported, and delivered in a manner which will prevent bends, dents, significant coating damage, or corrosion. Damaged materials shall be promptly replaced. Structural metal work shall be stored on blocking so that no metal touches the ground and water cannot collect thereon. The material shall be protected against bending under its own weight or superimposed loads.

B. Bolting materials shall be stored indoors. Weld rod shall be stored in accordance with the supplier's instructions and AWS D1.1.

1.4 FABRICATOR QUALIFICATION

A. All fabricating plants providing structural steel shall be qualified fabricators who participate in the AISC Certification program and are designated an AISC Certified Plant, Category BU.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials needed for both shop and field assembly shall be furnished.

2.2 MATERIALS

Steel

Shapes (W, WT)	ASTM A992.
Shapes (S, M, HP, C)	ASTM A36 or ASTM A572 Grade 50.
Other Shapes (angles)	ASTM A36.
Plates and Bars	ASTM A36.
Sheets	ASTM A1008 CS Type B or A1011 CS Type B.
Pipe	ASTM A53, Type E or S, Grade B (F_y = 35 ksi).
Round Structural Tubing	ASTM A500 Grade C (F_y = 46 ksi), or ASTM 1085 Grade A (F_y = 50 ksi).
Square and Rectangular Structural Tubing	ASTM A500 Grade C (F_y = 50 ksi), or ASTM 1085 Grade A (F_y = 50 ksi).
Bolts and Nuts	
Bolts, High Strength	ASTM F3125, Grade A325.
Bolts, Tension Control Type (Twist off)	ASTM F3125, Grade 1852.
Bolts, unfinished	ASTM A307.
Nuts, Heavy-Hex	ASTM A563, grade and finish compatible with bolts.
Nuts, Self-Locking	Prevailing torque type; IFI-100, Grade A.
Washers	
Flat, Hardened	ASTM F436, Type 1.
Lock	ANSI/ASME B18.21.1, helical spring type.

Beveled	ASTM F436.
Load Indicator	ASTM F959, compressible-washer-type direct tension indicator; type compatible with bolts tested in accordance with Article 10.2 of ASTM F959.
Threaded Rods (Including Hanger Rods for Pipe Supports)	ASTM A36. Threaded rods shall have sufficient threading to permit the maximum adjustment available. Continuously threaded rod is not acceptable for rods over 12 inches in length.
Forged Steel Sleeve Nuts	AISI C-1018, Grade 2.
Stainless Steel	
Shapes	ASTM A1069 or A276, Type 316L.
Plates	ASTM A240, Type 316L.
Pipe	ASTM A312, Grade TP316L.
Tube	ASTM A269, Grade TP316L.
Bolts	ASTM F593, Alloy Group 1 or 2, minimum yield strength of 45 ksi.
Nuts	ASTM F594, Alloy Group shall match that of the bolts. Nuts shall have a minimum proof stress equal to or greater than the minimum full-size tensile strength of the bolts.
Washers	
Flat	ANSI/ASME B18.22.1, Type 316.
Lock	ANSI/ASME B18.21.1, helical spring type, Type 316.
Threaded Rods (Including Hanger Rods for Pipe Supports)	ASTM A593, Alloy Group 1 or 2, minimum yield strength of 45 ksi.
Aluminum	
Sheet and Plate	ASTM B209, Alloy 6061-T6.
Rolled Sections	ASTM B308, Alloy 6061-T6. All members shall be Aluminum Association standard shapes. Special shapes with sloping flange surfaces, or Army-Navy type members, shall not be used unless specifically indicated on the Drawings.
Rod and Bar (Rolled or Drawn)	ASTM B211, Alloy 6061-T6 or 2017-T4.
Extrusions	ASTM B221, Alloy 6063-T5 or T6.
Pipe	ASTM B429, Alloy 6061-T6.
Rivets	ASTM B316, Alloy 6061-T6.
Bolts, Aluminum	ASTM F468, Alloy 2024-T4.

Nuts, Aluminum	ASTM F467, Alloy 6061-T6.
Washers, Aluminum	
Flat	ANSI/ASME B18.22.1, Type 6061 T-6.
Lock	ANSI/ASME B18.21.1, helical spring type, Type 6061-T6.
Weld Metal (Steel Connections)	ANSI/AWS D1.1, Table 3.1, filler metal with minimum 70 ksi tensile strength unless otherwise required.
Shop Coatings	
Universal Primer	As indicated in the Protective Coatings section.
Bituminous Paint	Metal fabricator's standard product.
Galvanizing	ASTM A123, A153, A385, and F2329 as applicable.

2.3 STRUCTURAL STEEL BOLTED CONNECTIONS

A. Bolt holes shall have a diameter nominally 1/16 inch larger than the nominal bolt diameter. Bolt holes for one ply of vertical diagonal bracing connections may be oversized to a diameter nominally 3/16 inch larger than the nominal bolt diameter.

2.4 SHOP COATING

A. All items shall be shop coated as specified herein. The requirements for field painting are covered in the Protective Coatings section.

B. Contact surfaces of structural steel slip critical bolted connections shall not be shop coated. Contact surfaces of structural steel bearing type bolted connections may be shop coated.

C. Cleaning

1. Surfaces shall be dry and of proper temperature when coated, and shall be free of grease, oil, dirt, dust, grit, rust, loose mill scale, weld flux, slag, weld spatter, and other objectionable substances. Articles to be galvanized shall be pickled before galvanizing. All other ferrous metal surfaces shall be cleaned by solvent, high-speed power wire brushing or by blasting to the extent recommended by the paint manufacturer and as required in the Protective Coatings section.

D. Edge Grinding

1. Sharp projections of cut or sheared edges of ferrous metals which will be submerged in operation, except for items specified to be hot-dip galvanized, shall be ground to a radius as needed to ensure satisfactory paint adherence and as required in the Protective Coatings section.

E. Prime Painted Steel

1. Unless otherwise specified or indicated on the Drawings, all ungalvanized steel shall be given a shop coat of universal primer after fabrication. The dry film thickness of the universal primer shall be at least 5 mils. Steel surfaces shall be prime coated as soon as practicable after cleaning. Steel shall not be moved or handled until the shop coat is dry and hard.

F. Galvanizing

1. Steel materials required to be galvanized are indicated on the Drawings. All galvanizing shall be done by the hot-dip process after fabrication. An approved zinc-rich paint shall be used to touch up minor coating damage, in accordance with ASTM A780. Materials with significant coating damage shall be regalvanized or replaced.

2. Bolts, nuts, and washers shall be galvanized when connected materials are galvanized or where indicated on the Drawings. The use of zinc-plated bolts will not be acceptable.

G. Stainless Steel

1. Unless otherwise specified, all items fabricated from stainless steel shall be thoroughly cleaned and degreased after fabrication. Pickling or a light blast cleaning shall produce a modest etch and remove all embedded iron and heat tint. Surfaces shall be subjected to a 24 hour water test or a ferroxyl test to detect the presence of residual embedded iron and shall be retreated as needed to remove all traces of iron contamination. Surfaces shall be adequately protected during shipping and handling to prevent contact with iron or steel objects or surfaces.

H. Aluminum

1. All surfaces of aluminum which will be in contact with concrete, mortar, or dissimilar metals shall be given a coat of bituminous paint.

PART 3 - EXECUTION

3.1 STRUCTURAL STEEL ERECTION

A. Structural steel shall be erected so that individual pieces are plumb, level, and aligned within a tolerance of 1:500. The elevations of the top of floor and roof members shall be within 1/16 inch of the elevations indicated on the Drawings. The faces of girts and other supporting members for rigid wall panels shall be in vertical planes within a maximum variation of 1/8 inch.

B. All members and parts, as erected, shall be free of warps, local deformations, and unauthorized bends. All parts shall be assembled accurately as indicated on the Drawings. Light drifting will be permitted to draw parts together, but drifting to match unfair holes will not be permitted. Any enlargement of holes necessary to make connections in the field shall be done by reaming with twist drills and only with the approval of Engineer. Enlarging holes by burning will not be permitted.

C. Inspection and Testing

1. Special inspection will be performed as indicated in the Code Required Special Inspections and Procedures section. The erector shall provide access as needed to facilitate all inspections and shall provide timely notification during erection when inspection milestones are approaching.

3.2 STRUCTURAL STEEL BOLTED CONNECTIONS

A. Unless otherwise indicated on the Drawings, bolted connections for structural steel, as defined in the AISC manual, shall be made with ASTM F3125 high strength bolts conforming to the "Specification for Structural Joints Using High-Strength Bolts" as approved by the Research Council on Structural Connections. The method of installation, pretensioning procedures, bolting equipment and tools shall likewise conform to the above referenced standard.

B. When assembled, all joint surfaces, including those adjacent to the bolt heads, nuts, or washers, shall be free of loose mill scale, dirt, burrs, oil, and other foreign material that would prevent solid seating of the parts.

C. Beveled washers shall be used when the bearing faces of bolted parts have a slope of 1:20 or greater with respect to a plane perpendicular to the bolt axis. Bolt length shall be increased as needed to accommodate the beveled washers.

D. Tightening of each connection assembly shall progress systematically from the most rigid part of the joint toward the free edges until all have been sufficiently rotated or the load indicator washers on all bolts have been closed to the average gap stipulated by the load indicator washer manufacturer.

E. Except as otherwise indicated on the Drawings or specified herein, bolted connections shall be bearing type with threads excluded from the shear plane. Slip critical connections shall be used in diagonal bracing connections, where oversize holes or slotted holes parallel to the direction of the load are used, and where indicated on the Drawings.

F. Bolts in all structural steel connections, both bearing and slip critical, shall be fully pretensioned in accordance with the AISC standards unless specifically noted otherwise on the Drawings. The calibrated wrench method of pretensioning bolts will not be acceptable. Acceptable pretensioning methods are as follows:

Connection Type	Acceptable Pretensioning Method
Bearing	Turn of the nut method and load-indicator washers are acceptable. Tension control (twist-off) type bolts may be used only if approved by Engineer.
Slip-Critical	Load indicator washers.

G. Turn of the Nut Method

1. The bolt, nut, and material shall be match marked. A wax lumber marker or paint shall be used to clearly mark the assembly.

H. Load-Indicator Washers

1. Load indicator washers shall be installed in accordance with the manufacturer's recommendations, as supplemented herein. To facilitate proper tightening of fastener assemblies with load indicator washers, a hardened flat washer shall be installed under the turned element (bolt head or nut) and between the turned element and the load indicator washer protrusions, in all cases. Whenever possible, the load indicator washer shall be installed on the head end of the bolt. If the bolt head will not be visible for inspection of the indicator washer after installation, or if the bolt head must be turned to tighten the assembly, the load indicator washer may be installed on the nut end of the bolt.

I. Tension Control (Twist-off) Bolts

1. Patented tension control bolts shall be of equivalent size and strength to the indicated high strength bolts, and shall be installed in strict accordance with the manufacturer's instructions. Load-indicator washers are not required on tension control bolts.

3.3 STRUCTURAL AND STAINLESS STEEL WELDING

A. Welding and related operations shall conform to applicable provisions of AWS D1.1 for steel and AWS D1.6 for stainless steel. All welding shall be performed in accordance with written procedures, using only those joint details which have prequalified status. All welding shall be performed by welders qualified in accordance with the American Welding Society.

B. Welds not dimensioned on the Drawings shall be sized to develop the full strength of the least strength component of the connection.

C. All butt and miter welds shall be continuous and, where exposed to view, shall be ground smooth. Intermittent welds shall have an effective length of at least 2 inches and shall be spaced not more than 6 inches apart.

D. Surfaces within 2 inches of a weld shall be free from loose or thick scale, slag, rust, moisture, grease, paint and other foreign materials that would prevent proper welding or release objectionable fumes.

E. Only shielded metal arc, gas metal arc, flux cored arc, submerged arc, and gas tungsten arc welding are permitted. For flux cored arc welding, only E70xx one (1) or five (5) wire electrodes with supplemental gas shielding shall be permitted. Use of electroslag or electrogas welding processes or the short-circuiting transfer mode of the gas metal arc process will not be acceptable.

F. Field welded connections shall not be substituted for field bolted connections indicated on the Drawings.

3.4 STRUCTURAL ALUMINUM

A. Unless otherwise noted, all work shall conform to applicable provisions of the Aluminum Association “Specification for Aluminum Structures.”

B. Connections

1. Connections not specifically detailed on the Drawings shall develop the full strength of the least strength member of the connections. Bolted connections shall be all-bolted bearing type, equipped with a helical spring lock washer under the stationary element (bolt head or nut) and a flat washer under the turned element. All bolts shall be fully tightened. Bolts and nuts for structural aluminum connections shall be stainless steel. A sufficient number of bolts shall be provided in each connection to develop the shear strength of the member.

2. Welded connections shall be made in accordance with the American Welding Society D1.2, Structural Welding Code - Aluminum. All welding shall be performed by welders qualified in accordance with American Welding Society. Welds shall be free of porosity, cracks, holes, and flux. Welded connections shall not be substituted for bolted connections without prior approval of Engineer.

C. Erection

1. Structural aluminum shall be erected so that individual pieces are plumb, level, and aligned within a tolerance of 1:500. The elevation of horizontal members shall be within 1/16 inch of the elevation indicated on the Drawings.

End of Section

SECTION 05 81 00 - ANCHORAGE IN CONCRETE

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the design and installation of anchors in concrete. It includes cast-in-place anchor bolts and anchor rods, adhesive anchors for both threaded rods and reinforcing bars, expansion anchors, screw anchors, and undercut anchors.

1.2 GENERAL

A. Anchors Designed by Engineer

1. Cast-in-place and post-installed anchors that are fully detailed on the Drawings have been designed by Engineer, unless noted otherwise.

2. Anchors detailed on the Drawings as cast-in-place shall not be changed to a post-installed type without approval of Engineer.

3. Post-installed anchors identified on the Drawings as a specific manufacturer and product shall not be changed to a different post-installed manufacturer or product without approval of Engineer.

4. Post-installed anchors identified on the Drawings as a specific anchor type, but indicating no specific product, may use any of the listed products of that anchor type.

5. Contractor shall reimburse Engineer, through Owner, for Engineer’s design costs related to evaluating alternative anchor types, products, or details.

B. Anchors Designed by Contractor or Contractor’s Suppliers

1. Contractor or Contractor’s material suppliers shall be responsible for design of anchors for delegated design items such as railings, ladders, equipment, pipe supports, pre-engineered structures, and other manufactured items, as indicated in the Drawings and Specifications.

2. Cast-in-place anchors shall be used unless post-installed types are indicated on the Drawings or accepted by Engineer.

3. Adhesive anchors used in vibrating applications shall only be used if the anchor manufacturer submits documentation indicating that the product is suitable for the anticipated service conditions.

4. Anchors shall be designed for loads due to all operating conditions, plus relevant snow, wind, and seismic loadings as indicated in the Meteorological and Seismic Design Criteria section.

5. Seismic anchorage design for non-structural components shall include the overstrength factors indicated in ASCE 7, Tables 13.5-1 and 13.6-1, when applicable.

6. Design of anchorage into concrete shall be in accordance with ACI 318 Chapter 17, shall consider concrete to be cracked, and shall not include the strengthening effects of supplementary reinforcement or anchor reinforcement unless approved by Engineer.

7. Post installed anchors shall be designed in accordance with the anchor manufacturer's research report, and shall consider the applicable effects of anchor spacing, edge distances, embedment depths, and temperature.

8. Anchorage calculations performed by Contractor's suppliers shall utilize design tools applicable to the specific anchorage products intended to be used by Contractor.

C. Materials

1. Unless otherwise indicated, anchors of structural steel members connected to concrete shall have a diameter of at least 3/4 inch. Anchors for ladders and equipment shall have a diameter of at least 1/2 inch.

2. Unless otherwise indicated on the Drawings, anchors used in the following locations and applications shall be of the indicated materials.

Cast-In-Place Anchor Bolts and Anchor Rods

Submerged locations	Stainless steel.
Locations subject to splashing	Stainless steel.
Buried locations	Stainless steel.
Anchorage of structural steel columns	Galvanized steel.
Other exterior locations	Galvanized steel.
Interior locations not subject to corrosion	Carbon steel.

Adhesive, Expansion, Screw, and Undercut Anchors

Submerged locations	Stainless steel.
Locations subject to splashing	Stainless steel.
Buried locations	Stainless steel.
Anchorage of structural steel columns	Stainless steel.
Other exterior locations	Stainless steel.
Interior locations not subject to corrosion	Carbon steel.

1.3 SUBMITTALS

A. All submittals shall be made in accordance with the Submittal Procedures section.

B. The following items shall be submitted, as a minimum.

1. Manufacturer's information for all products supplied under this section, in the form of manufacturer's research reports (from independent organizations such as ICC-ES or IAPMO UES), technical data sheets, and certificates of compliance.

2. Shop drawings for anchor bolts, anchor rods, and post-installed anchors, including anchor manufacturer, products, and embedment depth. Shop drawings for anchors designed by Contractor's suppliers shall be sealed by a professional engineer licensed in the state of the project.

3. Anchorage calculations performed by Contractor's suppliers. Calculations shall be prepared and sealed by a professional engineer licensed in the state of the project.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be handled, transported, and delivered in a manner which will prevent damage or corrosion. Damaged materials shall be promptly replaced. Materials shall be shipped and stored in original manufacturer's packaging.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Unless otherwise indicated on the drawings, materials shall be as indicated below.

Cast-In-Place Anchor Bolts and Anchor Rods	
Carbon steel	ASTM F1554, Grade 36 with compatible nuts.
Galvanized steel	ASTM F1554, Grade 36 with compatible nuts; hot-dip galvanized, ASTM F2329.
Stainless steel	Bolts, ASTM F593, Alloy Group 1 or 2 (minimum yield strength of 45 ksi); nuts, ASTM F594, Alloy Group 1 or 2.
Flat Washers	ANSI B18.22.1; of the same material as anchor bolts and nuts.
Expansion Anchors in Concrete	Products shall be single component anchors tested in accordance with ICC AC193 and shall have a manufacturer's research report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete, and for resisting seismic forces.
Carbon Steel	Hilti "Kwik-Bolt TZ2", Simpson "Strong-Bolt 2", or DeWalt "Power-Stud+SD2".

Stainless Steel	Hilti “Kwik-Bolt TZ2 SS304”, Hilti “Kwik-Bolt TZ2 SS316”, Simpson “Strong-Bolt 2”, DeWalt “Power-Stud+SD4”, or DeWalt “Power-Stud+SD6”.
Screw Anchors in Concrete	Products shall be single component anchors tested in accordance with ICC AC193 and shall have a manufacturer’s research report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete, and for resisting seismic forces.
Carbon Steel	Hilti “KH-EZ”, Simpson “Titen HD”, or DeWalt “Screw-Bolt+”.
Stainless Steel	Hilti “KH-EZ”.
Undercut Anchors in Concrete	Products shall be tested in accordance with ICC AC193 and shall have a manufacturer’s research report in compliance with the applicable building code.
Carbon Steel	Hilti “HDA Undercut Anchor”, Simpson “TCA Undercut Anchor”, or DeWalt “CCU+ Undercut Anchor”.
Stainless Steel	Hilti “HDA-R Undercut Anchor”.
Adhesive Anchors in Concrete	Products shall be tested in accordance with ICC AC308, and shall have a manufacturer’s research report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete, and for resisting seismic forces.
Threaded Rods and Nuts (Carbon Steel)	ASTM A307 or ASTM F1554 Grade 36.
Threaded Rods and Nuts (Stainless Steel)	ASTM F593, CW.
Reinforcing Bars	ASTM A615, Grade 60, deformed.
Reinforcing Bars, weldable	ASTM A706, Grade 60, deformed.
Adhesive (Epoxy)	Hilti “HIT-RE 500 V3,” Simpson “SET-3G”, or DeWalt “Pure 110+.”
Adhesive (Acrylic)	Hilti “HIT-HY 200 V3", Simpson “AT-XP”, or DeWalt “AC200+”.

2.2 ANCHORS

A. Cast-in-Place Anchor Bolts and Anchor Rods

1. Cast-in-place anchor bolts and anchor rods shall have forged heads or embedded nuts and washers. Anchors shall be delivered in time to permit setting prior to the placing of structural concrete. Anchor sleeves shall not be used unless acceptable to Engineer. Unless installed in sleeves, anchor bolts and anchor rods shall be provided with sufficient threads to permit a nut to be installed on the concrete side of the concrete form or the supporting template. Two nuts, a jam nut, and a washer shall be furnished for cast-in-

place anchor bolts and anchor rods indicated on the Drawings to have locknuts; two nuts and a washer shall be furnished for cast-in-place anchor bolts and anchor rods without locknuts.

B. Adhesive, Expansion, Screw, and Undercut Anchors

1. Unless otherwise noted, single nuts and washers shall be provided with adhesive anchors, expansion anchors, screw anchors, and undercut anchors. Adhesive anchors shall be free of coatings that would weaken the bond with the adhesive.

PART 3 - EXECUTION

3.1 GENERAL

A. Anti-seize thread lubricant shall be liberally applied to projecting, threaded portions of stainless steel anchors immediately before tightening of the nuts.

B. Compliance with Manufacturer's Instructions

1. Post-installed anchors shall be installed in accordance with the manufacturer's printed installation instructions and all applicable requirements of the manufacturer's research report for the specific anchor system. If conflicts are found between the Drawings, the manufacturer's printed installation instructions, and the manufacturer's research report installation requirements, Contractor shall notify Engineer for resolution.

C. Special Inspection

1. Special inspection requirements for cast-in-place and post-installed anchors shall be as indicated in the Code-Required Special Inspections and Procedures section. Anchorage work shall be performed in a manner that allows the inspections to take place without adversely impacting the schedule.

3.2 CAST-IN-PLACE ANCHOR BOLTS AND ANCHOR RODS

A. Cast-in-place anchor bolts and anchor rods shall be carefully positioned with templates and secured in the forms prior to placing concrete. Contractor shall verify that anchorage devices are positioned in accordance with the Drawings and with applicable equipment or structure submittal drawings.

B. Threads, bolts, and nuts spattered with concrete during placement shall be cleaned prior to final installation of the bolts and nuts.

C. Sleeves shall be filled with non-shrink grout.

3.3 ADHESIVE ANCHORS

A. Adhesive shall be statically mixed in the field during application. All proportioning and mixing of the components shall be in accordance with the manufacturer's recommendations.

B. Anchors or bars shall be installed in holes hammer drilled into hardened concrete. . Diameter of holes shall be 1/16 inch larger than the outside diameter of the rod or bar unless recommended otherwise by the anchor system manufacturer. Holes shall be prepared by removing all dust and debris using procedures recommended by the adhesive manufacturer.

C. Adhesive anchors and holes shall be clean, dry, and free of grease and other foreign matter at the time of installation. The adhesive shall be placed and the rods or bars shall be set in accordance with the recommendations of the manufacturer. Care shall be taken to ensure that all spaces and cavities are filled with adhesive, without voids.

D. Concrete Installation

1. Unless indicated otherwise on the Drawings, reinforcing bars shall be embedded to a depth of 15 bar diameters, and threaded rods shall be embedded to a depth that will develop the yield strength of the rod.

2. Adhesive anchors in concrete shall be installed under the following conditions.

Minimum Age of Concrete Prior to Anchor Installation	21 days.
Concrete Temperature Range	Maximum short-term temperature 162° F, maximum long-term temperature 110° F.
Moisture Condition	Dry concrete.
Type of Lightweight Concrete	N/A
Hole Drilling and Preparation	Hammer drill only.

3. Installation of adhesive anchors into concrete that are either horizontal or upwardly inclined shall be performed only by personnel certified by the ACI/CRSI Adhesive Anchor Installation Certification Program.

3.4 EXPANSION, SCREW AND UNDERCUT ANCHORS

A. Expansion, screw, and undercut anchors shall be installed using all procedures and accessory devices recommended by the anchor manufacturer.

End of Section

SECTION 07 11 00 - DAMPPROOFING

PART 1 - GENERAL

1.1 SCOPE

A. This section covers furnishing and installation of dampproofing for concrete.

1.2 SUBMITTALS

A. Drawings and Data

1. Complete specifications and data covering the dampproofing materials furnished under this section shall be submitted in accordance with the Submittals Procedures section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials to be used shall be as follows:

Waterborne Emulsified asphalt — BASF “Masterseal 615” (formerly Hydrocide 700B) or approved equal..

B. Emulsified asphalt shall be solvent free and made from asphalt emulsified with bentonite clay and water.

2.2 SURFACES TO BE DAMPPROOFED

A. Exterior wall surfaces which are poured against sheeting or undisturbed earth need not be dampproofed. The following concrete surfaces that are not in contact with treated or potable water shall be dampproofed:

1. All exterior wall surfaces of cast-in-place and precast concrete electrical manholes and handholes below finished grade and above the top of the footings or bottom slabs.

2. All exterior wall surfaces of cast-in-place and precast structures used along the Fayetteville transmission main including CAV manholes/vaults and blowoff manholes.

3. Exterior wall surfaces of cast-in-place and precast structures associated with the clearwell work including the groundwater drainage manhole and flow meter vault.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. When dampproofing is applied, concrete surfaces shall be clean and dry. Except where membrane is applied, new concrete shall cure at least 28 days before dampproofing material is applied. Concrete shall be allowed to cure in accordance with the membrane manufacturer's recommendation before membrane damproofing is applied. Concrete shall be prepared to receive the damproofing material as recommended by materials manufacturer.

B. All dirt, dust, sand, grit, mud, oil, grease, and other foreign matter shall be removed in accordance with ASTM D4258 and the surface abraded when recommended by the manufacturer of the dampproofing material. Abrading shall be done in accordance with ASTM D4259. Prior to application of the coating, the surfaces shall be thoroughly washed, or cleaned by air blasting, to remove all dust and residue.

3.2 APPLICATION

A. Dampproofing materials shall not be thinned unless recommended by the manufacturer.

B. Surfaces not intended to be dampproofed shall be protected from contamination, discoloration, or other damage. Such surfaces shall be masked as necessary to protect uncoated areas and to confine the dampproofing to the intended limits.

C. Surfaces shall be dry and at recommended temperature when dampproofing is applied. Unless properly protected, coatings shall not be applied in wet, damp, or foggy weather or when windblown dust, dirt, or debris, or insects would collect on the coating. Dampproofing, other than low temperature membrane dampproofing, shall not be applied when the temperature of the air or the surface is below 50°F, unless approved by manufacturer. Low temperature membrane dampproofing may be applied at air and surface temperatures as low as 25°F if approved by manufacturer and acceptable to the Engineer.

D. Dampproofing shall be applied by brush, high pile rollers, or spray equipment complying with the manufacturer's recommendations. If blistering occurs, all blisters larger than 1/4 inch in diameter shall be broken before the subsequent coat is applied.

E. Emulsified asphalt shall be installed in accordance with manufacturer's recommendations and at the maximum coverage rate recommended by manufacturer that is acceptable to Engineer.

End of Section

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SCOPE

A. This section covers caulking and sealing. Fire rated caulking is covered in the Fireproofing section.

1.2 GENERAL

A. The terms “caulking” and “sealing,” as used on the Drawings and in these Specifications, are synonymous. Both terms indicate the materials specified herein. Oil-base caulking shall not be used on this Project.

1.3 APPROVALS

A. All caulking shall meet the requirements of the standards specified herein. All caulking and sealing to be used in contact with potable water shall meet the requirements of ANSI/NSF Standard 61.

1.4 SUBMITTALS

A. Drawings and Data

1. Specifications and data covering the materials proposed for use, together with samples or color cards showing the manufacturer’s full line of sealant colors, shall be submitted in accordance with the Submittals Procedures section.

PART 2 - PRODUCTS

2.1 MATERIALS

Thiokol Sealants (polysulfides)	Fed Spec TT-S-00227E, Class A or ASTM 920 Type M; polysulfide rubber, two component.
Nonsag	
Submerged Service, Non potable water	Pecora “Synthacalk GC-2+.”
Nonsubmerged Service	Pecora “Synthacalk GC-2+”; Polymeric Systems “PSI-350.”

Self-Leveling, nonsubmerged	C. Horn “Hornflex Traffic Grade”; Polymeric Systems “PSI-350.”
Urethane Sealants (Polyurethanes)	Fed Spec TT-S-00227E, Class A, Type 2 and ASTM C920, Type M, Grade NS, two component.
Nonsag	
Submerged Service	
Potable Water	Polymeric Systems “RC-270”; Sika “Sikaflex-2cNS.
Nonsubmerged Service	Bostik “Chem-Calk 500”; Tremco “Vulkem 227”; Pecora “Dynatrol II”; Tremco “DYmeric 240”; Sika “Sikaflex-2cNS.”
Self-Leveling, Nonsubmerged Service	Bostik “Chem-Calk 550”; Tremco “Vulkem 245”; Pecora “Urexpan NR-200”; Polymeric Systems “RC-2SL”; Tremco “THC-900.”
Acrylic Sealant	Fed Spec TT-S-230; ASTM C834.
	Bostik “Chem-Calk 600”; Pecora “AC20”; Tremco “Mono 555.”
Silicone Sealant	Silicone rubber, neutral color; Dow Corning “Mildew-Resistant silicone 786”; General Electric “Silicone Sanitary 1702 Sealant.”
Primer	As recommended by the sealant manufacturer.
Backup Material	Polyethylene or polyurethane foam as recommended by the sealant manufacturer; Dow “Ethafoam SB” or Plateau “Denver Foam.”
Bondbreaker Tape	Adhesive-backed polyethylene tape as recommended by the sealant manufacturer.

2.2 COLORS

A. Colors of sealants shall be as selected by Engineer from the manufacturer’s standard line of colors. Different colors may be required for different locations.

2.3 LOCATIONS TO BE CAULKED

A. With Thiokol or Urethane Sealant (Nonsag) - Submerged Service

1. All joints requiring caulking in submerged locations.

B. With Thiokol or Urethane Sealant (Nonsag) - Nonsubmerged Service

1. Joints between masonry and cast-in-place concrete, where indicated on the Drawings.

C. With Thiokol or Urethane Sealant (Self-Leveling)

1. Horizontal joints in walks or drives.

PART 3 - EXECUTION

3.1 JOINT PREPARATION

A. All surfaces to receive sealant shall be clean, dry, and free from dust, grease, oil, or wax. Concrete surfaces which have been contaminated by form oil, paint, or other foreign matter which would impair the bond of the sealant to the substrate shall be cleaned by sandblasting. All surfaces shall be wiped with a clean cloth saturated with xylol or other suitable solvent, and shall be primed before the sealant is applied.

B. Unless otherwise recommended by the sealant manufacturer and permitted by the Engineer, the depth of sealant in a joint shall be equal to the width of the joint, but not more than 1/2 inch. Backup material shall be provided as necessary to control the depth of sealant and shall be of suitable size so that, when compressed 25 to 50 percent, the space will be filled. Backup material shall be rolled or pressed into place in accordance with the manufacturer's installation instructions, avoiding puncturing and lengthwise stretching. If depth of the joint does not permit use of backup material, bondbreaker tape shall be placed at the bottom of the joint to prevent three-sided adhesion.

3.2 SEALING

A. Sealing work shall be done before any field painting work is started. The air temperature and the temperature of the sealed surfaces shall be above 50° F when sealing work is performed.

B. Upon completion of the sealing work, each sealed joint shall have a smooth, even, tooled finish, flush with the edges of the sealing recess, and all adjacent surfaces shall be clean. Sealant shall not lap onto adjacent surfaces. Any sealant so applied as to prevent the painting of adjacent surfaces to a clean line, or with an excess of material outside the joint and feathered onto surfaces, shall be removed and the joint resealed.

End of Section

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SECTION 08 31 19 - FLOOR ACCESS DOORS AND HATCHES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the fabrication and installation of cast-in-place, off-street, floor access doors and hatches.

B. Fabricated items which are indicated on the Drawings but not mentioned specifically herein shall be fabricated in accordance with the applicable requirements of this section.

1.2 GENERAL

A. Equipment furnished under this section shall be fabricated and assembled in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

B. Equipment shall be furnished complete with all components and accessories required for proper operation, and any additional materials or construction required by the manufacturer's design.

C. General Equipment Stipulations

1. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this section differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

D. Seismic Design Requirements

1. Seismic design requirements for products specified herein shall be as indicated in the Meteorological and Seismic Design Criteria section.

1.3 SUBMITTALS

A. Drawings and Data

1. Complete assembly and installation drawings, together with detailed specifications, capacities, and data covering material used, and accessories forming a part of the equipment furnished, shall be submitted in accordance with the Submittals Procedures section.

2. Submit confirmation of compliance with the requirements of the Meteorological and Seismic Design Criteria section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

1.5 WARRANTY

A. The manufacturer shall guarantee against defects in material or workmanship for a warranty period of not less than 5 years.

PART 2 - PRODUCTS

2.1 GENERAL

A. Access doors and hatches shall be fabricated in conformity with dimensions, arrangements, sizes, and weights or thicknesses specified herein and as indicated on the Drawings.

B. All members and parts shall be free of warps, local deformations, and unauthorized bends. Holes and other provisions for field connections shall be accurately located and shop checked so that proper fit will result when the units are assembled in the field. All field connection materials shall be furnished.

2.2 ACCEPTABLE MANUFACTURERS

A. Access doors and hatches shall be as manufactured by Halliday Products, Bilco Company, or Dur-Red Products.

2.3 DESIGN REQUIREMENTS

A. Door leaves shall be 1/4 inch minimum thickness plate material with diamond pattern. Leaves in hatches not subject to vehicular loading shall be designed to withstand a minimum live load of 150 psf, with a maximum deflection of 1/150th of the span. Leaves shall pivot so that the cover does not protrude above the channel frame.

B. Door and hatch frames shall be provided with anchorage devices into the concrete slab. Where required for drainage, channel frames shall be 1/4 inch thick with a cross sectional area large enough to allow adequate water drainage. A 1-1/2 inch drainage coupling shall be located in the channel frame. The frame shall be designed to empty through the coupling. Frames shall have a neoprene door cushion unless a specific door model without a cushion is specified.

C. Hatches shall be supplied with lifting operators and hold-open devices. All doors shall automatically lock in the vertical position by means of a hold-open arm with release handle. A snap lock with a gasketed cover plug and removable turn handle shall be provided. The operators shall provide for smooth, easy and controlled door operation throughout the entire arc of opening and closing. Operation shall not be affected by temperature.

D. Fall protection grating panels shall be provided on all of the doors and hatches. The panels shall be aluminum or fiberglass grating panels designed to support a 300 psf loading. Panels shall be hinged along one edge and provided with a positive latch to maintain unit in an upright position. Provision for locking the panel in place shall be provided. All hardware shall be of non-corroding material.

2.4 MATERIALS

A. Floor access doors and hatches are indicated on the Drawings. Unless otherwise specified, materials, appurtenances, and finishes shall be the manufacturer's standard for each type of door and hatch. Doors and hatches do not need to be odor resistant or fire rated.

B. If floor access doors and hatches are shown on the Drawings but not identified by manufacturer’s name and product number, Contractor shall request clarification from Engineer prior to ordering and shipping the equipment. For purposes of bidding the work, unidentified hatches shall be assumed to be aluminum with a drained channel frame, suitable for a live load of at least 150 psf .

2.5 FINISHES

A. Aluminum access doors and hatches shall be given a mill finish.

B. All aluminum surfaces in contact with concrete or mortar shall be given a heavy coat of epoxy enamel unless specified otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Materials shall be erected and installed in conformity with the dimensions and arrangements specified or indicated on the Drawings and as recommended by the manufacturer. Product finishes damaged during erection shall be repaired as recommended by the manufacturer. Hatch frames with drainage couplings shall be connected to the appropriate drainage system.

End of Section

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SECTION 09 96 11 - PROTECTIVE COATINGS

PART 1 - GENERAL

1.1 SCOPE

A. This section covers field applied protective coatings, including surface preparation, protection of surfaces, inspection, and other appurtenant work for equipment and surfaces designated to be coated with heavy-duty maintenance coatings. Regardless of the number of coats previously applied, at least two field coats in addition to any shop coats or field prime coats shall be applied to all surfaces unless otherwise specified.

1.2 GENERAL

A. Cleaning, surface preparation, coating application, and thickness shall be as specified herein and shall meet or exceed the coating manufacturer's recommendations. When the manufacturer's minimum recommendations exceed the specified requirements, Contractor shall comply with the manufacturer's minimum recommendations. When equivalent products are acceptable to Engineer, Contractor shall comply with this section and the coating manufacturer's recommendations.

B. Governing Standards

1. All cleaning, surface preparation, coating application, thickness, testing, and coating materials (where available) shall be in accordance with the referenced standards of the following AWWA, ANSI, NACE, SSPC, NSF, and ASTM.

C. Delivery and Storage

1. All coating products shall be received and stored in accordance with the coating manufacturer's recommendations.

D. Coatings, Painting, and Linings Covered in other sections

1. Dampproofing of concrete when NSF compliance is not required.

1.3 SUBMITTALS

A. General Submittals and Data

1. Contractor shall submit color cards for all coatings proposed for use, together with complete descriptive specifications, manufacturer's product data sheet and the completed Coating System Data Sheets, to Engineer for review and color selection. Each product data sheet shall include application temperature limits including recoat time requirements for

the ambient conditions at the site, including temperatures up to 130° F . Requests for review submitted directly to Engineer by coating suppliers will not be considered.

B. NSF 61 Compliance

1. When the proposed products will be in contact with treated or raw water in potable water treatment facilities, Contractor shall submit certifications that the proposed systems are in compliance with ANSI/NSF 61.

C. Data Sheets

1. Contractor shall submit a Coating System Data Sheet for each separately identified surface in the Metal Surfaces Coating Schedule, Concrete and Masonry Surfaces Coating Schedule, and the Miscellaneous Surfaces Coating Schedule that will be used in the Project, using the appropriate Coating System Data Sheet forms (Figures 1-09 96 11 and 2-09 96 11) at the end of this section. Each field coating system shall be acceptable to the coating material manufacturer.

a. Coating System Data Sheets shall be assigned a unique number with a prefix letter based on the following:

Prefix	Surfaces	Fig. 09 96 11
A	Iron and steel (coated entirely in field)	1
A	Iron and steel (shop primed)	2
C	Concrete and concrete block	1
E	Equipment - submerged	1
E	Equipment - nonsubmerged	2
F	Nonferrous metal	1
G	Galvanized	1
H	High temperature	1
P	PVC and FRP	1

b. Each coating system that will be applied entirely in the field shall be assigned only a prefix letter and no suffix letter. Fig 1-09 96 11 shall be submitted for each surface coated entirely in the field.

c. Each shop-applied coating system that includes one or more field applied coats shall be assigned both a prefix letter and suffix letter “F.” Fig 2-09 96 11 shall be submitted for each surface having a shop applied coating and one or more field applied finish coats.

d. A separate Coating System Data Sheet shall be developed and submitted for each surface scheduled to be coated or variation or change in a coating system. The number identifying the surface and coating system shall be of the form $A1_1$ or $A1_2$-F. The subscript number shall be assigned by the Contractor so that each surface and coating system combination is uniquely identified. For example:

1) $A1_1$-F may be assigned to "Epoxy – one coat to metal curbs for skylights and power roof ventilators that have been shop primed."
2) $A2_1$ may be assigned to "Epoxy – two coats to non-galvanized structural and miscellaneous steel exposed to view inside buildings."
3) $C2_1$ may be assigned to "Epoxy – two coats to all concrete and concrete block in corrosive area (Except floors and surfaces scheduled to receive other coatings) which are exposed to view."
4) $C2_2$ may be assigned to "Epoxy – two coats to walls, floors, and curbed areas, adjacent to corrosive chemical storage and feed equipment as indicated on the Drawings."

D. Color Submittals

1. For the epoxy and for aliphatic polyurethane, a total of not more than 15 custom colors (excluding deeptone or highlevel colors) may be required. The manufacturer's standard colors will be acceptable for all other coatings.

2. The manufacturer's standard colors will be acceptable for all coatings.

1.4 QUALITY ASSURANCE

A. Coating System Data Sheet Certifications

1. The coating applicator and coating manufacturer shall review and approve in writing the coating manufacturer's written recommendations for the coating system and the intended service. Any variations from the Specifications or the coating manufacturers published recommendations shall be submitted in writing and approved by the coating manufacturer.

2. The coating manufacturer shall observe the surface preparation, mixing, and application of the coating systems and submit a written report of his observations and any additional recommendations.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Alternative Manufacturers

1. In addition to the coatings listed herein, equivalent products of other manufacturers that distribute globally will also be acceptable.

B. Equivalent Coatings

1. Whenever a coating is specified by the name of a proprietary product or of a particular manufacturer or vendor, it shall be understood as establishing the desired type and quality of coating. Other manufacturers' coatings will be accepted, provided that sufficient information is submitted to enable Engineer to determine that the proposed coatings are

equivalent to those named. Information on proposed coatings shall be submitted for review in accordance with the Submittals Procedures section. Requests for review of equivalency will be accepted only from Contractor and will be considered only after the contract has been awarded.

2.2 MATERIALS

A. All coatings shall be delivered to the job in original, unopened containers, with labels intact. Coatings shall be stored indoors and shall be protected against freezing. No adulterant, unauthorized thinner, or other material not included in the coating formulation shall be added to the coating for any purpose.

B. All coatings shall conform to the air quality regulations applicable at the location of use. Coating materials that cannot be guaranteed by the manufacturer to conform, whether or not specified by product designation, shall not be used.

C. With the exception of heat resistant coatings, the coatings specified have been selected on the basis of the manufacturer's statement that the VOC content of the product is 2.8 lbs per gallon or less; however, it shall be the Contractor's responsibility to use only coating materials that are in compliance with the requirements of all regulatory agencies. Local regulations may require some coatings to have a lower VOC content than specified herein. The coatings specified may meet the VOC limits in the unthinned (as shipped) condition but may exceed the limits if thinned according to the manufacturer's recommendations. In such case, the coatings shall not be thinned beyond the 2.8 lbs per gallon limit, and if the product cannot be thinned to suit the application method or temperature limits, another manufacturer's coating shall be used, subject to acceptance by Engineer's coating shall be used, subject to acceptance by Engineer.

D. Contractor shall be responsible for ensuring the compatibility of field coatings with each other or with any previously applied coatings. Coatings used in successive field coats shall be produced by the same manufacturer. The first field coat over shop coated or previously coated surfaces shall cause no wrinkling, lifting, or other damage to underlying coats.

E. All coatings used on surfaces that will be in contact with potable or treated water shall be certified as being in compliance with ANSI/NSF 61. Coatings that cannot be so certified, whether or not specified by manufacturer and by product designation, shall not be used.

F. Primers

Universal Primer (tie coat)	PPG "Amerlock Sealer," Carboline "Rustbond Series," International Devoe "Devran 201H," Tnemec "Series 27 F.C. Typoxy," or Sherwin-Williams "Dura Plate 235."

G. Intermediate and Finish Coatings

Epoxy (NSF certified systems)

Ferrous Metal Surfaces in Contact with Treated or Raw Water in Potable Water Facilities	PPG "Amerlock 400 High-Solids Epoxy Coating," Carboline "Carboguard 891 VOC," International Devoe "Bar-Rust 233H" Tnemec "Series N140 Pota-Pox Plus," or Sherwin-Williams "Dura Plate 235 NSF"; immersion service.
Epoxy	
Ferrous Metal Surfaces	PPG "Amercoat 385 Epoxy," Carboline "Carboguard 890," International Devoe Devran "224V," Tnemec "Series N69 Hi-Build Epoxoline II," or Sherwin-Williams "Dura Plate 235."
Aliphatic Polyurethane	PPG "Pitthane Ultra," Carboline "Carbothane 134HG," International "Intervane 990V" Tnemec "Series 1074 Endura-Shield II," or Sherwin-Williams "Acrolon 218HS."
Coal Tar Epoxy/ High-build coal tar epoxy	PPG Amercoat "78HB Coal Tar Epoxy," Carboline "Bitumastic 300 M," Tnemec "46H-413 Hi-Build Tneme-Tar," International "Interzone 954 Black" or Sherwin-Williams "Targuard Coal Tar Epoxy"
Medium Consistency Coal Tar	PPG Amercoat 240 Black, Carboline "Bitumastic 50" International "Devoe Bar-Rust 236 Black" or Tnemec "46-465 H.B. Tnemecol."

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. All surfaces to be coated shall be clean and dry and shall meet the recommendations of the coating manufacturer for surface preparation. Freshly coated surfaces shall be protected from dust and other contaminants. Oil and grease shall be completely removed by use of solvents or detergents before mechanical cleaning is started. The gloss on previously coated surfaces shall be dulled if necessary for proper adhesion of topcoats.

B. Surfaces shall be free of cracks, pits, projections, or other imperfections that would interfere with the formation of a smooth, unbroken coating film, except for concrete block construction where a rough surface is an inherent characteristic.

C. When applying touchup coating or repairing previously coated surfaces, the surfaces to be coated shall be cleaned as recommended by the coating manufacturer, and the edges of the repaired area shall be feathered by sanding or wire brushing to produce a smooth transition that will not be noticeable after the coating is applied. All coatings made brittle or otherwise damaged by heat of welding shall be completely removed.

D. Galvanized Surfaces

1. When a coating is required, galvanized surfaces shall be prepared for coating according to the instructions of the manufacturer of the epoxy. Any chemical treatment of galvanized surfaces shall be followed by thorough rinsing with clean water.

E. Ferrous Metal Surfaces

1. Ungalvanized ferrous metal surfaces shall be prepared for coating by using one or more of the following cleaning procedures specified here-in: solvents (SSPCSP1); abrasive blasting (SSPC-SP5, -SP10, -SP6, or -SP7) power tools (SSPCSP3 or -SP11); or hand tools (SSPCSP2). Oil and grease shall be completely removed in accordance with SSPCSP1 before beginning any other cleaning method. Surfaces of welds shall be scraped and ground as necessary to remove all slag and weld spatter. Tools which produce excessive roughness shall not be used.

2. All components of equipment that can be properly prepared and coated after installation shall be installed prior to surface preparation. Components that will be inaccessible after installation shall have the surfaces prepared and coated before installation. Motors, drive trains, and bearings shall be protected during surface preparation in accordance with the equipment manufacturer's recommendations.

3. All cut or sheared edges shall be ground smooth to a 1/8 inch minimum radius for all material 1/4 inch thickness and larger. For material thickness less than 1/4 inch all cut or sheared edges shall be ground smooth to a radius equal to 1/2 the material thickness. Grinding of rolled edges on standard shapes with a minimum radius of the 1/16 inch will not be required.

4. All ferrous metal surfaces shall have all welds ground smooth and free of all defects in accordance with NACE Standard SP0178, Appendix C, Designation C and sharp edges ground smooth, if not previously prepared in the shop. Instead of blending of the weld with the base metal as required by the NACE standard, it will be acceptable to furnish a welded joint that has a smooth transition of the weld to the base metal. All welds shall be ground smooth to ensure satisfactory adhesion of paint.

5. The cleaning methods and surface profiles specified herein are minimums, and if the requirements printed in the coating manufacturer's data sheets exceed the limits specified, the value printed on the data sheets shall become the minimum requirement.

6. Ferrous Metal Surfaces – Non-immersion Service

   a. Ferrous metal surfaces, including fabricated equipment, in non-immersion service shall be cleaned to the degree recommended by the coating manufacturer for surfaces to be coated with coal tar epoxy, epoxy, and heat-resistant coatings, except galvanized surfaces. Surface preparation of ferrous metal surfaces in non-immersion service shall consist of abrasive blast cleaning to SSPC-SP6, and the first application of coating shall be performed on the same day. If more surface area is prepared than can be coated in one day, the uncoated area shall be blast cleaned again to the satisfaction of Engineer. Surface profile shall be as recommended by coating manufacturer, but not less than 2.0 mils .

7. Ferrous Metal Surfaces - Immersion Service

a. Surface preparation of ferrous metal surfaces in immersion service shall consist of abrasive blast cleaning to at least SSPC-SP10 and the first application of coating shall be performed on the same day. If more surface area is prepared than can be coated in one day, the uncoated area shall be blast cleaned again to the satisfaction of Engineer. Surface profile shall be as recommended by coating manufacturer, but not less than 3.5 mils .

F. Hardware

1. Hardware items such as bolts, screws, washers, springs, and grease fittings need not be cleaned prior to coating if there is no evidence of dirt, corrosion, or foreign material.

G. Existing Coated Surfaces

1. Existing surfaces which are anticipated to be modified or disturbed by the Work have been tested for lead and chromium and the results are presented in the existing Hazardous Environmental Condition report identified in the Supplemental Conditions. Some surfaces tested positive for lead and chromium. As indicated in the Work Covered by Contract Documents section, Contractor shall abate all paint, protective coatings, and linings containing detectable quantities of lead, chromium, or other heavy metals that are in areas potentially impacted, damaged, or disturbed during execution of the Work.

2. Existing Piping. Testing of the existing coatings on existing piping to be coated shall be conducted to determine adhesion capability and compatibility with the coatings specified herein. Existing coatings on piping shall be checked and prepared as recommended by the coating manufacturer and topcoated with the specified coatings. If necessary, existing coatings shall be removed to bare substrate. The piping shall be cleaned, primed, and coated as specified.

3.2 MIXING AND THINNING

A. Coating shall be thoroughly mixed each time any is withdrawn from the container. Coating containers shall be kept tightly closed except while coating is being withdrawn.

B. Coating shall be factory mixed to proper consistency and viscosity for hot weather application without thinning. Thinning will be permitted only as necessary to obtain recommended coverage at lower application temperatures. In no case shall the wet film thickness of applied coating be reduced, by addition of coating thinner or otherwise, below the thickness recommended by the coating manufacturer. Thinning shall be done in compliance with all applicable air quality regulations.

3.3 APPLICATION

A. Coating shall be applied in a neat manner that will produce an even film of uniform and proper thickness, with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat

shall be thoroughly dry and hard before the next coat is applied. Each coat shall be a different color, if available. In no case shall coating be applied at a rate of coverage greater than the maximum rate recommended by the coating manufacturer.

B. Coating failures will not be accepted and shall be entirely removed down to the substrate and the surface recoated. Failures include but are not limited to sags, checking, cracking, teardrops, fat edges, fisheyes, or delamination.

C. Priming

1. Edges, corners, crevices, welds, and bolts shall be given a brush coat (stripe coat) of primer before application of the primer coat. The stripe coat shall be applied by a brush and worked in both directions. Special attention shall be given to filling all crevices with coating. When using zinc primers the stripe coat shall follow the initial prime coat.

2. Abraded and otherwise damaged portions of shop-applied coating shall be cleaned and recoated as recommended by the manufacturer of the finish coating. Welded seams and other uncoated surfaces, heads and nuts of field-installed bolts, and surfaces where coating has been damaged by heat shall be given a brush coat of the specified primer. Before the specified spot or touchup coating of metal surfaces, edges, corners, crevices, welds, and bolts in the area of the spot or touchup coating shall be given a brush coat of primer. This patch, spot, or touchup coating shall be completed, and the paint film shall be dry and hard, before additional coating is applied.

D. Epoxy

1. When used, epoxy shall be applied in accordance with the coating manufacturer's recommendations, including temperature limitations and protection from sunlight until top-coated.

2. When concrete is to be coated, coatings shall not be applied to concrete surfaces in direct sunlight or when the temperature of the concrete is rising. Preferably the coating shall be applied when the temperature of the concrete is dropping.

3. When applying high build epoxy coatings with a roller or brush and where a dry film thickness of at least 4-6 mils per coat is required, two or more coats shall be applied to achieve the recommended dry film thickness equal to a spray applied coating.

E. Coal Tar Epoxy

1. When used, the application of coal tar epoxy, including time limits for recoating, shall conform to the recommendations of the coating manufacturer.

2. When concrete is to be coated, coatings shall not be applied to concrete surfaces in direct sunlight or when the temperature of the concrete is rising. Preferably the coating shall be applied when the temperature of the concrete is dropping.

F. Film Thickness

1. The total coating film thickness including intermediate coats and finish coat, shall be not less than the following:

Type of Coating	Minimum Dry Film Thickness
Medium consistency coal tar	20 mils .
Coal tar epoxy (two coats)	20 mils .
Epoxy	
Floors (two coats)	10 mils .
Surfaces with first coat of epoxy and final coat of aliphatic polyurethane	7 mils (5 mils DFT for epoxy plus 2 mils DFT for aliphatic polyurethane).
Surfaces with first and second coat of epoxy and final coat of aliphatic polyurethane	12 mils (10 mils DFT for epoxy plus 2 mils DFT for aliphatic polyurethane).
Other surfaces (two coats)	10 mils .
Immersion service (three coats)	15 mils .
Other (one coat)	5 mils .
Other (two coats)	10 mils .

G. Weather Conditions

1. Coatings shall not be applied, except under shelter, during wet, damp, or foggy weather, or when windblown dust, dirt, debris, or insects will collect on freshly applied coating.

2. Coatings shall not be applied at temperatures lower than the minimum temperature recommended by the coating manufacturer, or to metal surfaces such as tanks or pipe containing cold water, regardless of the air temperature, when metal conditions are likely to cause condensation. When necessary for proper application, a temporary enclosure shall be erected and kept heated until the coating has fully cured.

3. Coatings shall not be applied at temperatures higher than the maximum temperature recommended by the coating manufacturer. Where coatings are applied during periods of elevated ambient temperatures, Contractor and the coatings manufacturer shall be jointly responsible to ensure that proper application is performed including adherence to all re-coat window requirements. Precautions shall be taken to reduce the temperature of the surface application, especially for metal, at elevated temperatures above 100° F including shading application area from direct sunlight, applying coating in the evening or at night, and ventilating the area to reduce the humidity and temperature,

3.4 REPAIRING FACTORY FINISHED SURFACES

A. Factory finished surfaces damaged prior to acceptance by Owner shall be spot primed and recoated with materials equivalent to the original coatings. If, in the opinion of Engineer, spot repair of the damaged area is not satisfactory, the entire surface or item shall be recoated.

3.5 PROTECTION OF SURFACES

A. Throughout the work Contractor shall use drop cloths, masking tape, and other suitable measures to protect adjacent surfaces. Contractor shall be responsible for correcting and repairing any damage resulting from its or its subcontractors' operations. Coatings spilled or spattered on adjacent surfaces which are not being coated at the time shall be immediately removed. Exposed concrete not specified to be coated which is damaged by coatings shall be either removed and rebuilt or, where authorized by Owner, coated with two coats of masonry coating.

3.6 FIELD QUALITY CONTROL

A. The following inspection and testing shall be performed: surface profile, visual inspection, and wet and dry film thickness testing. All inspection and testing shall be witnessed by Engineer.

B. Surface Profile Testing

1. The surface profile for ferrous metal surfaces shall be measured for compliance with the specified minimum profile. The surface profile for concrete shall comply with SSPC 13/NACE 6 Table 1 for severe service.

C. Visual Inspection

1. The surface of the protective coatings shall be visually inspected.

D. Film Thickness

1. Coating film thickness shall be verified by measuring the film thickness of each coat as it is applied and the dry film thickness of the entire system. Wet film thickness shall be measured with a gauge that will measure the wet film thickness within an accuracy of ±0.5 mil . Dry film thickness shall be measured in accordance with SSPC-PA 2.

3.7 FIELD PRIMING SCHEDULE

A. In general, steel and cast iron surfaces of equipment are specified to be shop primed. Any such surfaces which have not been shop primed shall be field primed. Damaged or failed shop coatings which have been determined unsuitable by Engineer shall be removed and the surfaces shall be field coated, including prime coat (if any). Galvanized, aluminum, stainless steel, and insulated surfaces shall be field primed. Primers used for field priming, unless otherwise required for repair of shop primers, shall be:

Surface To Be Primed	Material
Equipment, surfaces to be coated with	
Aliphatic polyurethane	Universal primer.
Epoxy	Same as finish coats.
Coal tar coating	Same as finish coats.

Surface To Be Primed	Material
Steel and cast iron, surfaces to be coated with	
Epoxy	Same as finish coats or inorganic zinc.
Coal tar coating	Same as finish coats.

B. Unless otherwise recommended by the coating manufacturer or specified herein, priming will not be required on concrete, or concrete block, nor on metal surfaces specified to be coated with coal tar epoxy, and heat-resistant coatings. Concrete surfaces to be coated with epoxy shall be filled with epoxy concrete filler and surfacer so that a continuous film is obtained, except where concrete is damp-proofed with epoxy.

3.8 FINISH COATING SYSTEMS

A. The following schedule lists coatings systems and coating surface designations. See Article 1-3 for a definition of the surface designations.

No.	Finish Coating Systems	Coating Surface Designation						
		A	C	E	F	G	H	P
1.	Epoxy – One coat	x			x	x		
2.	Epoxy – Two coats	x	x	x	x	x		x
3.	Epoxy / NSF – Two coats		x	x				
4.	Epoxy – Three coats	x	x	x				
5.	Epoxy / NSF – Three coats	x	x	x				
6.	Epoxy – First coat Aliphatic polyurethane – Finish coat	x	x	x	x	x		x
7.	Epoxy – First and second coat Aliphatic polyurethane – Finish coat	x	x	x	x	x		
8.	Universal primer – First coat Aliphatic polyurethane – Finish coat	x		x				
9.	Medium consistency coal tar – Two coats	x	x	x				
10.	Coal tar epoxy – Two coats	x	x	x				

B. Surfaces Not To Be Coated

1. Unless otherwise specified, the following surfaces shall be left uncoated:

   a. Exposed aluminum, except ductwork.
   b. Polished or finished stainless steel. Unfinished stainless steel, except flashings and counter flashings, shall be coated.
   c. Nickel or chromium.

d. Galvanized surfaces, except piping, conduit, ductwork, and other items specifically noted. Hot dipped galvanized fabrications, including fabricated pipe supports, except where specifically noted. Rubber and plastics, except as specified.
e. Exterior concrete.
f. Surfaces specified to be factory finished.

C. Shop Finishing

1. Items to be shop finished including the following. Shop finishing shall be in accordance with the coating manufacturer's recommendations.

a. Other surfaces where blast cleaning cannot be or is not recommended to be performed in the field.
b. Other items as otherwise specified.

D. Field Coating

1. Items to be field coated include the following. Field coating shall be in accordance with the field priming schedule, the coating schedule, and the manufacturer's recommendations.

a. Surfaces not indicated to be shop finished and surfaces where blast cleaning can be performed in the field.
b. Other items as otherwise specified.

3.9 METAL SURFACES COATING SCHEDULE

Surfaces to be coated shall include new work, including Owner furnished equipment and surfaces disturbed by the Work. Surfaces that are not disturbed will not require recoating unless noted otherwise on the Drawings.

Surface To Be Coated	Finish Coating System
Non-galvanized structural and miscellaneous steel exposed to view or to the elements in exterior locations.	A7
Actuator surfaces for gates, unless factory finished.	Outdoor – E7 Indoor – E8
Surfaces of cranes and hoists exposed to the elements outdoors.	E7
Cast Iron and steel piping inside buildings, including piping to be insulated, valves, fittings, flanges, bolts, pipe support, hangers, and accessories	A2
Pipe supports, hangers, bolts, and accessories inside buildings	A2
Cast Iron and steel piping in immersion service including inside buildings, including valves, fittings, flanges, bolts, pipe support, hangers, and accessories [and galvanized surfaces after proper priming.	A5

Surface To Be Coated	Finish Coating System
Pipe supports, hangers, bolts, and accessories in immersion service including inside buildings	**A5**
Cast Iron and steel piping above grade exposed to the elements and to view outdoors, including piping to be insulated, valves, fittings, flanges, bolts, pipe support, hangers, and accessories and galvanized surfaces after proper priming.	A7
Pipe supports, hangers, bolts, and accessories above grade exposed to the elements and to view outdoors	**A7**
Miscellaneous castings, including manhole rings and covers, and manhole steps. (One coat, if not shop coated.)	A10
Cast iron and steel piping in manholes, wetwells, and similar locations, including valves fittings, flanges, bolts, supports, and accessories.	A4
All metal harness anchorage for buried piping.	A9

3.10 MISCELLANEOUS SURFACES COATING SCHEDULE – Not used

3.11 PIPING IDENTIFICATION SCHEDULE

A. Exposed piping and piping in accessible chases shall be identified with lettering or tags designating the service of each piping system, marked with flow directional arrows, and color coded.

B. Piping scheduled to be color coded shall be completely coated with the indicated colors, except surfaces specified to remain uncoated shall include sufficiently long segments of the specified color to accommodate the lettering and arrows. All other piping shall be coated to match adjacent surfaces, unless otherwise directed by Engineer.

C. Location

1. Lettering and flow direction arrows shall be provided on pipe near the equipment served, adjacent to valves, on both sides of wall and floor penetrations, at each branch or tee, and at least every 50 feet in straight runs of pipe. If, in the opinion of Engineer, this requirement will result in an excessive number of labels or arrows, the number required shall be reduced as directed.

D. Metal Tags

1. Where the outside diameter of pipe or pipe covering is 5/8 inch or smaller, aluminum or stainless steel tags shall be provided instead of lettering. Tags shall be stamped as specified and shall be fastened to the pipe with suitable chains. Pipe identified with tags shall be color coded as specified.

E. Lettering

1. Lettering shall be painted or stenciled on piping or shall be applied as snapon markers. Snapon markers shall be plastic sleeves, Brady "BradysnapOn B915," Seton "Setmark," or equal. Letter size shall be as follows:

Outside Diameter of Pipe or Covering	Minimum Height of Letters
5/8 inch and smaller	Metal tags -1/4 inch
3/4 to 4 inches	3/4 inch
5 inches and larger	2 inches

F. Color Coding and Lettering

1. All piping for the following services shall be color coded. Bands shall be 6 inches wide spaced along the pipe at 5 foot intervals. For services not listed, the color coding and lettering shall be as directed by the Engineer.

Piping Identification		
Service	**Color of Pipe**	**Color of Letters**
Drain	Dark gray	White
Potable Water (hot or cold)	Dark blue	White[4]
Sample	Light gray with green bands	Black

G. Notes:

1. Electrical conduit shall be coated to match adjacent ceiling or wall surfaces as directed by Engineer. Vent lines shall be coated to match surfaces they adjoin.

2. In addition, special coating of the following items will be required:

Item	Color
Valve handwheels and levers	Red
Hoist hooks and blocks	Yellow and black stripes

3. Numerals at least 2 inches high shall be painted on or adjacent to all accessible valves, pumps, flowmeters, and other items of equipment which are identified on the Drawings or in the Specifications by number.

End of Section

SURFACE DESCRIPTION	**SYSTEM NO.**

SURFACE PREPARATION DESCRIPTION
☐ Solvent SSPC-SP1
☐ Ferrous Metal Nonimmersion SSPC-SP6
☐ Ferrous Metal Immersion
☐ SSPC-SP10
☐ SSPC-SP-5
☐ Other

COATING	**DFT** mils	**MANUFACTURER AND PRODUCT**
First Coat (Primer)		
Second Coat		
Third Coat		
Total System		Not less than minimum thickness specified.

Notes: (Attached if needed.)

Project:	
Coatings Manufacturer:	Initials _____
Painting Applicator:	Initials _____

BLACK & VEATCH	COATING SYSTEM DATA SHEET	Fig 1- 09 96 11

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SHOP PRIMED SURFACE DESCRIPTION SYSTEM NO. - -F

SURFACE PREPARATION DESCRIPTION
☐ Solvent SSPC-SP1
☐ Other

COATING	**DFT mils [µm]**	**MANUFACTURER AND PRODUCT**
Shop Primer		(Identify Product/Type)
Touchup		
Intermediate Coat		
Finish Coat		
Total System		Not less than minimum thickness specified.

Notes: (Attached if needed.)

Project:	
Coatings Manufacturer:	Initials _____
Painting Applicator:	Initials _____

BLACK & VEATCH	COATING SYSTEM DATA SHEET	Fig 2-09 96 11

SECTION 13 47 13.13 - GALVANIC ANODE TYPE CATHODIC PROTECTION FOR PIPELINES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the material and construction specifications to furnish, install, and test the corrosion protection system for the following:

1. Steel Pipe-Cathodic protection with galvanic anodes.

B. The items specified in this section include materials and installation procedures for polyethylene encasement of pipe, as well as miscellaneous cathodic protection materials and equipment for stray current interference testing

1.2 GOVERNING STANDARDS

A. ANSI/AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems, NACE International SP0169 and RP0286.

1.3 GENERAL REQUIREMENTS

A. The Contractor shall be responsible for all specified testing and the furnishing and proper installation of all materials and equipment, as specified herein and as indicated on the Drawings.

B. The Contractor shall obtain the services of a NACE certified corrosion or cathodic protection specialist to review installation procedures and supervise the testing. The corrosion or cathodic protection specialist shall be acceptable to the Owner and the Engineer.

1.4 SUBMITTALS

A. Drawings and Data – General

1. Complete specifications, data, and catalog information or drawings covering the items furnished under this section shall be submitted in accordance with the Submittals Procedures section. Submittals shall include, but not be limited to, the items listed in this Section.

B. Specialist Experience Record.

1. Experience record for the proposed NACE certified corrosion or cathodic protection specialist.

C. Drawings and Data – Protection Systems.

1. Drawings and data shall include the following items:

    a. Drawings which indicate the location of each anode, underground reference electrode, buried insulated flange, and field test station complete with a description of piping connected are indicated.
    b. Drawings with sufficient information that each underground galvanic anode and underground reference electrode can be exactly excavated or replaced.

D. Operations and Maintenance Manual

1. Operations and maintenance manual for the cathodic protection system.

E. Reports.

1. Tabulated reports of the following, where the reports are relevant to the specified cathodic protection systems:

    a. Underground reference electrode tests.
    b. Insulated flange tests.
    c. Anode current measurements of each test station connected galvanic anode.
    d. Pipe system potential measurements.

F. Test Reports

1. All test reports shall be submitted 15 days after completion of the cathodic protection tests.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

PART 2 - PRODUCTS

2.1 MAGNESIUM GALVANIC ANODES

A. Magnesium galvanic anodes shall be high potential magnesium anodes furnished as a packaged assembly with insulated lead wire. The packaged assembly shall consist of a permeable cloth bag containing the anode and special compacted backfill. The anode shall be centered in the bag and completely surrounded by the backfill.

B. High potential magnesium anode alloy shall be Grade M1C, UNS alloy M15102, complying with ASTM B843 and shall have the following composition in percent by weight:

Element	Percent
Aluminum	0.010 maximum
Manganese	0.50 to 1.30

Silicon	0.05 maximum
Copper	0.02 maximum
Nickel	0.001 maximum
Iron	0.03 maximum
Other	0.05 each and 0.30 maximum total
Magnesium	Remainder

C. Backfill surrounding the anode shall have the following composition in percent by weight:

Material	Percent
Ground hydrated gypsum	75
Powdered bentonite	20
Anhydrous sodium sulfate	5

D. Packaged anode component specifics shall be as follows:

Bare anode dimensions	4 inches by 6.5 inches by 60 inches
Bare anode weight	60 pounds
Lead wire type and size	Type TW insulated, 12 AWG solid copper
Lead wire length	50 feet
Approximate packaged weight	130 pounds

E. High potential Magcorp magnesium anodes shall be as manufactured by Mesa Products, Inc.; Stuart Steel Protection Company; Farwest Corrosion Control Company; or acceptable equal. High potential Winca (formerly Dow) magnesium anodes shall be as manufactured Norton Corrosion, Allied Corrosion, or equal.

2.2 WIRE AND CABLE ACCESSORIES

A. Cathodic Protection Cable

1. All cable, sizes 12 AWG and larger, where specified herein or on the Drawings to be cable Type CP, shall be stranded copper cathodic protection cable with low density high molecular weight polyethylene (HMWPE) insulation as supplied by the Kris-Tech Wire Company, Inc.; Energy Economics, Inc.; or Mesa Products, Inc. Provide color coding as indicated on the Drawings.

B. Wire and Cable Markers

1. Markers for wire and cable circuits shall be of an opaque nylon material consisting of a marker board, non-releasing holding device, and cable fastening tail. The holding device shall be designed to allow the fastening tail to pass around the cable and through the holding device, so the cable marker can not be removed except by cutting it loose from

the cable. The marker board shall not be less than 3/8 inch wide, 3/4 inch long, and 25 mils thick with one side roughened to hold ink from a marking pen.

2. Cable markers shall be "TY-RAP" identification cable ties, "Part Number TY551M" as manufactured by Thomas & Betts; or "PAN-TY" marker ties, "Type PLF" as manufactured by Panduit Corporation, or equal.

3. As an alternative one inch diameter brass tags with 3/16 inch minimum stamped identification for anode, referenced electrode, or identified pipe test lead connected to cable with nylon wire ties is acceptable.

C. Marking Pens

1. Marking pen ink shall be suitable for marking on nylon and shall be black, permanent, and waterproof. Marking pens shall be Part Number "H-873" as manufactured by ULINE Industrial Markers, or "Part Number PX-0" as manufactured by Panduit Corporation, or equal.

D. Compressed Ring-Tongue Terminals

1. Compression ring tongue terminals shall be single hole, uninsulated, compression type terminal lugs made of corrosion-resistant copper, bronze, or nickel-plated brass. Compression ring tongue terminal part numbers shall be as indicated in the table below:

Wire Size	Stud Size	Ring-Tongue Terminal Part No.	Manufacturer
14 AWG Stranded	1/4 inch	YAV12-G3	Burndy Corporation
12 AWG or 10 AWG Stranded or Solid	1/4 inch	YAV10-T3	Burndy Corporation

E. Exothermal Connections

1. Welding charge formulation, equipment selection, and welding procedures shall be as recommended by the manufacturer of the exothermal weld materials for the size, shape, and composition of the materials being welded. Where the manufacturer offers a choice of exothermal weld materials, the recommended materials for cast iron pipe shall be used for ductile iron pipe. Materials shall be Cadweld as manufactured by Erico Products, Inc., or Thermoweld, a Division of Continental Industries, or equal.

F. Oxidation Inhibiting Compound

1. Oxidation inhibiting compound shall be an electrically conductive paste material, compatible with both steel and copper, and shall be Contax Type CT as manufactured by Thomas & Betts; Kopr-Shield as manufactured by Jet-Lube, Inc.; Dostex Type AP as manufactured by Dossert Corporation, Ox-Gard, as manufactured by Gardner Bender, Inc.; DEOX Oxide Inhibitor as manufactured by Ilsco; or equal.

G. Solder Connections

1. All soldering shall be with 50/50 tin/lead hollow core solder with non-acid flux.

2.3 ABOVEGROUND FIELD TEST STATIONS

A. Aboveground field test stations shall consist of a cast aluminum enclosure with a terminal block accessible from both sides and from when the cover is removed. Each terminal block shall be special-ordered with five nickel-plated marine brass terminals and one nickel-plated marine brass jumper strap. The cover fastener shall be stainless steel. The enclosure shall have a threaded hub suitable for connection of 2 inch rigid conduit. Aboveground field test stations shall be Testox 715 as manufactured by Gerome Manufacturing Company, Cathodic Protection Services Company, or equal.

2.4 UNDERGROUND REFERENCE ELECTRODES

A. Underground reference electrodes shall be of the saturated, gelled, copper-copper sulfate type, packaged in a special backfill and complete with 75 feet of 14 AWG stranded copper lead wire with high molecular weight polyethylene insulation. Underground reference electrodes shall have a 30 year minimum design life. Underground reference electrodes shall be “Stealth SRE-007-CUY” as manufactured by Borin Manufacturing, Inc., “Model UL-CUG” as manufactured by Electrochemical Devices, Inc., or equal.

2.5 FLANGE INSULATING KITS

A. The flange insulating materials and special gasket diameters specified in this article may not be stock items and shall be ordered early to allow time for manufacture. Ordering information should include:

1. Type E retainer.
2. Double washers.
3. Retainer material.
4. Sealing element material.
5. Insulating washer material.
6. Insulating sleeve material.
7. Nominal flange size.
8. ANSI pressure class.

B. Each insulated flange kit shall include the following:

1. One Type “E,” full-faced insulating and sealing flange gasket, consisting of a 1/8 inch thick retainer with special ring seal. The inside diameter shall be 1/8 inch less than the

inside diameter of the flange in which it is to be installed and shall be PSI Linebacker, Advance Products Trojan, or acceptable equal.

2. One full length bolt insulating sleeve, 1/32 inch thick, for each flange bolt.

3. Two flat insulating washers, 1/8 inch thick, for each flange bolt.

4. Two flat steel backing washers, 1/8 inch thick, for each flange bolt. The backing washer outside diameter shall not be larger than the outside diameter of the insulating washer.

5. Insulating material selection shall be based on the application as indicated in the following table and notes:

Fluid	Sleeves	Insulating Washers	Gasket / Retainer	Seal Element
Water	G-10	G-10	G-10	Nitrile or EPDM

2.6 SHRINK SLEEVES FOR BURIED INSULATED FLANGES

A. Shrink sleeves shall be used where indicated on the Drawings to coat buried insulated flanges and shall conform to the requirements of ANSI/AWWA C217. Shrink sleeves shall be of the wraparound type for all pipe sizes for which they are available. Widths shall be as recommended by the manufacturer for the flange size being coated. Flange shrink sleeves shall be Type Raychem FCWS-F/FLANGESEAL as manufactured by Berry Plastics, Corrosion Protection Group, or Aqua-Shield Flange Protection Kit, Type AQW-FPK, as manufactured by Canusa-CPS.

2.7 WAX TAPE COATING FOR BURIED INSULATED PIPE FLANGES

A. The wax-tape coating shall be used where indicated on the Drawings and shall conform to the requirements of ANSI/AWWA C217, and shall consist of three parts: surface primer, wax-tape and outer covering. The primer shall be a blend of petrolatum, plasticizer and corrosion inhibitors having a paste like consistency such as Trenton Wax-Tape Primer. The wax-tape shall be a plastic-fiber felt tape, 50 to 70 mils thick, and saturated with a blend of petrolatum, plasticizer, and corrosion inhibitors that is easily formed over irregular surfaces such as Trenton #1 wax-tape. The outer covering shall be a plastic wrapper consisting of three each 50 gauge, clear polyvinylidene chloride, high cling membranes wound together as a single sheet such as Trenton Poly-Ply.

2.8 PIPE COATING REPAIR MATERIALS AT CABLE CONNECTIONS

A. Materials used to repair pipe coating at lead wire or joint bond connections shall be Thermit Weld Caps and Thermit Weld Mastic as manufactured by Mesa Products Incorporated; Royston Handy Caps as manufactured by Royston Laboratories, Inc., or equal.

2.9 NONDETECTABLE UNDERGROUND MARKING TAPE

A. Underground, nondetectable marking tape shall be a minimum 3 inches in width, red in color, with “Caution Electric Line Buried Below,” “Caution Cathodic Protection Cable Buried Below,” or similar words printed in black. Nondetectable underground marking tape shall be “Shieldtec” as manufactured by Empire Level Manufacturing Company and as supplied by Hoff Company, Inc., or equal.

2.10 POLYETHYLENE ENCASEMENT MATERIALS

A. Polyethylene film for encasement pipe shall be a linear low density (LLD) or high density cross laminated (HDCL) material conforming to the applicable requirements of ANSI/AWWA-C105/A21.5, and as specified in this article.

B. Under no circumstance shall a co-extruded product be considered for this project. Material shall conform to the definitions as called for in ANSI/AWWA C105/A21.5. The polyethylene sleeve shall be as manufactured by Fulton Enterprises, Birmingham, Alabama, or equal.

C. The film supplied shall be clearly marked at a minimum of every two feet along its length, as stated in the ANSI/AWWA C105/A21.5.

D. At the discretion of the Owner, material delivered to the job site may be sampled and tested at the Owner’s expense to determine adherence to these specifications.

E. Polyethylene encasement materials shall meet the following minimum requirements:

Item	LLDPE-8 mil/ HDCLPE-4 Mil
Tensile Strength, psi	3600/6300
Elongation, %	800/100
Dielectric Strength, V/mil	800
Tear Resistance, gf	2550/250
Impact Resistance, g	600/800

F. Joint tape shall be PVC or polyethylene, self-sticking type, 10 mils thick. Joint tape shall be Chase “Chasekote 750,” Kendall “Polyken 900,” or 3M “Scotchrap 50.”

G. Strapping shall be the nonmetallic, water resistant type, conforming to Fed. Spec. PPP-S-760, Type II.

PART 3 - EXECUTION

3.1 INSTALLATION

A. An insulated type joint shall be provided at each connection through a structure wall, and where indicated on the Drawings.

B. Field test stations shall be provided at each buried insulated joint.

C. Underground reference electrodes shall be provided where indicated on the Drawings.

D. Galvanic anodes shall be installed where indicated on the Drawings.

E. Galvanic Anodes

1. The burial depth of galvanic anodes and distance from the pipe shall be as indicated on the Drawings.

2. When installing anodes, penetration of layers of brick, concrete, or other debris may be required to properly place the anodes. It is not intended that anodes be installed at locations where penetration of solid reinforced concrete or rock is necessary.

3. If solid rock or reinforced concrete is encountered at the location and burial depth indicated on the Drawings for an anode, and prevents vertical installation of the anode, an investigation of the immediate area shall be made to determine a suitable location for vertical installation of the anode at the specified burial depth. If the Contractor is unable to find a suitable location in the immediate area of the specified anode location, the anode shall be installed vertically closer to the surface with a minimum earth cover of 5 feet. If a minimum earth cover of 5 feet cannot be maintained, the Engineer will direct the Contractor how to proceed.

4. After placement of packaged galvanic anodes, at least 5 gallons of water shall be poured over and around packaged anodes before backfilling.

5. Packaged galvanic anodes shall be backfilled with clean earth, free from rocks and debris. Anodes shall not be backfilled with sand.

F. Wire, Cable, and Cable Accessories

1. Routing

a. Unless otherwise indicated on the Drawings, lead wire and cable shall be installed at a minimum of 3 feet below grade. Where lead wire is connected to pipe or to field test stations, a minimum of 18 inches of slack shall be left in the lead wire to permit settling of the backfill without stressing the electrical connection.

2. Pipe Lead Wires

a. Pipe lead wires shall be connected to the pipe at each field test station location as indicated on the Drawings. Pipe lead wires shall be two Type CP cables, size 12 AWG.
b. Connection of the lead wires to the pipe shall be as specified in the Cable Connections to Pipe article. To the extent practical, pipe lead wires shall be attached to the pipe on the top center line and separated a minimum distance of 12 inches.
c. Pipe lead wires shall not be spliced.

d. Pipe lead wires shall be clearly identified by and indication of the pipe they are connected to. Identification shall be made at installation using the specified permanent cable markers. The Contractor shall maintain the identification markings throughout construction to ensure that each pipe lead wire is clearly and correctly marked when terminated in the field test stations.

3. Field Test Station Terminations

a. Terminations shall be arranged on the field test station terminal boards as indicated on the Drawings.
b. Terminations at field test stations shall be made with single hole compression type terminal lugs of corrosion-resistant copper, bronze, or nickel-plated brass. A calibrated crimping tool designed to crimp the connector shall be used for all compression connections. The connector shall not release from the conductor when pulled or twisted.
c. All terminals, terminal lugs, jumpers, link bars, and any other terminal board metal parts or hardware installed in flush mounted field test stations shall be coated with a conductive oxidation inhibiting compound as specified in the article titled Oxidation Inhibiting Compound.
d. Solid conductors shall additionally be soldered in the terminal lug before terminating the lug in the field test station.
e. Permanent, legible identification markers shall be attached to each lead wire in each field test station. Each pipe lead wire shall be identified with pipe diameter and service, as a minimum. Underground reference electrode lead wires for pipe installation shall be identified as "Cu-$CuSO_4$."

4. Cable Connections to Pipe

a. Except for stainless steel pipe, cables shall be exothermally welded to pipe. Cable connections to stainless steel pipe shall be made with silver brazing.
b. No connection to pipe shall be coated or covered until it has been inspected by the Engineer. The Engineer may reject any connection if it fails when the cable is pulled, breaks loose from the pipe when struck at an angle with a hammer, or does not appear to be a complete, properly shaped and made connection. Inspection by the Engineer in no way relieves the Contractor of responsibility for the performance of the connection.
c. After the connection has been inspected by the Engineer, the exposed part of the wire and the connection shall be coated as specified in the article titled Coating Electrical Connections to Pipe.

5. Splices

a. Splices in solid wires shall be made by twisting the conductors together and soldering with 50-50 solid solder and non-acid flux. Splices in stranded wires shall be performed using a properly sized uninsulated butt splice compression connector and a calibrated crimping tool designed to crimp the connector. The connector shall not release from the conductor when pulled or twisted. Acceptable butt splice connectors for the various cable sizes shall be as follows.

Stranded Cable Size	Connector Type	Manufacturer

Stranded Cable Size	Connector Type	Manufacturer
14-10 AWG	Hylink, Type YSV Box	Burndy
8 AWG	Pan-Term Splice-Type SCS	Panduit
6 AWG and larger	Copper Hylink, Type YS	Burndy

b. A compression connection installed underground shall additionally be soldered before insulation and burial. After inspection by the Engineer, splices shall be insulated with one half-lapped layer of varnished cambric tape covered by two half-lapped layers of rubber tape elongated not more than 20 percent. Two half-lapped layers of vinyl electrical tape shall be applied over the rubber tape. At each end of each splice the vinyl tape shall overlap the rubber tape onto the undamaged cable insulation a minimum of two cable diameters.

6. Exothermal Welds

a. This article covers requirements for exothermal welding, including but not restricted to, cable-to-cable, cable-to-rod, cable-to-pipe, and cable-to-steel structure connections.
b. Exothermal welds shall be made using molds, sleeves, and cartridges sized in accordance with the welding equipment manufacturer's recommendations for the particular application.
c. Completed welds shall be capable of withstanding moderate hammer blows. Porous or deformed welds will not be acceptable. Damaged or worn molds shall not be used and shall be removed from site.
d. The inspection of, and responsibility of the Contractor for, exothermal welds shall be as described in the article titled Cable Connections to Pipe.

7. Joint Bonds

a. All underground non-insulated steel pipe and ductile iron pipe gasketed joints shall be made electrically continuous by joint bonding.
b. Non-insulated mechanical pipe couplings shall be joint bonded as detailed on the Drawings.
c. The method of attaching joint bond cables to pipe or to pipe fittings shall be as described in the article titled Cable Connection to Pipe.
d. Joint bonding cable connections on either side of a joint shall be separated a minimum distance of 12 inches. Except where indicated otherwise, joint bonding cables shall be made with two #8 AWG Type CP cables. Joint bond cables shall contain at least 6 inches of slack wire to compensate for pipe movement and backfill settlement.
e. Joint bonding of prestressed concrete cylinder pipe shall be at locations indicated and in accordance with the details on the Drawings.

G. Underground Reference Electrodes

1. Underground reference electrodes shall be installed at the locations indicated on the Drawings.

2. Underground reference electrodes shall be stored and maintained in a dry environment, above freezing temperatures, until activation and installation. Underground reference electrodes shall be activated by complete immersion in clean, fresh water for approximately 8-12 hours prior to installation.

3. Except as indicated otherwise on the Drawings, the packaged underground reference electrode shall be installed horizontally below the frost line, in permanently moist soil, with a minimum of 6 inches of clean earthfill between the electrode package and any surrounding rock.

4. Activated reference electrodes shall be tested for proper operation in accordance with applicable articles of the subsection titled TESTING, after placement and before backfilling.

H. Insulated Joints

1. Flange insulating kits shall be installed in pipe flanges where indicated on the Drawings and as specified herein. After installation, protective coatings shall be provided around the joint as specified herein.

2. Bolting at insulated flanges shall consist of studs and nuts with sufficient stud length to allow at least one full stud thread protruding through each nut. Sleeves shall extend into the insulating washers.

3. Flange gasket seating surfaces shall be free from tool marks, scratches, pits, deposits, and other defects. Stud tensioning shall be performed using a torque wrench or other tensioning device such as a hydraulic wrench. Torque settings shall not exceed the maximum value specified by the insulated flange kit manufacturer.

4. Insulated flange kits shall be installed as follows:

   a. Inspect the gasket kits. Verify that the material is as specified and provided in a new and undamaged condition.
   b. Clean the bolting materials. Apply lubricant or antiseizing compound to all threads required for engagement with nuts and nut facings.
   c. Align flange faces so that they are parallel and concentric with each other within 0.010 inch without external loading or springing.
   d. Line up bolt holes by driving two tapered drift pins in opposite directions to each other into two diametrically opposite bolt holes.
   e. Insert insulating sleeves into the bolt holes. If they do not slide in easily, the flanges are not lined up properly. Do not force sleeves into bolt holes as sleeve damage may result.
   f. Assemble the studs (or bolts) as follows:
      1) Run one nut on each stud so that two full threads are showing beyond the nut.
      2) Slide a steel washer onto stud and insert into bolt hole. (If the flange requires two sided insulation, add an insulating washer after the steel washer.)
      3) From the opposite end of the stud, place an insulating washer, a steel washer, and then a nut. Hand tighten.

g. Torque studs to a maximum of 30 percent of the final torque value specified. Replace the two drift pins with stud assemblies. Torque the remaining studs to 30 percent of the final torque value in a star pattern sequence.
h. Repeat steps in g., increasing the torque to approximately 60 percent to 80 percent of the final torque value.
i. Continue torquing all studs in the sequence using the specified torque setting (100 percent) until there is no further rotation of nuts.

5. After installation, all insulated fittings shall be tested as specified in the paragraph entitled Insulated Fitting Tests.

6. Buried Insulated Flange Coating

a. Coat buried insulated pipe flanges with an external wax-tape coating in accordance with ANSI/AWWA C217. Do not apply the wax-tape coating until the insulated pipe flanges have been tested and approved by the Owner. The wax-tape coating shall consist of a surface primer, wax-tape and an outer covering. The wax tape coating system shall extend over the adjacent pipe coating by a minimum 12 inches or18 inches away from the flange surface, whichever is greater.
b. The surfaces to receive the wax tape coating shall be clean and free of all dirt, grease, and other foreign material. Apply the primer by gloved hand or brush onto all exposed metal surfaces. Apply the wax tape immediately after the primer application. Cut strips of wax tape and apply them by gloved hand around all bolts, nuts, and other irregular shapes so that there are no voids or spaces under the tape. Apply a sufficient amount of tape to completely encapsulate all exposed metal surfaces with a minimum wax tape thickness of 140-mils. Apply by hand two layers of polyvinylidene chloride, high cling membrane sheet over the wax tape coating by tightly wrapping it around the pipe such that it adheres and conforms to the wax tape. Secure the plastic wrap to the pipe with adhesive tape.

I. Polyethylene Encasement

1. Provide polyethylene tube protection in accordance with ANSI/AWWA-C105/A21.5, Method A or Method C as specified in this article.

2. Preparation of the pipe shall include, but is not limited to, removing lumps of clay, mud, cinders, etc., prior to installation. Prior to installing the polyethylene tube, all irregular or sharp surfaces which could damage the polyethylene shall be covered with a minimum of two layers of the specified joint tape.

3. All polyethylene tube material shall be held firmly against the pipe with the specified strapping material installed on two-foot spacings.

4. The terms polyethylene tube protection and polyethylene encasement are equivalent and are used interchangeably in these Contract Documents.

5. Unless otherwise acceptable to the Engineer, polyethylene tube protection shall be provided at the following locations and as indicated on the Drawings:

Ductile Iron Pipe	Entire length, including all buried piping, bends, tees, adapters, closure pieces, valves, and other

fittings or specials.

J. Field Test Stations

1. Field test stations shall be at locations indicated on the Drawings.Where it is not practical to locate field test stations directly over the pipe it is connected to because of interference with the normal use of the area, field test stations shall be located nearby. Test station locations shall be in protected locations, such as in fence rows or adjacent to manholes, or similar structures where they will experience minimum chance of damage and provide minimum interference with normal use of the area in which they are installed.

K. Coating Electrical Connections to Pipe

1. Electrical connections to pipe having a dielectric coating system shall be coated immediately following inspection of the connection. Coating shall be with the materials specified in the article titled Pipe Coating Repair Materials at Cable Connections, and shall be as recommended by the coating repair material manufacturer and as specified in this article.

2. All slag, splatter, and scale shall be removed from welded connections. Sharp edges or burrs shall be removed by grinding or filing. Connections shall be allowed to cool to handling temperature. All moisture shall be removed from surfaces prior to application of the coating materials. The coating material shall be firmly pressed into place, forcing the mastic material to completely cover the exposed connection area and to conform around the wire, and the undamaged pipe coating.

3.2 TESTING

A. Testing to verify acceptable installation and performance of the cathodic protection system and associated equipment and materials shall be performed by the Contractor as specified in this section.

B. The Contractor shall ensure that all necessary safety precautions are taken, and shall provide all necessary equipment, materials, and labor for the performance of tests. If defects are discovered, the Contractor shall perform additional tests as are required to establish the nature of the defects.

C. If tests indicate that defects exist in materials, equipment, or installations which are the sole responsibility of the Contractor, these defects shall be immediately corrected. Tests and repairs shall continue until the materials, equipment, and installations are in accordance with the specification requirements. Corrective action shall include the restoration of all other construction and facilities disturbed by the repair work.

D. Test Equipment

1. Required test equipment to be used for the specified testing shall include the following:

a. Eight inch saturated copper-copper sulfate solution portable reference electrode, M.C. Miller Model RE7, available from the M.C. Miller Co., Inc.; or Tinker and

Rasor Model 8A, available from Agra Equipment Company; or equal. The reference electrode copper rod shall be clean and filled with a fresh copper-sulfate and distilled water saturated solution within 30 days of testing time.

b. Flexible test leads as required.

c. High input impedance dc voltmeter with millivolt scale and built-in ohmmeter, Wavetek Model HD110, available from Mesa Products; Fluke Model 87 hand-held multimeter available from John Fluke Mfg. Co.; or equal.

d. Insulation checker, Gas Electronics Model 601. Available from M.C. Miller Company.

e. Six volt lantern battery or 12 volt automotive battery.

f. Low resistance dc ohm-meter, AVO International "Catalog No. 247001 (Biddle DLRO)," complete with helical spring point test leads; AVO International "Catalog No. 242011-7," available from E.I.L. Instruments; Transcat.

E. Test Procedures

1. The Contractor shall record and submit test data for each test performed.

2. Joint Bond Continuity Tests

a. The Contractor shall not permanently cover any joint bonded pipe with soil, concrete, or other backfill until the pipe continuity is tested. The pipe joint or joints shall be tested for continuity using low-resistance dc ohm-meter as follows:

1) A helical spring point test lead shall be placed in contact with the pipe adjacent to continuity bond wire exothermal weld on each side of the pipe joint being tested.

2) The electrical resistance across the mechanical joint under test shall be measured directly using the low-resistance ohm-meter. The electrical resistance of the pipe joint shall be less than 250 micro-ohms.

3) Discontinuities shall be repaired and testing repeated to verify successful repair.

3. Underground Reference Electrodes

a. After each underground reference electrode is installed, a minimum of 10 gallons of water shall be poured over and around the electrode. After the surrounding soil and underground reference electrode is saturated with water, place a mild steel stake or rod in firm contact with the soil, several feet from the reference electrode package. Connect the negative test lead of the specified dc voltmeter to the reference electrode lead wire. Firmly connect the voltmeter positive test lead to the mild steel stake or rod. Measure and record the dc voltage on the voltmeter.

b. For copper-copper sulfate type underground reference electrodes, the reading shall be stable between -0.4 and -0.8 volts. For zinc type underground reference electrodes, the reading shall be stable between +0.3 and +0.7 volts.

4. Insulated Fitting Tests

a. Tests to verify acceptable insulated pipe fitting installations shall be performed after pipe installation is completed. Insulated flanges shall not be disassembled or reworked after the insulated fitting tests are complete. Underground insulated

fittings shall not be backfilled until the insulation integrity is verified by the Engineer. If the tests indicate that an insulating flange is not providing satisfactory isolation of connecting piping, the Contractor shall perform additional tests and work as required to locate and correct deficiencies.

b. Insulated flange testing shall be performed using the insulation checker. Prior to testing, the insulation checker shall be calibrated and zeroed as recommended by the manufacturer.

c. Firm metal-to-metal contact shall be established between each instrument probe and flange face across the insulator being tested. An effective insulator is indicated by a full scale reading on the instrument. Any deflection less than full scale indicates a shorted insulator.

d. Electrical insulation tests shall be performed at 6 inch (150 mm) intervals around the circumference of the insulated flange. Failure of the insulation test at any location around the circumference shall qualify as a failed insulator.

e. Defective components shall be identified and replaced. Testing shall be repeated to verify insulator effectiveness.

5. Cathodic Protection Tests

a. Electrical and mechanical connections to the underground piping systems shall be complete before testing. Underground piping shall be electrically isolated from above-ground piping during testing. Underground piping shall have been completely backfilled for at least one month before final testing, although prior tests may be made at the Contractor’s option for his own information.

1) Pipe Lead Wire Continuity Testing. Prior to performing anode current measurement tests or pipe potential tests, electrical continuity of pipe lead wires terminated in field test stations shall be verified.

2) The measurements shall be made as follows:

a) At the field test station, pipe lead wire or wires shall be disconnected from any anodes or shunts. The voltmeter shall be connected between the two pipe lead wires, and potential measurements recorded.

b) If no potential exists between the pipe lead wires, the resistance between the two pipe lead wires shall be measured. This resistance reading should be a relative reading to nullify the resistance of the meter lead wires or the lead wire resistance shall be subtracted from the reading to calculate the resistance of the pipe lead wires. The resistance reading shall be stable and less than 0.1 ohm.

c) If a potential exists, if the reading is unstable, or if there is a high resistance between the pipe lead wires, one or both of the pipe lead wires may be damaged. To determine if either of the pipe lead wires is satisfactorily connected to the pipe, the following tests shall be performed after satisfactory results have been obtained for the anode open circuit potential test:

d) The current flowing from a pipe lead wire to an anode shall be measured and recorded. The above procedure shall be repeated using the spare pipe lead wire. Low current flow through pipe lead wires indicates a discontinuity. Pipe lead wires with discontinuities shall be repaired or appropriately marked in the test station as determined by the Engineer.

e) Pipe lead wires shall be reconnected to the test station terminal board in their original positions.

b. Pipe Connected Anode Current Measurements. After the piping and galvanic anodes have been backfilled for a minimum of 30 days, and connecting above-grade piping has been isolated, galvanic anode current shall be measured as follows:
   1) At each field test station with connected anodes, the voltage across and resistance through the shunt associated with each anode shall be recorded. The current through each shunt shall be calculated and recorded.
   2) For test stations not furnished with shunts, the positive terminal multimeter test lead wire shall be connected to the Pipe Lead Wire 1 lug in the test station terminal block and the negative terminal multimeter test lead wire to the anode lead wire lug in the test station terminal block. The current shall be measure using the multimeter mA scale and recorded. The current polarity shall be confirmed to be positive.

c. Pipe System Potential Measurements. After satisfactory current measurements have been obtained for all test station connected anodes, pipe potentials shall be measured.
   1) The measurements shall be made as follows:
      a) At each field test station, the negative terminal of the voltmeter shall be connected to the portable reference electrode and the positive terminal connected directly to a pipe lead wire. The portable reference electrode shall be placed in moist soil, free of vegetation, on the surface directly over the pipe. The potential measurement and the location where the reference electrode was placed shall be recorded. The potential polarity shall be confirmed to be negative.
      b) At locations where underground reference electrodes are installed, measurements shall be made as follows.
      c) The negative terminal of the voltmeter shall be connected to the underground reference electrode lead wire and the positive terminal connected directly to a pipe lead wire. The potential shall be recorded and polarity of the measurement confirmed to be negative.

F. Test Reports and Acceptance

1. Within 15 calendar days after completion of the cathodic protection tests, a complete report of the test results shall be submitted to the Engineer. The Engineer will interpret the results and advise the Contractor whether or not the system is acceptable.

2. For the system to be acceptable, tests results shall indicate that a protective anode current output of 0.03 milliamperes per square foot of coated pipe surface will produce potentials which are more negative than -0.90 volts at any location.

3. If the indicated protective current outputs are in excess of 0.03 milliamperes per square foot of coated pipe surface, the system will not be acceptable and the Contractor shall locate and repair defective coating and/or locate and remove grounds on the system.

4. If the galvanic system anode current output is less than 0.03 milliampere per square foot of coated pipe surface and potentials do not indicate protection has been achieved, the Engineer will advise the Contractor how to proceed.

5. The test reports shall include the following items:

    a. Drawings upon which the location of each test station, underground reference electrode, galvanic anode, and insulated fitting is indicated.
    b. Drawings with sufficient information that each underground galvanic anode can be exactly excavated or replaced.
    c. Drawings showing the location of each field test station complete with a description of pipe lead wire connections.
    d. Records of all anode installation details.

6. Tabulated reports of:

    a. Final anode current measurements of each test station connected galvanic anode.
    b. Final insulated fitting test measurements, with the test method indicated.
    c. Final pipe system potential measurements.
    d. Underground reference electrode tests.

End of Section

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SECTION 22 13 29.14 - TREATED WATER SAMPLE PUMPS

GENERAL

1.1 SCOPE.

A. This section covers the furnishing and installation of a treated water sample pump for installation in the Clearwell TW Interconnect Flow Meter Vault.

B. Piping, pipe supports, and accessories which are not an integral part of the equipment or are not specified herein are covered in other sections.

C. Each pumping unit shall be complete with a submersible electric motor, a pump support table, sufficient cable to install at the locations shown on the drawings, and all other appurtenances specified or otherwise required for proper operation.

1.2 GENERAL.

A. Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer. Hydraulic considerations and definition of terms shall be as set forth in the Hydraulic Institute Standards.

B. Each pumping unit shall be furnished complete with all accessories and appurtenances which are specified or required for proper installation and operation.

C. All materials or products furnished or installed under this section which can contact water (in the treatment process and drinking water) or a water treatment chemical shall conform to ANSI/NSF 60 and 61 as applicable and be in accordance with Arkansas Department of Health Requirements.

D. General Equipment Stipulations.

1. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

E. Coordination.

1. Contractor shall verify that each component of the system is compatible with all other parts of the system; that all piping, materials, pumps, and motor sizes are appropriate; and that all devices necessary for a properly functioning system have been provided.

2. Where two or more units of the same class of equipment are required, they shall be the product of a single manufacturer; however, all the component parts of the system need not be the products of one manufacturer.

3. Where several manufacturers' names have been listed in this section as possible suppliers, only the products of the first manufacturer listed have been checked for size, functions, and features.

F. Tagging.

1. Each item of equipment and each part shipped separately shall be tagged and identified with indelible markings for the intended service. Tag number shall be clearly marked on all shipping labels and on the outside of all containers.

G. Power Supply.

1. Unless otherwise indicated, power supply to the equipment shall be 120V/60 hertz single phase.

H. Mechanical Identification.

1. Pumps shall be identified in accordance with the Equipment and Valve Identification section.

1.3 SUBMITTALS.

A. Drawings and Data.

1. Complete fabrication and assembly drawings, together with detailed specifications and data covering materials used, parts, devices, and other accessories forming a part of the equipment furnished, shall be submitted in accordance with the Submittals section. Drawings submitted shall include separate wiring diagrams for each pumping unit. The data and specifications for each unit shall include, but shall not be limited to, the following:

a. Pumps
   1) Name of manufacturer.
   2) Type and model.
   3) Number of units.
   4) Design rotative speed.
   5) Size of discharge pipe.
   6) Net weight of pump only.
   7) Data on shop painting.
   8) Complete performance curves showing capacity versus head, NPSH required, pump efficiency, and bhp.
   9) ANSI/NSF 61 Certification.
   10) Pump tags.
   11) Pump support table drawing and selection.

b. Motors
   1) Name of manufacturer.
   2) Type and model.
   3) Type of bearings and method of lubrication.
   4) Rated size of motor, hp (kW).
   5) Full load current.

6) Locked rotor current.

B. Operation and Maintenance Data and Manuals.

1. Adequate operation and maintenance information shall be supplied as required in the Submittals section. Operation and maintenance manuals shall be submitted in accordance with the Submittals section.

1.4 QUALITY ASSURANCE.

A. Observation.

1. Owner and Engineer may elect to observe the fabrication process at the facilities of the treated water sample pump manufacturer. Costs for this observation shall be the responsibility of Owner. The treated water sample pump manufacturer shall make viewing of the fabrication process accessible to Owner and Engineer at an agreed upon time interval.

B. Balance.

1. All rotating parts shall be accurately machined and shall be in as nearly perfect rotational balance as practicable. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that resonance at normal operating speeds is avoided. In any case, the vibration as measured at any point on the machine including motor and gear reducer shall not exceed 0.315 inch/sec.

2. At any operating speed, the ratio of rotative speed to the critical speed of a unit or components thereof shall be less than 0.8 or more than 1.3.

1.5 DELIVERY, STORAGE, AND HANDLING.

A. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

1.6 EXTRA MATERIALS.

A. The following extra materials shall be furnished for the equipment:

One spare mechanical seal and one manufacturer’s repair kit shall be furnished for each pump.

Spare parts shall be suitably packaged in accordance with the General Equipment Stipulations, with labels indicating the contents of each package. Spare parts shall be delivered to the Owner as directed.

1.7 ACCEPTABLE MANUFACTURERS.

A. The pumping units shall be single-stage centrifugal-type Price Pump “Type MS” Series or approved equal.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS.

A. The units shall be suitable for pumping treated water from the sample point in the Clearwell TW Interconnect flow meter vault to the Owner-provided water quality panel within the High Service Pump Station. Unless otherwise indicated in the schedules, pumps shall be suitable for pumping clear water with minimal solids of 3/16 inch diameter or less. The pumped liquid temperature will range between 36°F to 86°F. The manufacturer shall submit written confirmation that pumping unit can meet the service conditions specified.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS.

A. Pumping units shall be designed for the following operating conditions.

Pump Tag Numbers	45-TW-PMP-0002	Qty 1
Rated head	81	Ft
Capacity at rated head	5	gpm
Minimum shutoff head	10	Ft
Capacity at shutoff head	1.5	gpm
Maximum nominal speed	3450	rpm
Maximum horsepower	1/2	HP
Discharge Size	½ FNPT	Inches

2.3 MATERIALS.

Motor Housing	Stainless Steel
Impeller Material	Celcon or thermoplastic
Casing	Stainless Steel
Shaft	Stainless Steel

Hardware	Stainless Steel
Cable Length	30 ft
Shaft	Stainless steel, AISI Type 303, 316, or 416.
Thrust Bearing	Antifriction, grease lubricated.
Intermediate Shaft Bearing (Pump columns greater than 6 feet in length).	Bronze, ASTM B62, sleeve type, grease lubricated.
Lower Shaft Bearing	Bronze, ASTM B62, sleeve type, grease lubricated.
Lower Shaft Bearing (where indicated in the schedules)	Goodrich "Cutless Rubber", oil-resistant, water lubricated.
Stuffing Box	
Stuffing Box Hardware	Corrosion-resistant metal.
Packing	Braided, graphited or Teflon impregnated Kevlar.
Pump Column and Discharge	Galvanized or epoxy coated steel pipe
Pipe	ASTM A53, Schedule 40.
Motor Support Pedestal	Cast iron, ASTM A48.
Baseplate and Sump Cover	Galvanized or epoxy coated steel plate.
Epoxy Coating	
Primer and Finish Coat	Carboline "Carbogard 891" or Tnemec "Series N140 Pota-Pox Plus".

2.4 PUMP CONSTRUCTION.

A. The motor, rotor, and bearings shall be mounted in a sealed submersible housing. The pump inlet shall be screened with corrosion resistant material. The unit shall be equipped with integral removable check valve.

2.5 MOTOR

A. All motors shall conform to the requirements of the Common Motor Requirements for Process Equipment section and shall be rated for continuous duty in 40°C ambient temperature.

2.6 PUMP TABLE

A. Pump support table shall be provided as recommended by pump manufacturer. Dimensions shall accommodate the selected pump model.

B. Pump table shall be bolted to the concrete floor, or a concrete pad as required per the pump manufacturer's installation requirements.

PART 3 - EXECUTION

3.1 INSTALLATION.

A. Equipment and materials furnished under this section shall be installed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

B. Pumping units shall be leveled, plumbed, aligned, and wedged into position to fit connecting piping. Installation procedures shall be as recommended by the pump manufacturer and the Hydraulic Institute Standards. Grouting shall be as specified in the Grout section.

C. Special care shall be taken to ensure that piping stresses are not transmitted to the pump connections. After final alignment and bolting, pump connections shall be tested for applied piping stresses by loosening the pump connections. If any movement or opening of the joints is observed, piping shall be adjusted to proper fit.

3.2 INSTALLATION CHECK.

A. An installation check by an authorized representative of the manufacturer is not required.

3.3 STARTUP AND TESTING.

A. Startup requirements and field performance tests shall be as specified in the Startup Requirements section.

End of Section

SECTION - SUBMERSIBLE SUMP PUMPS

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the furnishing and installation of medium and heavy duty single-stage, submersible, end suction centrifugal pumping units and controls for clear water (sump) service as specified and as indicated in the Performance and Design Requirements section.

B. Piping, pipe supports, and accessories which are not an integral part of the equipment or are not specified herein are covered in other sections.

C. Each pumping unit shall be complete with a close-coupled, submersible electric motor; controls; and all other appurtenances specified or otherwise required for proper operation.

1.2 GENERAL

A. Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in operating condition in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer. Hydraulic considerations and definition of terms shall be as set forth in the Hydraulic Institute Standards.

B. Coordination

1. Contractor shall verify that each component of the system is compatible with all other parts of the system; that all piping, materials, pumps, and motor sizes are appropriate; and that all devices necessary for a properly functioning system have been provided.

2. Where two or more units of the same class of equipment are required, they shall be the product of a single manufacturer; however, all the component parts of the system need not be the products of one manufacturer.

3. Each manufacturer of major equipment shall have a local service center, or with written consent of Engineer, shall be able to provide service from other locations within 24 hours. The service center shall be equipped and staffed to service the system and shall maintain a local parts supply. Information on equipment manufacturers' representatives shall be included with the submittals.

4. Where several manufacturers' names have been listed in this section as possible suppliers, only the products of the first manufacturer listed have been checked for size, functions, and features.

C. General Equipment Stipulations

1. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

D. Seismic Design Requirements

1. Seismic design requirements for products specified herein shall be as indicated in the Meteorological and Seismic Design Criteria section.

E. Power Supply

1. Power supply to equipment will be as indicated in the Performance and Design Requirements section.

F. Mechanical Identification

1. Pumps shall be identified in accordance with the Equipment and Valve Identification section.

1.3 SUBMITTALS

A. Drawings and Data

1. Complete fabrication and assembly drawings, together with detailed specifications and data covering materials, parts, devices, and accessories forming a part of the equipment furnished, shall be submitted in accordance with the Submittals Procedures section. The data and specifications for each unit shall include, but shall not be limited to, the following:

Pumps

Name of manufacturer.

Type and model.

Rotative speed.

Size and type of pump discharge connection.

Net weight of pump and motor only.

Complete performance curves showing capacity versus head, bhp [brake kW], NPSH required, and efficiency.

Seal type and manufacturer.

Data on shop painting.

Motors

Name of manufacturer.

Type and model.

Type of bearings and method of lubrication.

Rated size of motor, hp .

Full load current.

Locked rotor current.

Control Panel and Components

Name of manufacturer.

Type and model.

Dimensions and net weight of complete panel.

Pump control sequence.

Liquid level sensors with mounting details and cable lengths, and sump controls.

Wiring diagrams.

Power and control cable type and size.

Accessories

Sump Cover

Material, thickness, and finish.

Overall dimensions.

Opening locations and dimensions.

Guiderail System

Materials.

Dimensions.

Seismic Design Requirements

Confirmation of compliance with the requirements of the Meteorological and Seismic Design Criteria section.

B. Operations and Maintenance Data and Manuals

1. Adequate operation and maintenance information shall be supplied as required in the Submittals Procedures section. Operation and maintenance manuals shall be submitted in accordance with the Submittals Procedures section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

1.5 EXTRA MATERIALS

A. A complete set of seals, O-rings, and gaskets, and one spare set of mechanical seals shall be furnished for each type and size of pump provided.

B. Extra materials shall be packaged with labels indicating the contents of each package. Each label shall indicate the manufacturer’s name, equipment designation, part nomenclature, part number, address of nearest distributor, and current list price. Extra materials shall be delivered to Owner as directed.

C. Extra materials subject to deterioration such as ferrous metal and electrical components shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The equipment shall be manufactured by Zoeller, Pentair (Myers), or equal.

2.2 SERVICE CONDITIONS

A. Unless otherwise indicated, sump pumps shall be suitable for pumping clear water with minimal solids of 3/16 inch diameter or less. The maximum pumped liquid temperature shall be 85°F .

2.3 PERFORMANCE AND DESIGN REQUIREMENTS

A. Pumping units shall be designed for the operating conditions and requirements indicated below:

Tag Number	45-TW-PSP-0001
Location	Flow Meter Vault
Type	Submersible
Rated Capacity (GPM)	20
Rated Head (FT)	31
Max Speed (RPM)	1750
Motor (HP)	1/2
Power Supply Volts / Phase	115V 1 Phase
Discharge Size (IN)	1 1/2
Sump Level, HIGH (FT)	1344.0
Sump Level, OFF (FT)	1341.5
Mounting Type	Pedestal Mounted

B. Pump performance shall be stable and free from cavitation and noise throughout the specified operating head range at minimum suction submergences. Minimum pump hydrostatic test pressure shall be 1.5 times the pump shutoff head. Each pumping unit shall be designed so that reverse rotation at rated head will not cause damage to any component.

2.4 MATERIALS

Stator Housing and Pump Casing	Cast iron, ASTM A48.
Impeller	
Medium Duty Sump Pumps	Bronze
Shaft	Stainless steel, AISI Type 316.
All Wetted Assembly Fasteners	Stainless steel.
Mechanical Seals	
Medium Duty Pumps	Single type, with ceramic and carbon seal faces.
Pedestal Base	Cast iron.
Epoxy Coating	
Primer & Finish Coat	Carboline “Carboguard 891” or Tnemec “Series N140 Pota-Pox Plus.”

2.5 PUMP CONSTRUCTION

A. Impeller Casing

1. The impeller casing shall have well-rounded water passages and smooth interior surfaces free from cracks, porosity, blowholes, or other irregularities. Guiderail mounted pumps shall be provided with a flanged discharge nozzle sufficiently rigid to support the pumping unit under all operating conditions. Pedestal mounted pumps shall be provided with a threaded or compression discharge connection. Pipe threads shall conform to ANSI/ASME B1.20.1, NPT.

B. Impeller

1. The impeller shall be a semiopen or enclosed one-piece casting. The interior water passages shall have uniform sections and smooth surfaces and shall be free from cracks and porosity. The impeller shall be dynamically balanced and securely locked to the shaft by means of a key and self-locking bolt or nut.

C. Sealing of Mating Surfaces

1. All mating surfaces of major components shall be machined and fitted with O-rings where watertight sealing is required. Sealing shall be accomplished by O-ring contact on four surfaces and O-ring compression in two planes, without reliance on a specific fastener torque or tension to obtain a watertight joint. The use of elliptical O-rings, gaskets, or seals requiring a specific fastener torque value to obtain and maintain

compression and watertightness will not be acceptable. The use of secondary sealing compounds, gasket cement, grease, or other devices to obtain watertight joints will not be acceptable.

D. Lifting Chain

1. Where indicated in the Performance and Design Requirements section , stainless steel chain or cable suitable for removing and installing each pumping unit shall be selected and provided by the pump manufacturer. The chain or cable shall be rated for at least four times the weight of the pumping unit and shall be of adequate length to reach five feet above the sump cover with the pumping unit in the normal operational position.

2.6 FABRICATION AND MANUFACTURE

A. Shop Painting

1. All iron and steel parts of heavy duty pumping units which will be in contact with pumped liquid or submerged after installation, including the inside of the casing, the impeller, and the discharge elbow, shall be shop cleaned in accordance with the coating manufacturer's recommendations and painted with an epoxy coating system. The coating shall have a dry film thickness of at least 10 mils and shall consist of a prime (first) coat and one or more finish coats. At least 1 quart of the finish coat material shall be furnished with each pump for field touchup.

2.7 BALANCE

A. All rotating parts shall be accurately machined and shall be in as nearly perfect rotational balance as practicable. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that resonance at normal operating speeds is avoided. In any case, the unfiltered vibration displacement (peak-to-peak), as measured at any point on the machine, shall not exceed 4 mils for pumping units with a nominal rotative speed of 1500 rpm or greater, 5 mils for pumping units with a nominal rotative speed less than 1500 rpm and greater than 900 rpm, or 6 mils for pumping units with a nominal rotative speed of 900 rpm or less.

B. At any operating speed, the ratio of rotative speed to the critical speed of a unit or its components shall be less than 0.8 or more than 1.3.

2.8 MOTORS

A. Motors

1. Pumps shall be driven by an air-filled, totally submersible electric motor manufactured by the pump manufacturer. Motors shall have a minimum service factor of 1.05. Motor nameplate rating shall exceed the maximum horsepower required by the pump in an operating head range 20 percent above or below the design point. The stator housing shall be an air-filled, watertight casing. Motor insulation shall be moisture resistant, Class F,

155°C. Each motor shall be NEMA Design B for continuous duty at 40°C ambient temperature, and designed for at least 10 starts per hour.

2. 120 volt motors shall be provided with integral auto-reset thermal overload protection.

3. Motor bearings shall be antifriction, permanently lubricated type. The lower bearing shall be fixed to carry the pump thrust and the upper bearing free to move axially. The bearings shall have a calculated AFBMA L_{10} Life Rating of 40,000 hours when operating at maximum operating head. Maximum shaft runout at the mechanical seals shall not exceed 2 mils at any point in the operating head range.

4. Each pump shall be equipped with one or more multiconductor cable assemblies for power and control. Each multiconductor assembly containing power cables shall be provided with a separate grounding conductor. Each cable assembly shall bear a permanently embossed code or legend indicating the cable is suitable for submerged use. Cable sizing shall conform to NEC requirements. With the exception of 120 volt units, all cables shall be of sufficient length to terminate in a junction box or control panel outside the sump as indicated on the Drawings, with 10 feet of slack which will be coiled in the sump. Power and control cables for 120 volt units shall be of sufficient length to reach the power supply receptacle or junction box as indicated on the Drawings with 5 feet of slack. Each cable shall be supported by AISI Series 300 corrosion-resistant stainless steel Kellems or woven grips to prevent damage to the cable insulation. Mounting of cable supports in the sump shall be coordinated by the supplier to prevent damage to the cable.

5. The cable entry water seal shall include a strain relief and a grommet type seal designed so that a specific fastener torque is not required to ensure a watertight, submersible seal. The cable entry junction box and motor shall be separated by a stator lead sealing gland or a terminal board. The junction box shall isolate the motor interior from moisture gaining access through the top of the stator housing.

6. The motor and its integral protective controls shall be rated and labeled for use in an exposure classification similar to that of the pump, under both submerged and unsubmerged conditions.

2.9 CONTROLS

A. Each pumping unit shall be provided with a complete control system as indicated herein. The control system type shall be as indicated in the Performance and Design Requirements section

B. Simplex Piggyback Control

1. Simplex piggyback control systems shall consist of a weighted ball float assembly with an integral differential switch, control cord with piggyback plug, and mounting hardware. The plug shall be suitable for connection into a standard 120 volt receptacle, and shall accept a 120 volt plug from the pumping unit. Differential switches shall be single pole and rated for at least 1.0 hp at 120 volts. The control cable shall be suitable for submerged service and shall be rated for at least 15 amps. The mounting hardware shall be suitable for attachment to the pump discharge piping, and shall be constructed of corrosion resistant materials. The control system shall automatically energize and de-

energize the pumping unit as the sump water level rises and falls. The control system shall be Weil “Model 8245” or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment and materials furnished under this section shall be installed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

B. Pumping units shall be leveled, plumbed, aligned, and wedged into position to fit connecting piping. Installation procedures shall be as recommended by the pump manufacturer and the Hydraulic Institute Standards. Grouting shall be as specified in the Grouting section.

C. Special care shall be taken to ensure that piping stresses are not transmitted to the pump connections. After final alignment and bolting, pump connections shall be tested for applied piping stresses by loosening the pump connections. If any movement or opening of the joints is observed, piping shall be adjusted to proper fit.

D. Control cables shall be supported to avoid tension and damage. Liquid level sensors shall operate freely and shall be adjusted to the levels indicated on the Drawings.

3.2 STARTUP AND TESTING

A. Startup requirements and field performance testing shall be as indicated in the Startup Requirements section.

End of Section

SECTION 23 0000 - HEATING, VENTILATING, AND AIR CONDITIONING

PART 1 - GENERAL

1.1 SCOPE

a. This section covers the furnishing and installation of heating, ventilating, and air conditioning (HVAC) equipment, devices, and appurtenances associated with the HVAC systems.

b. Piping, pipe supports, valves, and accessories which are not an integral part of the equipment or are not specified herein are covered in other sections.

1.2 GENERAL

a. Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer unless exceptions are noted by Engineer.

b. Coordination

1. Contractor shall verify that each component of the system is compatible with all other parts of the system; that all piping, ductwork, materials, fans, and motor sizes are appropriate; and that all devices necessary for a properly functioning system have been provided.

2. Where two or more units of the same class of equipment are needed, they shall be the product of a single manufacturer; however, all the component parts of the system need not be the products of one manufacturer.

3. Where individual equipment paragraphs specify the requirement for local service, each manufacturer shall have a local service center, or with written consent of Engineer, shall be able to provide service from other locations within 24 hours. The service center shall be equipped and staffed to service the system and shall maintain a local parts supply. Information on equipment manufacturers' representatives shall be included with the submittals.

4. Where several manufacturers' names have been listed in this section as possible suppliers, only the products of the first manufacturer listed have been checked for size, functions, and features.

c. General Equipment Stipulations

1. The General Equipment Stipulations shall apply to all equipment and materials furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

d. Seismic Design Requirements

1. Seismic design requirements for products specified herein shall be as indicated in the Meteorological and Seismic Design Criteria section.

e. Governing Standards

1. Except as modified or supplemented herein, all work covered by this section shall be performed in accordance with all applicable municipal codes and ordinances, laws, and regulations. In case of a conflict between this section and any state law or local ordinance, the latter shall govern.

2. All work shall comply with UL safety requirements.

f. Power Supply

1. Power supply to equipment with motors shall be as indicated in schedules on the Drawings. Power supply for controls shall be 120 volts, 60 Hz, single phase unless otherwise required for a properly operating system.

g. Metal Thickness

1. Metal thickness and gages specified herein are minimum requirements. Gages refer to US Standard gage.

h. Mechanical Identification

1. Mechanical identification shall conform to the requirements of the Equipment and Valve Identification section.

1.3 SUBMITTALS

a. Drawings and Data

1. Complete assembly and installation drawings, and wiring and schematic diagrams, together with detailed specifications and data covering materials, parts, devices, and accessories forming a part of the equipment furnished, shall be submitted in accordance with the Submittals Procedures section. Device tag numbers indicated on the Drawings shall be referenced on the wiring and schematic diagrams where applicable. The data and specifications for each unit shall include, but shall not be limited to, the following:

a. Fans
1) Name of manufacturer.
2) Type and model.
3) Construction materials, thickness, and finishes.
4) Overall dimensions and required clearances.
5) Net weight and load distribution.
6) Performance curves with the specified operating point clearly identified for each unit, type, and model, with capacity in cubic feet per minute as the

abscissa and brake horsepower, static pressure, and efficiency as the ordinate. The fan curves shall include a family of curves for at least 3 different rotative speeds on a single chart.

7) Certified AMCA standard test code sound power output data for the fan outlet and casing when operating at the specified volume flow rate. Sound data shall list dB re 10-12 watts in each octave band, with midrange frequencies starting at 63 Hz and ending at 8,000 Hz.
8) Where specified, information on equipment manufacturers' representatives.

b. Equipment (not specifically listed)
1) Name of manufacturer.
2) Type and model.
3) Construction materials, thickness, and finishes.
4) Manufacturer's performance data.
5) Overall dimensions and required clearances.
6) Net weight and load distribution.
7) Wiring diagrams.

c. Sheet Metal Ductwork
1) Sheet metal duct fabrication drawings indicating dimensions of individual shop and field fabricated sections, top and/or bottom duct elevations, joint locations, and dimensions of duct from walls or column rows.
2) Pressure and seal classifications.
3) Reinforcement types and spacing.
4) Joint and seam types.
5) Hanger and support types, spacing, and attachment methods.
6) Access panel and door construction, sizes, and locations.
7) Duct sealant, adhesive, gasket, and tape information.
8) Coatings.
9) Ductwork materials and thicknesses.

d. Seismic Design Requirements
1) Confirmation of compliance with the requirements of the Meteorological and Seismic Design Criteria section.

b. Operation and Maintenance Data and Manuals

1. Adequate operation and maintenance information shall be supplied as required in the Submittals Procedures section. Operation and maintenance manuals shall be submitted in accordance with the Submittals Procedures section. The operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered.

2. In addition to the requirements of the Submittals Procedures section, the operation and maintenance manuals shall include a listing of all filter locations, types, sizes, and quantities associated with each piece of equipment.

1.4 QUALITY ASSURANCE

a. Quality assurance shall comply with the requirements of the Basic Mechanical Building Systems Materials and Methods section.

1.5 DELIVERY, STORAGE, AND HANDLING

a. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and Storage shall be in accordance with the Product Storage and Handling Requirements section.

1.6 EXTRA MATERIALS

a. Extra materials shall be furnished for the equipment as specified in the individual equipment paragraphs.

b. Extra materials shall be packaged in accordance with the Product Delivery Requirements section, with labels indicating the contents of each package. Each label shall indicate manufacturer's name, equipment name, equipment designation, part nomenclature, part number, address of nearest distributor, and current list price. Extra materials shall be delivered to Owner as directed.

c. Extra materials subject to deterioration such as ferrous metal items and electrical components shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

a. All equipment shall be designed and selected to meet the specified conditions.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

a. Equipment capacities shall be as indicated on the schedule on the Drawing..

b. Each fan's operating selection point on the fan curves shall be selected to the right of the peak pressure/efficiency point and below the lowest point along the fan curve to the left of the peak pressure/efficiency point.

c. Dimensional Restrictions

1. Layout dimensions will vary between manufacturers and the layout area indicated on the Drawings is based on typical values of the first manufacturer listed. Contractor shall review the contract Drawings, the manufacturer's layout drawings, and installation requirements and shall make any modifications required for proper installation subject to

acceptance by Engineer. At least 3 feet of clear access space shall be provided on all sides of the unit unless otherwise indicated.

d. Elevation

1. Equipment shall be designed to operate at the elevation indicated in the Meteorological and Seismic Design Criteria section. All equipment furnished for sites above 2000 feet above sea level shall be properly derated to operate and meet the specified capacities at the site conditions.

2.3 ACCEPTABLE MANUFACTURERS

a. Acceptable manufacturers shall be as listed in the respective product description paragraphs.

2.4 MATERIALS

a. Fans

1. Fans shall be rated in accordance with AMCA standards, shall be licensed to bear the AMCA Certified Rating Label unless otherwise indicated in the Fan Schedule on the Drawings, and shall be UL listed.

2. The manufacturer of the equipment provided shall have a local service center.

3. Each fan shall be complete with an electric motor, factory mounted safety disconnect switch with wiring to the motor, drive, and accessories required for satisfactory operation. Belt-driven fans shall be complete with a V-belt drive designed for 50 percent overload capacity, sheaves, adjustable base or rails for belt tightening, and a belt guard. Adjustable pitch sheaves shall be furnished for fans with less than 10 horsepower motors and fixed sheaves for 10 horsepower and larger motors or motors with multiple belts. Adjustable sheaves shall be selected so that the fan speed at the specified conditions is at the mid-position of the sheave range. Sheaves shall be replaced with sheaves of the proper size after the air system balancing if necessary, to provide the required fan speed for the specified airflow.

4. Fan drive motors shall be as specified in the Electrical paragraph, unless otherwise indicated. Fans shall be suitable for use with the power supply indicated on the Drawings.

5. The external static pressure values indicated in the schedules on the Drawings are external to the complete unit. Internal fan housing and when furnished, backdraft damper and filter losses are not included.

6. Where indicated in the schedules on the Drawings, fans shall be given a special coating resistant to the corrosive atmosphere indicated.

7. Extra Materials

Extra Materials	Quantity

Sets of matched belts per fan 1

8. Power Roof Ventilators

a. Power roof ventilators, denoted by the symbol "PRV" and an identifying number, shall be Greenheck "CUE," PennBarry "Fumex," or Loren Cook "ACRU."
b. Power roof ventilators shall be centrifugal roof mounted type and shall be direct or belt driven as indicated in the schedules on the Drawings. Fan wheels shall be aluminum, backward inclined type statically and dynamically balanced at the factory for quiet, vibration-free operation. Fan housings shall be constructed of aluminum and shall have an aluminum base of the self-flashing type, suitable for mounting on the curbs indicated on the Drawings. Each fan shall be complete with 1/2 inch mesh aluminum bird screen over all openings, and, where indicated in the schedules on the Drawings, a backdraft damper.
c. Motors and drives shall be mounted outside the airstream. The wheel shaft shall be of ground and polished steel, mounted in heavy-duty, relubricatable or permanently sealed bearings with a minimum L_{50} service life of at least 200,000 hours at the equipment's maximum cataloged operating conditions.
d. A safety disconnect switch shall be mounted in the hood. Where a factory installed integral disconnect switch is not available as a standard option, a disconnect for field installation shall be provided.

b. Sheet Metal Ductwork

1. Ductwork, accessories, bracing, and supports shall be constructed of aluminum. Ductwork, turning vanes, and other accessories shall be fabricated in accordance with the latest SMACNA HVAC Duct Construction Standards unless otherwise indicated. Accessories, bracing, and supports shall be constructed of similar materials as the ductwork.

2. Aluminum ductwork shall be constructed of aluminum alloy 3003-H14 or better in accordance with ASTM B209. Ductwork shall be uninsulated.

3. Sealants shall be suitable for the duct service and shall maintain leakage integrity at pressures in excess of the ductwork pressure classification.

2.5 ELECTRICAL

1. Electric motors and motor controls shall conform to the following:

a. Motor horsepower scheduled on the Drawings is minimum motor horsepower. Larger motors shall be provided if required to meet the specified capacities for the equipment furnished. Motors furnished with equipment shall meet the following requirements.
b. Premium efficient motors with a minimum efficiency of at least that specified in the Electrical section shall be provided where available as a standard option. All other motors shall meet the minimum efficiency standards required by the adopted Energy Code.

c. Designed and applied in accordance with NEMA, ANSI, IEEE, AFBMA, and NEC for the duty service imposed by the driven equipment, such as frequent starting, intermittent overload, high inertia, mounting configuration, or service environment.
d. Rated for continuous duty at 40°C ambient.
e. Motors used in applications which exceed the usual service conditions as defined by NEMA, such as higher than 40°C ambient, altitude exceeding 3,300 feet, explosive or corrosive environments, departure from rated voltage and frequency, poor ventilation, frequent starting, or adjustable frequency drive applications, shall be properly selected with respect to their service conditions and shall not exceed specified temperature rise limits in accordance with ANSI/NEMA MG 1 for insulation class, service factor, and motor enclosure type.
f. To ensure long life, motors shall have nameplate horsepower equal or greater than the maximum load imposed by the driven equipment, and fractional hp enclosed motors shall carry a service factor rating of 1.0.
g. Designed for full voltage starting.
h. Designed to operate from an electrical system that may have a maximum of 5 percent voltage distortion according to IEEE 519.
i. Totally enclosed motors shall be furnished on outdoor equipment and shall have a continuous moisture drain that also excludes insects.
j. Bearings shall be either oil or grease lubricated.
k. Motor nameplates shall indicate as a minimum the manufacturer name and model number, motor horsepower, voltage, phase, frequency, speed, full load current, locked rotor current, frame size, service factor, power factor, and efficiency.

2. Motor starters and controls shall be furnished and installed under the Electrical section, except for equipment specified or furnished with prewired integral starters. Disconnects for equipment shall be furnished and installed under the Electrical section, except where specified with integral disconnects. All electrical controls shall have enclosures suitable for the environment and NEMA rating as indicated on the electrical Drawings. Equipment installed outdoors shall have NEMA Type 4 enclosures.

2.6 DRIVE UNITS

1. Electric motors, V-belt drives, and safety guards shall be in accordance with the following:

a. Drive units shall be designed for 24-hour continuous service.
b. V Belt Drives. Each V belt drive shall include a sliding base or other suitable belt tension adjustment. V belt drives shall have a service factor of at least 1.5 at maximum speed based on the nameplate horsepower of the drive motor unless otherwise indicated in the specific equipment paragraph. Multiple belts shall be provided in matched sets and shall be oil resistant, non-static type. External belts and drive assemblies shall be protected by a belt safety guard constructed in accordance with OSHA requirements. The guard shall be provided with a tachometer opening.

2.7 MANUFACTURE AND FABRICATION

1. Manufacture and fabrication shall comply with the following:

    a. Anchor Bolts and Expansion Anchors. Anchor bolts, expansion anchors, nuts, and washers shall be as indicated in the Anchorage in Concrete and Masonry section unless otherwise indicated on the Drawings.
    b. Surface Preparation. All iron and steel surfaces, except motors, shall be shop cleaned by sandblasting or equivalent, in strict conformance with the paint manufacturer's recommendations. All mill scale, rust, and contaminants shall be removed before shop primer is applied.

2. SHOP TESTING

The equipment furnished under this section shall be tested at the factory according to the standard practice of the manufacturer. Ratings shall be based on tests made in accordance with applicable AMCA, ASHRAE, AHRI, NBS, NFPA, and UL Standards.

2.8 BALANCE

a. All rotating parts shall be accurately machined and shall be in as nearly perfect rotational balance as practicable. Excessive vibration shall be sufficient course for rejection of the equipment. The mass of the unit and its distribution shall be such that the resonance at normal operating speeds is avoided. In any case, the maximum measured root-mean-square (rms) value as measured at any point on the equipment shall not exceed those listed in the latest ASHRAE Applications Handbook.

b. At any operating speed, the ratio of rotative speed to the critical speed of a unit or components thereof shall be less than 0.8 or more than 1.3.

PART 3 - EXECUTION

3.1 INSPECTION – Not used.

3.2 PREPARATION

a. Field Measurement

1. Contractor shall be responsible for verifying all field dimensions, and for verifying location of all equipment relative to any existing equipment or structures.

b. Surface Preparation

1. All surfaces to be field painted shall be dry and free of dirt, dust, sand, grit, mud, oil, grease, rust, loose mill scale, or other objectionable substances, and shall meet the recommendations of the paint manufacturer for surface preparation. Cleaning and

painting operations shall be performed in a manner which will protect freshly painted surfaces from dust or other contaminants. Oil and grease shall be completely removed by use of solvents or detergents before mechanical cleaning is started. The gloss of previously painted surfaces shall be dulled if necessary for proper adhesion of top coats.

2. Surface finish damaged during installation shall be repaired to the satisfaction of Engineer. Field painting shall be as specified in the Protective Coatings sections.

3.3 INSTALLATION

a. Equipment and materials furnished under this section shall be installed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

b. Fans

1. Power roof ventilators shall be secured with corrosion resistant lag screws to the roof curb.

c. Sheet Metal Ductwork

1. Ductwork, turning vanes, and other accessories shall be installed and supported in accordance with the latest SMACNA Duct Construction Standards unless otherwise indicated. The locations, arrangement, and sizes of ductwork shall be as indicated on the Drawings. The duct sizes indicated are clear dimensions inside the duct.

2. Ductwork shall be fabricated, reinforced, supported, and sealed for the operating pressures indicated in the schedules for the connected equipment. All ductwork shall have a pressure classification of at least 1 inch .

3. Sheet metal ductwork shall be sealed according to the classifications described in the SMACNA HVAC Duct Construction Standards in accordance with the following:

	Duct Type			
	Supply		Exhaust	Return
Duct Location	≤ 2 inches wc	> 2 inches wc		
Outdoors	A	A	A	A
Unconditioned Areas	B	A	B	B

Sealing Levels

A - All transverse joints, longitudinal seams, and duct wall penetrations

B - All transverse joints and longitudinal seams

4. All joints, seams, connections, and penetrations in ductwork located outdoors shall be sealed watertight and weatherproof. Transverse joints shall be flanged and shall be provided with a continuous gasket and flange cap.

5. Ductwork shall be supported as required by SMACNA. Where ductwork is connected to equipment, it shall be independently supported with no weight bearing on the equipment and in such a manner that the equipment maybe removed for service without temporary support of the ductwork. Ductwork shall be supported within 24 inches of each elbow and within 48 inches of each branch intersection. Strap or wire hangers shall not be used where the hanger length exceeds 5 feet .

6. Ductwork shall be constructed and installed in accordance with the Drawings. When acceptable to Owner, modifications in the size and location of ductwork may be made where required to avoid interference with the building structure, piping systems, or electrical work. The installation shall be coordinated with other phases of work to establish space and clearance requirements.

3.4 FIELD QUALITY CONTROL

a. Installation Check

1. An installation check by an authorized representative of the manufacturer is not required for equipment specified in this section.

b. Startup and Testing

1. After the equipment and systems have been installed, adjusted, and balanced, tests shall be conducted to demonstrate that each system is functioning as specified and to the satisfaction of Engineer. Tests shall be as indicated in the Commissioning section.

2. If inspection or tests indicate defects, the defective work or material shall be replaced, and inspection and tests repeated. All repairs to piping shall be made with new materials. Caulking of threaded joints or holes will not be acceptable.

3.5 CLEANING

a. At the completion of the testing, all equipment, ductwork and fittings shall be cleaned of grease, debris, metal cuttings, and sludge. Any stoppage, discoloration, or other damage to parts of the building, its finish, or furnishings shall be repaired by Contractor at no additional cost to Owner.

End of Section

SECTION 26 05 11 - ELECTRICAL

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the furnishing and installation of all equipment and materials needed for the electrical requirements of this Contract. It also covers conduit, wiring, and terminations for electrical equipment installed under Electrical Equipment Installation section.

B. This section covers the installation and interconnection of electrical equipment furnished under other sections, except electrical items designated to be installed under those sections.

C. This section covers installation of equipment furnished by Owner.

1.2 GENERAL

A. Electrical apparatus on all equipment shall be installed complete and placed in readiness for proper operation.

B. Electrical materials furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

C. General Equipment Stipulations

1. The General Equipment Stipulations section shall apply to all equipment provided under this section. If requirements in this section differ from those in the General Equipment Stipulations section, the requirements specified herein shall take precedence.

D. Seismic Design Requirements

1. Seismic design requirements for products specified herein shall be as indicated in the Meteorological and Seismic Design Criteria section.

E. Coordination

1. Electrical work shall conform to the construction schedule and the progress of other trades.

F. Anchor Bolts and Expansion Anchors

1. All anchor bolts, nuts, washers, and expansion anchors shall comply with Anchorage in Concrete and Masonry section, except smaller than 3/4 inch [19 mm] will be permitted to match NEMA standard size bolt holes on motors and electrical equipment.

G. Drawings

1. Supplementing this section, the Drawings indicate locations of equipment and enclosures and provide one-line and schematic diagrams regarding the connection and interaction with other equipment.

1.3 CODES AND PERMITS

A. All work shall be performed and materials shall be furnished in accordance with the NEC - National Electrical Code, the NESC - National Electrical Safety Code, and the following standards where applicable:

AEIC	The Association of Edison Illuminating Companies
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
Fed Spec	Federal Specification
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IESNA	Illuminating Engineering Society of North America
NEIS	National Electrical Installation Standards
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
UL	Underwriters' Laboratories

B. Equipment covered by this section shall be listed by UL, or by a nationally recognized third party testing laboratory. All costs associated with obtaining the listing shall be the responsibility of Contractor. If no third-party testing laboratory provides the required listing, an independent test shall be performed at Contractor’s expense. Before the test is conducted, Contractor shall submit a copy of the testing procedure to be used.

1.4 SEISMIC DESIGN REQUIREMENT.

A. Seismic Design Requirements

1. Submit confirmation of compliance with the requirements of the Meteorological and Seismic Design Criteria section.

1.5 IDENTIFICATION.

A. Conduit

1. Conduits in manholes, handholes, building entrance pull boxes, junction boxes, and equipment shall be provided with identification tags. Identification tags shall be 19 gage stainless steel, with 1/2 inch stamped letters and numbers as indicated on the Drawings. Identification tags shall be attached to conduits with nylon tie wraps and shall be positioned to be readily visible.

B. Conductors

1. All conductors in power, control, and instrumentation circuits shall be identified and color coded as described herein.

2. Conductor Identification Number

a. Except for lighting and receptacle circuits, each individual conductor in power, control, and instrumentation circuits shall be provided with wire identification markers at the point of termination.
b. The wire markers shall be of the heat-shrinkable tube type, with custom typed identification numbers.
c. The wire numbers shall be as indicated on the equipment manufacturer's drawings.
d. The wire markers shall be positioned to be readily visible for inspection.

3. Conductor Color Coding

a. Power conductors shall be color coded as indicated below. For conductors 6 AWG and smaller, the color coding shall be the insulation finish color. For sizes larger than 6 AWG, the color coding may be by marking tape. The equipment grounding conductor shall be green or green with one or more yellow stripes if the conductor is insulated.
b. The following color coding system shall be used:
1) 120/240V single-phase — black, red, and white
2) 120/208V, three-phase — black, red, blue, and white
3) 120/240V, three-phase — black, orange, blue, and white
4) 277/480V, three-phase — brown, orange, yellow, and gray
5) 2400/4160V, three-phase — black, red, blue, and white
6) 7200/12470V, three-phase — black, red, blue, and white

c. Where 120/240 and 120/208 volt systems share the same conduit or enclosure, the neutral for either the 120/240 volt system or the 208 volt system shall be white with a permanent identifiable violet stripe.
d. Control and instrumentation circuit conductors shall be color coded as indicated in the Cable Data Figures at the end of this section.

C. Motor Starters

1. Motor starters shall be provided with nameplates identifying the related equipment. Pilot controls and indicating lights shall have engraved or etched legends ("start", "stop", etc.)

as indicated on the Drawings. Nameplates shall be laminated black-over-white plastic, with 1/8 inch engraved letters, and shall be securely fastened to the motor starters.

D. Control Stations

1. Control stations shall be provided with nameplates identifying the related equipment. Pilot controls and indicating lights shall have engraved or etched legends ("start", "stop", etc.) as indicated on the Drawings. Nameplates shall be laminated black-over-white plastic, with 1/8 inch engraved letters, and shall be securely fastened to the control stations.

E. Disconnect Switches

1. All switches shall have front cover-mounted permanent nameplates that include switch type, manufacturer's name and catalog number, and horsepower rating. An additional nameplate, engraved or etched, laminated black-over-white plastic, with 1/8 inch letters, shall be provided to identify the associated equipment. Both nameplates shall be securely fastened to the enclosure.

F. Arc Flash Hazard Labels

1. Lighting panels, power panels, power centers, switchgear, switchboards, motor control centers, motor control line ups, transfer switches, industrial control panels, adjustable frequency drives, fused switches, meter socket enclosures, and other electrical equipment likely to be worked on energized shall be provided with permanent labels warning the risk of arc flash and shock hazard. Labels shall be designed in accordance with ANSI Z535.4 and shall include the following:

WARNING
Arc Flash and Shock Hazard

Appropriate personal protection equipment (PPE) required. SEE NFPA 70E. Equipment must be accessed by qualified personnel only.
Turn off all power sources prior to working on or inside equipment.

1.6 SUBMITTALS

A. Drawings and Data – General

1. Complete assembly, foundation, and installation drawings, together with complete engineering data covering the materials used, parts, devices, and accessories forming a part of the work performed by the Contractor, shall be submitted in accordance with the Submittal Procedures section. The drawings and data shall include, but shall not be limited to, the following:

a. Drawings and data.
b. Operating manuals.
c. Samples.
d. Test reports

e. Studies

B. Submittal Details & Identification

1. Information covering all materials and equipment shall be submitted for review in accordance with the Submittal Procedures section. Each sheet of descriptive literature submitted shall be clearly marked to identify the material or equipment as follows:

a. Lamp fixture descriptive sheets shall show the fixture schedule letter, number, or symbol for which the sheet applies.
b. Equipment and materials descriptive literature and drawings shall show the specification paragraph for which the equipment applies.
c. Sheets or drawings covering more than the item being considered shall have all inapplicable information crossed out.
d. A suitable notation shall identify equipment and materials descriptive literature not readily cross-referenced with the Drawings or Specifications.
e. Schematics and connection diagrams for all electrical equipment shall be submitted for review. A manufacturer's standard connection diagram or schematic showing more than one scheme of connection will not be accepted unless it is clearly marked to show the intended connections.
f. Surge protective device submittals shall include drawings (including unit dimensions, weights, component and connection locations, mounting provisions, and wiring diagrams), equipment manuals that detail the installation, operation and maintenance instructions for the specified unit(s), and manufacturer’s descriptive bulletins and product sheets.

C. Engineering and Testing Firm

1. Contractor shall submit the name and qualifications of the Engineering and Testing Services firm proposed to perform the protective device study and the on-site testing.

D. Cable and Conduit Submittal

1. Within 90 days after the Notice to Proceed, Contractor shall furnish a submittal for all types of cable and conduit to be provided. The submittal shall include the cable manufacturer and type, and sufficient data to indicate that the cable and conduit meet the specified requirements.

E. Cable Samples

1. In addition to the complete specifications and descriptive literature, a sample of the largest size of each type of cable shall be submitted for review before installation. Each sample shall include legible and complete surface printing of the cable identification.

F. Seismic Design Requirements

1. Submitted confirmation of compliance with the requirements of the Meteorological and Seismic Design Criteria section.

1.7 PROTECTION AND STORAGE

A. During construction, the insulation on all electrical equipment shall be protected against absorption of moisture, and metallic components shall be protected against corrosion by strip heaters, lamps, or other suitable means. This protection shall be provided immediately upon receipt of the equipment and shall be maintained continuously.

PART 2 - PRODUCTS

2.1 CABLE

A. All cables of each type (such as instrument cable or 600 volt power cable) shall be from the same manufacturer.

B. All types of cable shall conform to the Cable Data Figures at the end of this section and as described herein.

C. 600 Volt Power Cable

1. Cable in power, control, indication, and alarm circuits operating at 600 volts or less, except where lighting, multiconductor control, and instrument cables are required, shall be 600 volt (Figure 2-26 05 11 XHHW-2) power cable.

D. Instrument Cable

1. Cable for electronic circuits to instrumentation, metering, and other signaling and control equipment shall be two- or three-conductor instrument cable twisted for magnetic noise rejection and protected from electrostatic noise by a total coverage shield. Types of instrument cables shall be (Figure 4-26 05 11 single pair) .

2.2 RACEWAY

A. Conduit shall be as described in the following paragraphs:

B. Liquidtight Flexible Metal Conduit

1. Liquidtight flexible metal conduit shall be hot-dip galvanized steel, shall be covered with a moistureproof polyvinyl chloride jacket, and shall be UL labeled.

C. Rigid Nonmetallic (PVC) Conduit

1. PVC conduit shall be heavy wall, Schedule 40, UL labeled for aboveground and underground uses, and shall conform to NEMA TC-2 and UL 651.

D. PVC-Coated Rigid Steel Conduit

1. The conduit shall be rigid steel. Before the PVC coating is applied, the hot-dip galvanized surfaces shall be coated with a primer to obtain a bond between the steel substrate and the coating. The PVC coating shall be bonded to the primed outer surface of the conduit. The bond on conduit and fittings shall be stronger than the tensile strength of the PVC coating. The thickness of the PVC coating shall be at least 40 mils.

2. A chemically cured two-part urethane coating, at a nominal 2 mil thickness, shall be applied to the interior of all conduit and fittings. The coating shall be sufficiently flexible to permit field bending the conduit without cracking or flaking of the coating.

3. Every female conduit opening shall have a PVC sleeve extending one conduit diameter or 2 inches, whichever is less, beyond the opening. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit before coating. The wall thickness of the sleeve shall be at least 40 mils.

4. All fittings, condulets, mounting hardware, and accessories shall be PVC-coated. All hollow conduit fittings shall be coated with the interior urethane coating described above. The screw heads on condulets shall be encapsulated by the manufacturer with a corrosion-resistant material.

5. PVC coated rigid steel conduit shall be manufactured by Calbond, Ocal, or Robroy Industries.

2.3 WIRING DEVICES, BOXES, AND FITTINGS

A. Concealed conduit systems shall have flush-mounted switches and convenience outlets. Exposed conduit systems shall have surface-mounted switches and convenience outlets.

B. Conduit Boxes and Fittings

1. In applications utilizing aluminum conduit systems, aluminum boxes and fittings manufactured by Crouse-Hinds, Appleton, or O Z Gedney shall be installed.

2. PVC coated device boxes shall be manufactured by Calbond, Ocal, or Robroy Industries.

3. Hub arrangements on threaded fittings shall be the most appropriate for the conduit arrangement to avoid unnecessary bends and fittings.

C. Device Plates.

1. Galvanized or cadmium-plated device plates shall be used on surface mounted outlet boxes where weatherproof plates are not required.

2. Device plates on flush mounted outlet boxes where weatherproof plates are not required shall be AISI Type 302 stainless steel, Eaton "93000 series", Hubbell "S series", or Leviton "840nn-40 series"; nylon or polycarbonate, Eaton "5000 series", Hubbell "Pn series", or Leviton "807nn-I series".

3. Device plate mounting hardware shall be countersunk and finished to match the plate.

4. Device plates for switches outdoors or indicated as weatherproof shall have provisions for padlocking switches "On" and "Off", and shall be Appleton "FSK-1VS", Crouse-Hinds "DS185" or O Z Gedney "FS-1-WSCA".

5. Device plates for receptacles indicated as weatherproof shall be Appleton "FSK-WRD", Crouse-Hinds "WLRD1", or O Z Gedney "FS-1-WDCA.

6. Flush-mounted, weatherproof plates shall be provided with adapter plates, Appleton "FSK-SBA" or Crouse-Hinds "FS031".

7. Device plates for ground fault interrupter receptacles indicated to be weatherproof shall be Appleton "FSK-WGFI", Eaton "S966", or O Z Gedney "FS-1-GFCA".

8. Receptacle covers outdoors or otherwise indicated to be weatherproof while in-use shall be die cast aluminum and shall include a padlock eye. Covers for standard convenience outlets shall be Hubbell “WP8M” or Thomas and Betts Red Dot “CKMUV”. Covers for ground fault interrupter receptacles shall be Hubbell “WP26M” or Thomas and Betts Red Dot “CKMUV”.

9. Engraved device plates, where required, shall be manufactured by Leviton, or equal.

10. Device plates on PVC conduit fittings shall be Carlon "E98 Series" or Cantex "513300 Series".

D. Wall Switches

1. Switches on ac lighting panel load circuits through 277 volts shall be 20 amperes, 120/277 volts, Eaton "AH1221V" through "AH1224V", Hubbell "HBL 1221I" through "HBL 1224I", or Leviton "1221-2I" through "1224-2I".

2.4 JUNCTION BOXES, PULL BOXES, AND WIRING GUTTERS

A. Indoor boxes (larger than switch, receptacle, or fixture type) and gutters shall be constructed of sheet steel, shall be galvanized after fabrication, and shall be rigidly supported by hot-dip galvanized hardware and framing materials, including nuts and bolts.

B. Indoor boxes and gutters in corrosive areas indicated on the Drawings and outdoor boxes and gutters shall be NEMA Type 4X, ABS or stainless steel and shall be rigidly supported by PVC-coated or stainless steel framing materials. Mounting hardware, which includes nuts, bolts, and anchors, shall be stainless steel. All damaged coatings shall be repaired according to the manufacturer's instructions.

C. Bolt-on junction box covers 3 feet square or larger, or heavier than 25 lbs, shall have rigid handles. Covers larger than 3 by 4 feet shall be split.

D. Where indicated on the Drawings, junction and pull boxes with a removable side opposite the underground conduits shall be provided over building ends of underground conduit banks. Boxes shall be sized in accordance with the National Electrical Code, including space for full size continuations of all underground conduits not originally continued. Conduit arrangement shall leave maximum space for future conduits.

2.5 LIGHTING FIXTURES

A. Lighting fixtures shall be furnished as described in the fixture schedule and as indicated on the Drawings. Lighting fixtures shall be furnished complete with lamps. Pendant fixtures shall have swivel type box covers and threaded conduit pendants unless otherwise specified. Lighting fixtures shall be provided with disconnects in accordance with NEC requirements.

B. Electronic Drivers

1. Electronic drivers furnished with LED type lighting fixtures shall be certified as meeting requirements of ANSI C82.77 with a THD level of not more than 20 percent.

2.6 LIGHTING PANELS

A. Each lighting panel shall be a dead-front, 120/240 volt, single phase or 120/208 volt, three phase panelboard with circuit breakers, in accordance with the Drawings and the following:

B. Cabinet

1. The panel shall have a flush-mounted or surface-mounted enclosure with a NEMA designation appropriate for the location where it will be installed. The enclosure shall have a hinged trim (cover). Breaker operating handles shall be accessible through a latched, lockable, door. At the completion of the Contract, a neatly printed or typed directory listing the panel and circuit identities shall be mounted inside the door.

C. Circuit Breakers

1. Circuit breakers shall be thermal-magnetic, bolt-in, individually front replaceable, and shall indicate "On", "Off", and "Tripped". Breakers indicated as multiple-pole shall be common trip. Breakers shall have interrupting ratings not less than 10,000 amperes. Handle clips to prevent casual operation of breakers shall be provided for 10 percent (at least two) of the breakers and applied to the circuits directed. Breakers and provisions for future breakers shall be provided in the quantities, number of poles, and ampere ratings indicated on the Drawings.

2. Where indicated on the Drawings, circuit breakers shall include arc-fault circuit interrupter (AFCI) and/or ground fault circuit interrupter (GFCI) protection functions. Where GFCI breakers dedicated to protect heat tracing circuits, GFCI breakers shall be configured for equipment protection with a ground fault trip threshold of 30 mA. Otherwise, GFCI breakers shall be configured for personnel protection with a ground fault trip threshold of 5 mA.

D. Buses

1. The panel shall have main and neutral buses insulated from the cabinet, and a ground bus. Buses shall be copper, with ampere ratings and main lugs or breaker as indicated. The ground bus shall be similar to a neutral bus and shall have a good ground connection to the cabinet, a removable bond to the neutral bus, clamp type lugs for the ground cable in each supply conduit, and connections for a ground cable in each load conduit.

2.7 SEPARATELY ENCLOSED MOTOR STARTERS

A. Separately enclosed motor starters, unless otherwise specified, shall be full voltage, magnetic, nonreversing and NEMA rated. The starter enclosures shall have NEMA type designations appropriate for the locations where they will be installed. Unless otherwise noted, NEMA Type 4X stainless steel enclosures shall be provided for outdoor locations.

B. Heaterless overload protection shall be provided by three current sensors monitored by a microprocessor. The overload device shall also include phase loss and unbalance protection, trip class selection, Class II ground fault protection, and manual reset.

C. Each starter shall include auxiliary contacts as required, plus one spare NO and one spare NC contact.

D. Contractor shall match the sizes of control power transformers, overload devices, heaters, and starters to the equipment furnished, as they may differ from the values indicated on the Drawings. Control power transformers shall have both primary leads fused, one secondary lead fused, and one secondary lead grounded.

E. All starters shall be provided with control terminal blocks. Terminal blocks shall be pull-apart type rated 20 amperes. All current carrying parts shall be tin-plated. The removable portion of the terminal blocks shall be used for factory installed wiring.

F. All push buttons, selector switches, and pilot lights indicated on the schematics to be provided on or in the starter enclosure shall be 30.5 mm heavy-duty, oiltight construction. Pilot lights shall be full voltage type with LED lamps. Push buttons on starters located outdoors shall be provided with protective caps.

G. Three Phase Starters

1. Three phase starters shall be circuit breaker combination type consisting of 3 phase, 60 Hz contactors with heaterless overloads, a 120 volt ac coil, a dry type control power transformer where required, and a circuit breaker disconnect. Control power transformers shall be sized to handle all simultaneous loads. Starters shall be at least NEMA Size 1, or shall be sized as indicated on the Drawings.

2. Circuit breakers shall be 600 volt magnetic motor circuit protectors for motors smaller than 100 horsepower and 600 volt thermal-magnetic type for 100 horsepower and larger motors. Each breaker shall be manually operated with a quick-make, quick-break, trip-free toggle mechanism.

3. Three phase starters shall be furnished with external manual breaker operating handles and provisions for up to three padlocks. The access door shall be interlocked with the motor circuit protector, so that the door cannot be opened, except by an interlock override, while the breaker is closed.

4. The complete 3 phase starter shall have an interrupting rating of at least 65,000 amperes at 480 volts.

H. Single Phase Starters

1. Single phase starters shall consist of single phase, 60 Hz contactors with thermal overloads and an integral or separately enclosed short-circuit protection device. Starters shall be at least NEMA Size 0, or shall be sized as indicated on the Drawings. Integral short-circuit protection devices for single-phase starters shall be 120/240 volt, magnetic motor circuit protectors.

2. Separately enclosed short-circuit protection devices for single phase starters shall be molded-case circuit breakers for motor loads 6 amperes and higher and fused switch disconnects for motor loads lower than 6 amperes. Circuit breaker disconnects shall be 120/240 volt, molded-case, thermal-magnetic circuit breakers. Fused switch disconnects shall have quick-make, quick-break mechanisms and 250 volt, dual-element, time-delay fuses.

3. The short-circuit protection devices shall have external operating handles capable of being padlocked in the open position, and shall have an interrupting rating of at least 22,000 amperes at 240 volts.

2.8 DISCONNECT SWITCHES

A. Unless otherwise specified, each disconnect switch shall be 3 pole, nonfusible, 600 volts, with a continuous current rating as indicated on the Drawings.

B. Where indicated on the Drawings, fused switches shall be furnished complete with fuses. Fuse sizing shall be as indicated on the Drawings, as required by the results of the protective device study, or as recommended by the respective protected equipment manufacturer.

C. Switches located indoors shall have NEMA type enclosure designations as required by the locations where they will be installed. Switches located outdoors shall have NEMA Type 4X enclosures. Switches in chlorine rooms, or in other areas where contact with caustic substances may occur, shall have NEMA Type 4X enclosures of molded reinforced polyester.

D. Switches shall have high conductivity copper, visible blades; nonteasible, positive, quick-make, quick-break mechanisms; and switch assembly plus operating handle as an integral part of the enclosure base. Each switch shall have a handle whose position is easily recognizable and which can be locked in the "Off" position with three padlocks. The "On" and "Off" positions shall be clearly marked.

E. All switches shall be UL listed and horsepower rated, and shall meet the latest edition of NEMA KS1. Switches shall have defeatable door interlocks that prevent the door from being opened while the operating handle is in the "On" position.

PART 3 - EXECUTION

3.1 INSTALLATION, TESTING, AND COMMISSIONING

A. All material, equipment, and components specified herein shall be installed, tested, and commissioned for operation in compliance with NECA 1000 – NEIS Specification System. Where required in NECA 1000, testing and commissioning procedures shall be followed prior to energizing equipment.

3.2 CABLE INSTALLATION

A. Except as otherwise specified or indicated on the Drawings, cable shall be installed according to the following procedures, taking care to protect the cable and to avoid kinking the conductors, cutting or puncturing the jacket, contamination by oil or grease, or any other damage. Circuits to supply electric power and control to equipment and devices, communication and signal circuits as indicated on the one-line diagrams shall be installed continuous and may not be spliced unless approved by the Engineer.

1. Stranded conductor cable shall be terminated by lugs or pressure type connectors. Wrapping stranded cables around screw type terminals is not acceptable.

2. Stranded conductor cable shall be spliced by crimp type connectors. Twist-on wire connectors may only be used for splicing solid cable and for terminations at lighting fixtures.

3. Splices may be made only at readily accessible locations.

4. Cable terminations and splices shall be made as recommended by the cable manufacturer for the particular cable and service conditions.

5. Cable shall not be pulled tight against bushings nor pressed heavily against enclosures.

6. Cable-pulling lubricant shall be compatible with all cable jackets; shall not contain wax, grease, or silicone; and shall be Polywater "Type J".

7. Where necessary to prevent heavy loading on cable connections, in vertical risers, the cable shall be supported by Kellems, or equal, woven grips.

8. Spare cable ends shall be taped, coiled, and identified.

9. Cables shall not be bent to a radius less than the minimum recommended by the manufacturer.

10. All cables in one conduit, over 1 foot long, or with any bends, shall be pulled in or out simultaneously.

11. Circuits to supply electric power and control to equipment and devices are indicated on the one-line diagrams. Conductors in designated numbers and sizes shall be installed in

conduit of designated size. Circuits shall not be combined to reduce conduit requirements unless acceptable to Engineer.

12. Instrument cable shields and drain wires shall be continuous over the entire length of the circuit and grounded at one end only. In general, the field end of the shield shall be ungrounded. At the ungrounded termination of the circuit, the shield and drain wire shall be insulated by taping to prevent grounding.

B. Underground Cable Pulling Procedure

1. Care shall be taken to prevent excessive physical stresses that would cause mechanical damage to cables during pulling.

3.3 RACEWAY INSTALLATION

A. Contractor shall be responsible for routing all raceway. This shall include all conduits indicated on the one-lines, riser diagrams, and home-runs shown on the plan Drawings. Conduits shall be routed as defined in these Specifications. Where conduit routing is shown on plans, it shall be considered a general guideline and shall be field verified to avoid interferences.

B. Except as otherwise specified or indicated on the Drawings, conduit installation and identification shall be completed according to the following procedures.

C. Installation of Interior and Exposed Exterior Conduit

1. This section covers the installation of conduit inside structures, above and below grade, and in exposed outdoor locations. In general, conduit inside structures shall be concealed. Large conduit and conduit stubs may be exposed unless otherwise specified or indicated on the Drawings. No conduit shall be exposed in water chambers unless so indicated on the Drawings.

2. Unless otherwise indicated on the Drawings, Contractor shall be responsible for routing the conduit to meet the following installation requirements:

a. Conduit installed in all exposed indoor locations, except corrosive areas indicated on the Drawings, and in floor slabs, walls, and ceilings of hazardous (classified) locations, shall be PVC-coated rigid steel. Exposed conduit shall be rigidly supported by PVC-coated framing materials. Mounting hardware, including nuts, bolts, and anchors, shall be stainless steel.

b. Conduit installed in floor slabs and walls in non-hazardous locations shall be rigid Schedule 40 PVC.

c. Conduit installed in all exposed outdoor locations shall be PVC-coated rigid steel, rigidly supported by PVC-coated framing materials. Mounting hardware, which includes nuts, bolts, and anchors, shall be stainless steel. All damaged coatings shall be repaired according to the manufacturer's instructions.

d. Final connections to dry type transformers, to motors without flexible cords, and to other equipment with rotating or moving parts shall be liquidtight flexible metal conduit with watertight connectors installed without sharp bends and in the minimum lengths required for the application, but not longer than 6 feet unless otherwise acceptable to Engineer.

e. Terminations and connections of rigid conduit shall be taper threaded. Conduits shall be reamed free of burrs and shall be terminated with conduit bushings.

f. Exposed conduit shall be installed either parallel or perpendicular to structural members and surfaces.

g. Two or more conduits in the same general routing shall be parallel, with symmetrical bends.

h. Conduits shall be at least 6 inches from high temperature piping, ducts, and flues.

i. Rigid Schedule 40 PVC conduit shall have supports and provisions for expansion as required by NEC Article 352.

j. Metallic conduit connections to sheet metal enclosures shall be securely fastened by locknuts inside and outside.

k. Rigid Schedule 40 PVC conduit shall be secured to sheet metal device boxes using a male terminal adapter with a locknut inside or by using a box adapter inserted through the knockout and cemented into a coupling.

l. Conduits in walls or slabs, which have reinforcement in both faces, shall be installed between the reinforcing steel. In slabs with only a single layer of reinforcing steel, conduits shall be placed under the reinforcement. Conduits larger than 1/3 of the slab thickness shall be concrete encased under the slab.

m. Conduits that cross structural joints where structural movement is allowed shall be fitted with concretetight and watertight expansion/deflection couplings, suitable for use with metallic conduits and rigid Schedule 40 or 80 PVC conduits. The couplings shall be Appleton Type DF, Crouse-Hinds Type XD, or O-Z Type DX.

n. Conduit shall be clear of structural openings and indicated future openings.

o. Conduits through roofs or metal walls shall be flashed and sealed watertight.

p. Conduit installed through any openings cut into non-fire rated concrete or masonry structure elements shall be neatly grouted. Conduit penetrations of fire rated structure elements shall be sealed in a manner that maintains the fire rating as indicated on the Architectural Drawings.

q. Conduits shall be capped during construction to prevent entrance of dirt, trash, and water.

r. Exposed conduit stubs for future use shall be terminated with galvanized pipe caps.

s. Concealed conduit for future use shall be terminated in equipment or fitted with couplings plugged flush with structural surfaces.

t. Where the Drawings indicate future duplication of equipment wired hereunder, concealed portions of conduits for future equipment shall be provided.

u. Horizontal conduit shall be installed to allow at least 7 feet of headroom, except along structures, piping, and equipment or in other areas where headroom cannot be maintained.

v. Conduit shall not be routed across the surface of a floor, roof, or walkway unless approved by Engineer.

w. PVC-coated rigid conduit shall be threaded and installed as recommended by the conduit manufacturer's installation procedure using appropriate tools.

x. All conduits that enter enclosures shall be terminated with acceptable fittings that will not affect the NEMA rating of the enclosure.

y. Conduit which turns out of concrete slabs or walls, shall be connected to a 90 degree elbow of PVC-coated rigid aluminum conduit before it emerges. Conduits shall have PVC-coated rigid aluminum coupling embedded a minimum of 3 inches when emerging from slabs or walls and the coupling shall extend 2 inches from the wall.

D. Underground Conduit Installation

1. All excavation, backfilling, and concrete work shall conform to the respective sections of these Specifications. Underground conduit shall conform to the following requirements:

a. All underground conduits shall be concrete encased unless indicated otherwise on the Drawings. Concrete encasement within 15 feet of building entrances, under and within 5 feet of roadways, and within 10 feet of indicated future excavations shall be reinforced as detailed on the Drawings.

b. Concrete encased conduit shall be schedule 40 PVC. Conduits shall have PVC-coated rigid steel coupling embedded a minimum of 3 inches when emerging from walls and the coupling shall extend 2 inches from the wall. All PVC joints shall be solvent welded in accordance with the recommendations of the manufacturer.

c. Concrete encasement on exposed outdoor conduit risers shall continue to 6 inches 150 mm above grade, with top crowned and edges chamfered, unless otherwise

indicated on the drawings.

d. Conduit and concrete encasement installed underground for future extension shall be terminated flush at the bulkhead with a coupling and a screw plug. The termination of the duct bank shall be reinforced with bars 100 diameters long that shall be terminated 2 inches from the bulkhead. Matching splice bars shall be 50 bar diameters long. Each longitudinal bar shall be provided with a Lenton "Form Saver" coupler and plate or a Dayton "Superior DBR" coupler at the bulkhead. The coupler shall be threaded to accept a dowel of like diameter in the future. Threads shall be protected with screw-in plastic caps. A 1-3/4 by 3/4 inch deep horizontal shear key shall be formed in the concrete encasement above and below the embedded conduits. After concrete placement, conduit and bar connector ends shall be cleaned and coated with two coats of thixotropic coal tar.

e. Underground conduits indicated not to be concrete encased shall be rigid Schedule 40 PVC.

f. Underground conduit bend radius shall be at least 2 feet at vertical risers and at least 3 feet elsewhere.

g. Underground conduits and conduit banks shall have at least 2 feet of earth cover, except where indicated otherwise.

h. Underground conduit banks through building walls shall be cast in place, or concreted into boxouts, with water stops on all sides of the boxout. Water stops are specified in the Cast-In-Place Concrete section.

i. Underground nonmetallic conduits, which turn out of concrete or earth in outdoor locations, shall be connected to 90 degree elbows of PVC-coated rigid steel conduit before they emerge.

j. Conduits not encased in concrete and passing through walls, which have one side in contact with earth, shall be sealed watertight with special rubber-gasketed sleeve and joint assemblies or with sleeves and modular rubber sealing elements.

k. Underground conduits shall be sloped to drain from buildings to manholes.

l. Each 5 kV or higher voltage cable, each 250 kcmil or larger cable, and each conduit group of smaller cables shall be supported from manhole walls by Kindorf "D-990" or Unistrut "P-3259" inserts, with Kindorf "F-721-24" or Unistrut "P-2544" brackets and Unistrut "P1753" or "P1754" fiberglass reinforced polyester cable saddles.

m. Intercommunication and instrument cables shall be separated the maximum possible distance from all power wiring in pull-boxes, manholes, and handholes.

E. Sealing of Conduits

1. After cable has been installed and connected, conduit ends shall be sealed by forcing nonhardening sealing compound into the conduits to a depth at least equal to the conduit diameter. This method shall be used for sealing all conduits at handholes, manholes, and building entrance junction boxes, and for 1 inch and larger conduit connections to equipment.

2. Conduits entering chlorine feed and storage rooms shall be sealed in a junction box or conduit body adjacent to the point of entrance.

3. Conduits entering hazardous (classified) areas and submersible or explosion proof enclosures shall have Appleton "Type ESU" or Crouse-Hinds "EYS" sealing fittings with sealing compound.

F. Reuse of Existing Conduits

1. Existing conduits may be reused subject to the concurrence of Engineer and compliance with the following requirements:

a. A wire brush shall be pulled through the conduit to remove any loose debris.
b. A mandrel shall be pulled through the conduit to remove sharp edges and burrs.

3.4 WIRING DEVICES, BOXES, AND FITTINGS INSTALLATION

A. Metallic and nonmetallic conduit boxes and fittings shall be installed in the following locations:

B. Conduit Boxes and Fittings

1. Aluminum device boxes shall be installed in exposed rigid aluminum conduit systems.

2. Rigid PVC device boxes shall be installed in exposed nonmetallic conduit systems.

3. PVC coated boxes and fittings shall be installed in PVC coated conduit systems.

C. Wall Switches

1. Wall switches shall be mounted 3'-6" above floor or grade.

2. After circuits are energized, all wall switches shall be tested for proper operation.

3.5 EQUIPMENT INSTALLATION

A. Except as otherwise specified or indicated on the Drawings, the following procedures shall be used in performing electrical work.

B. Setting of Equipment

1. All equipment, boxes, and gutters shall be installed level and plumb. Boxes, equipment enclosures, metal raceways, and similar items mounted on water- or earth-bearing walls

shall be separated from the wall by at least 1/4 inch thick corrosion-resistant spacers. Where boxes, enclosures, and raceways are installed at locations where walls are not suitable or available for mounting, concrete equipment pads, framing material, and associated hardware shall be provided.

C. Sealing of Equipment

1. All outdoor substation, switchgear, motor control center, and similar equipment shall be permanently sealed at the base, and all openings into equipment shall be screened or sealed with concrete grout to keep out rodents and insects the size of wasps and mud daubers. Small cracks and openings shall be sealed from inside with silicone sealant, Dow-Corning "795" or General Electric "SCS1200".

3.6 GROUNDING

A. General

1. The electrical system and equipment shall be grounded in compliance with the National Electrical Code and the following requirements:

B. Grounding System Resistance

1. The ground system resistance shall comply with National Electrical Code.

C. Grounding System Testing

1. The grounding system of each new building or structure and each existing building or structure indicated below, shall be tested to determine the resistance to earth. Testing shall be performed by an independent electrical or grounding system testing organization. Testing shall be completed after not less than three full days without precipitation and without any other moistening or chemical treatment of the soil.

2. New Grounding Systems

a. Grounding systems of each new building or structure shall be tested for resistance to earth utilizing the three-point fall of potential test as defined by IEEE 81. Testing shall be completed prior to installation of the electrical distribution equipment to ensure the grounding system is isolated from the utility grounding system and the systems of other structures. The current source probe for the test shall be placed in soil at a distance of 5 to 10 times the distance of the widest measurement across the grounding system ring or grid to ensure adequate measurements outside of the grounding system’s sphere of influence. Test probe measurements shall be taken at a distance of one foot from the grounding system reference connection and at each 10 percent increment from the grounding system reference connection to the current source probe location. Test results shall be documented on a graphical plot with resistance in ohms on the vertical axis and distance in feet on the horizontal axis. The results shall clearly indicate a system resistance plateau which confirms a valid test procedure.

3. Grounding System Test Report

a. A report certified by the testing organization shall be prepared and submitted in accordance with the Submittal Procedures section. The final report shall include complete testing results for each building or structure, graphical representation of the test point results for the three-point fall of potential method, and complete observations of all site weather conditions and other environmental conditions that may affect the test results. Final acceptance of the results reported shall be subject to the review and approval of Engineer.

3.7 LIGHTING FIXTURE INSTALLATION

A. The Drawings indicate the general locations and arrangements of the lighting fixtures. Fixtures in rows shall be aligned both vertically and horizontally unless otherwise specified. Fixtures shall be clear of pipes, mechanical equipment, structural openings, indicated future equipment and structural openings, and other obstructions.

B. Conduit and wire for lighting fixture installation is not shown on the Drawings and shall be sized, furnished and installed by Contractor. Circuits to emergency lighting units, exit signs, and fixtures indicated to be night lights shall not be switched. Circuits to lighting fixtures indicated to have emergency battery packs shall include an additional un-switched hot conductor. Conductors shall be minimum 12 AWG and conduit shall be minimum 3/4 inch for lighting fixture installation.

3.8 MODIFICATIONS TO EXISTING EQUIPMENT

A. Modifications to existing equipment shall be completed as specified herein and indicated on the Drawings. All existing facilities shall be kept in service during construction. Temporary power or relocation of existing power and control wiring, equipment, and devices shall be provided as required during construction. Coordination and timing of outages shall be as specified in other sections of these Specifications. Electrical power interruptions will only be allowed where agreed upon in advance with Owner, and scheduling at times of low demand may be required.

Modifications to Panel 8EPP1 shall conform to lighting panel and breaker requirements specified herein.

End of Section

STANDARD SPECIFICATIONS

REFERENCE: ICEA S-95-658 (NEMA WC 70).

CONDUCTOR: Concentric-lay, uncoated copper; strand Class B. Wet/dry maximum operating temperature 90°C.

INSULATION: Cross-linked thermosetting polyethylene, ICEA S-95-658, Paragraph 3.6.

SHIELD: None.

JACKET: None.

FACTORY TESTS: Cable shall meet the requirements of ICEA S-95-658.

Cable Details

Size		Number of Strands	Conductor Insulation Thickness*		Maximum Outside Diameter	
AWG or kcmil	mm^2		in.	μm	in.	mm
14	2.5	7	0.030	760	0.17	4.32
12	4.0	7	0.030	760	0.19	4.83
10	6.0	7	0.030	760	0.21	5.33
8	10.0	7	0.045	1140	0.27	6.86
6	16.0	7	0.045	1140	0.31	7.87
4	25.0	7	0.045	1140	0.36	9.14
2	35.0	7	0.045	1140	0.42	10.67
1	40.0	19	0.055	1400	0.48	12.19
1/0	50.0	19	0.055	1400	0.52	13.21
2/0	70.0	19	0.055	1400	0.57	14.48
4/0	95.0	19	0.055	1400	0.68	17.27
250	120.0	37	0.065	1650	0.75	19.05
350	185.0	37	0.065	1650	0.85	21.59
500	300.0	37	0.065	1650	0.98	24.89
750	400.0	61	0.080	2030	1.22	31.00
1,000	500.0	61	0.080	2030	1.37	34.80

*The average thickness shall be not less than that indicated above. The minimum thickness shall be not less than 90 percent of the values indicated above.

A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches (600 mm). Marking shall include manufacturer's name, XLP, XHHW-2, conductor size, and voltage class.

600 Volt, Single Conductor Lighting/Power Cable (600-1-XLP-NONE-XHHW-2)

BLACK & VEATCH	Cable Data	Figure 2-26 05 11

STANDARD SPECIFICATIONS

REFERENCE: UL 66, UL 1277.

CONDUCTOR: 16 AWG (1.5 mm^2), 7-strand, concentric-lay, uncoated copper. Maximum operating temperature 90°C dry, 75°C wet.

INSULATION: Polyvinyl chloride, not less than 15 mils (380 μm) average thickness; 13 mils (330 μm) minimum thickness, UL 66, Type TFN.

LAY: Twisted pair with 1-1/2 inch to 3 inch (38.10 mm - 63.5 mm) lay.

SHIELD: Cable assembly, combination aluminum-polyester tape and 7-strand, 20 AWG (0.5 mm^2) minimum size, tinned copper drain wire, shield applied to achieve 100 percent cover over insulated conductors.

JACKET: Conductor: Nylon, 4 mils (100 μm) minimum thickness, UL 66.

Cable assembly: Black, flame-retardant polyvinyl chloride, UL 1277, applied over tape-wrapped cable core.

CONDUCTOR IDENTIFICATION: One conductor black, one conductor white.

FACTORY TESTS: Insulated conductors shall meet the requirements of UL 66 for Type TFN. Assembly jacket shall meet the requirements of UL 1277. Cable shall meet the vertical-tray flame test requirements of UL 1277.

Cable Details

	Assembly Jacket Thickness*		**Maximum Outside Diameter**	
	in.	**μm**	**in.**	**mm**
Single Pair	0.045	1140	0.34	8.64

*The average thickness shall be not less than that indicated above. The minimum thickness shall be not less than 80 percent of the value indicated above.

A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches (600 mm). Marking shall include manufacturer's name, Type TC, Type TFN, conductor size, single pair, and voltage class.

600 Volt, Single Pair, Shielded Instrument Cable (600-SINGLE-PAIR-SH-INSTR)

BLACK & VEATCH	**Cable Data**	**Figure 4-26 05 11**

SECTION 26 05 83 - ELECTRICAL EQUIPMENT INSTALLATION

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the installation of electrical equipment.

1.2 GENERAL

A. Equipment specified to be installed under this section shall be erected, and placed in proper operating condition in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

B. The electrical equipment identified as being provided by others will be furnished complete for installation by Contractor. Technical specifications under which the equipment will be purchased are available.

C. Coordination

1. When manufacturer's field services are provided by the equipment manufacturer, Contractor shall coordinate the services with the equipment manufacturer. Contractor shall give Engineer written notice at least 14 days prior to the need for manufacturer's field services furnished by others.

2. Submittals for equipment furnished under the original procurement contract will be furnished to Contractor upon completion of review by Engineer. Contractor shall review equipment submittals and coordinate with the requirements of the Work and the Contract Documents. Contractor accepts sole responsibility for determining and verifying all quantities, dimensions, and field construction criteria.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. When sills are required for electrical equipment, they shall be shipped ahead of the scheduled equipment delivery to permit installation before concrete is placed.

B. Storage

1. Upon delivery, all equipment and materials shall immediately be stored and protected by Contractor in accordance with Product Storage and Handling Requirements section, and in accordance with manufacturer's written instructions, until installed in the Work. Equipment shall be protected by Contractor against damage and exposure from the

elements. At no time shall the equipment be stored on earth or grass surfaces or come into contact with earth or grass. Contractor shall keep the equipment clean and dry at all times. Openings shall be plugged or capped (or otherwise sealed by packaging) during temporary storage.

C. Handling

1. Electrical equipment shall be moved by lifting, jacking, or skidding on rollers as described in the manufacturer's instructions. Special lifting harness or apparatus shall be used when required. Lifting and jacking points shall be used when identified on the equipment. Contractor shall have required unloading equipment on site to perform unloading work on the date of equipment delivery.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 INSTALLATION, TESTING, AND COMMISSIONING

A. All installation work shall be in accordance with manufacturer's written instructions.

B. All material, equipment, and components specified to be installed according to this section shall be installed, tested, and commissioned for operation in compliance with NECA 1000 – NEIS Specification System. Where required in NECA 1000, testing and commissioning procedures shall be followed prior to energizing equipment.

C. Electrical equipment cubicles and vertical sections shall be installed plumb and level. Drawout equipment carriages, circuit breakers, and other removable components shall operate free and easy without binding or distortion.

D. Unless otherwise indicated or specified, all indoor floor-mounted electrical equipment and control cabinets shall be installed on concrete equipment pads four inches [102 mm] in height.

E. Indoor metalclad switchgear shall be bolted to steel floor channels which are installed level and flush with the top of the concrete floor or equipment pad.

F. Outdoor metalclad switchgear and interrupter gear with integral floor channels or beams shall be secured to concrete pads with anchor bolts and clips.

G. Motor control centers with integral floor sills shall be secured to concrete floors or equipment pads with anchor bolts.

H. Adequate bracing shall be provided for seismic forces. The bracing shall be designed to meet the requirements of the Meteorological and Seismic Design Criteria section.

I. Cleaning

1. All deposits of oil, grease, mud, dirt or debris shall be cleaned from the electrical equipment following installation and field wiring. A detergent water based solution, or other liquid cleaners not harmful to material or equipment finishes, shall be used as recommended by the manufacturer.

End of Section

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Section 31 23 11 - EXCAVATION AND FILL FOR STRUCTURES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers earthwork and shall include the necessary clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation; handling, storage, transportation, and disposal of all excavated material; all necessary temporary earth retention and other protection work; preparation of subgrades; pumping and dewatering as necessary; protection of adjacent property; backfilling; construction of fills and embankments; grading; and other appurtenant work.

1.2 GENERAL

A. With reference to the terms and conditions of the construction standards for excavations set forth in OSHA "Safety and Health Regulations for Construction", Chapter XVII of Title 29, CFR, Part 1926, Contractor shall employ a competent person and, when necessary based on the regulations, a licensed professional engineer in the state where the earthwork is located, to act upon all pertinent matters of the work of this section.

1.3 SUBMITTALS

A. Drawings and Data – General

1. Drawings, specifications, and data covering the proposed materials shall be submitted in accordance with the Submittals Procedures section.

B. Temporary Excavation Design Certificate

1. Before starting construction on the temporary excavation and in accordance with OSHA requirements enumerated above, the Contractor shall ensure that the temporary excavation design engineer shall complete and submit to Engineer the Temporary Excavation Design Certificate , Figure 1-31 23 11 and the Contractor shall use the temporary excavation design. If required by the OSHA requirements enumerated above or to protect existing facilities, the Contractor is responsible for ensuring that a separate certificate shall be submitted for each unique design. Refer to paragraph in this specification titled, “Temporary Excavations.”

C. Filter Fabric Data

1. Complete descriptive and engineering data for the fabric shall be submitted in accordance with the Submittals Procedures section. Data submitted shall include:

a. A 12 inch square sample of fabric.

b. Manufacturer's descriptive product data.
c. Installation instructions.

D. Test Results for Review of Materials

1. Complete test results for tests performed on fill and backfill, and other material specified herein, by an independent commercial laboratory retained by the Contractor, as described in the paragraph titled, “Review of Materials”.

1.4 INSURANCE

A. Professional Liability insurance shall be provided as specified in the Supplementary Conditions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Filter Fabric

1. Filter fabric shall be provided in rolls wrapped with covering for protection from mud, dirt, dust, and debris.

2. Filter Fabric Type A

a. Filter fabric Type A shall be provided for installation at locations indicated on the Drawings and as specified herein. Filter fabric Type A shall be a non-woven fabric consisting of only continuous chains of polypropylene filaments or yarns of polyester formed into a stable network by needle punching. The fabric shall be inert to commonly encountered chemicals; shall be resistant to mildew, rot, ultraviolet light, insects, and rodents; and shall have the indicated properties (Minimum average roll value in weakest principal direction):
1) Property – Grab Strength
a) Test Method : ASTM D4632
b) Unit : lbs Min Roll Value : 160
2) Property – Grab Elongation
a) Test Method : ASTM D4632
b) Unit : percentMin Roll Value : 50
3) Property – CBR Puncture Strength
a) Test Method : ASTM D6241
b) Unit : lbs Min Roll Value : 410
4) Property – Trapezoidal Tear
a) Test Method : ASTM D4533
b) Unit : lbs Min Roll Value : 60
5) Property – UV Resistance at 500 hours
a) Test Method : ASTM D4355
b) Unit : % Strength RetainedMin Roll Value : 70

b. The apparent opening size (diameter) for the filter fabric Type A shall be no larger than the U.S. Standard Sieve Size 70 per ASTM D4751.

B. Polyethylene Film

1. Polyethylene film beneath concrete slabs or slab base course material shall comply with requirements of ASTM D4397, 6 mil minimum thickness.

C. Fill and Embankment Materials

1. To the maximum extent available, excess suitable material obtained from structure and trench excavation shall be used for the construction of site fills and embankments. Additional material shall be provided from Contractor's offsite source.

2. All material placed in fills and embankments shall be free from rocks or stones larger than 3 inches in their greatest dimension, brush, stumps, logs, roots, debris, and other organic or deleterious materials. No rocks or stones shall be placed in the upper 18 inches of any fill or embankment. Rocks or stones within the allowable size limit may be incorporated in the remainder of fills and embankments, provided they are distributed so that they do not interfere with proper compaction.

D. Granular Fill

1. Granular fill material shall be crushed rock or gravel suitable for use as a free draining subbase beneath slabs and foundations. Granular fill shall be free from dust, clay, and trash; hard, durable, non-friable; and shall be graded 1-1/2 inch to No. 8 as defined in ASTM C33 for No. 57 coarse aggregate. Granular fill shall meet the quality requirements for ASTM C33 coarse aggregate. The edges of granular fill shall be confined, either by placing against an excavation face or other fill.

E. Structure Backfill

1. Structure backfill shall be defined as the material placed around and outside of structures. For structures constructed in open excavations, structure backfill shall extend to the temporary excavation slope so that the entire excavation outside the structure shall be filled with structure backfill. For structures constructed in supported excavations, the structure backfill shall completely fill the space between structure and temporary earth retention, or between structure and excavation face, if these specifications permit removal of the system. Structure backfill shall meet the requirements of the previous paragraph entitled "Fill and Embankment Materials" except that only separately stockpiled material classified as GC or CL per ASTM D2487 with a liquid limit less than 45, a maximum plasticity index (PI) of 18 and a maximum particle size of 1.5 inches shall be used.

2. Clay Cap Structure Backfill. The top 18 inches of structure backfill materials shall consist of low permeability material classified as CL per ASTM D2487 and as specified herein for structure backfill.

F. Select Fill

1. Select fill shall be defined as the material placed beneath the structure foundations and slabs below any granular material layer or lean concrete slab indicated on the Drawings. Select fill shall be used to replace any unsuitable material below the structure foundations and slabs and to raise the site grades below and within 5 feet horizontally (unless a different dimension is otherwise indicated on the Drawings or specified) of structural footprints and at locations indicated on the Drawings.

2. Class 7 Select Fill. Class 7 select fill to be used under the Clearwell mat foundations shall meed the gradation and quality requirements as specified under Arkansas State Highway and Transportation Department's Standard Specifications for Highway Construction.

2.2 MATERIAL TESTING

A. Review of Materials

1. As stipulated in the Quality Control section, all tests required for preliminary review of materials and materials delivered to the Site shall be made by an acceptable independent testing laboratory at the expense of Contractor. Tests performed by the aggregate supplier are not acceptable. Tests shall have been performed within 2 months of submittal and shall be representative of the material that will be delivered to the Site. Acquisition of samples for testing, both for preliminary review of materials and for testing of materials at the Site, shall be by the Contractor's independent testing laboratory. Samples acquired at the Site shall be obtained after placement and compaction of the material. Aggregate material shall be sampled in accordance with ASTM D75.

2. Two initial gradation tests shall be made for each type of general fill, select fill, structure backfill, granular fill, or other specified material, and one additional gradation test shall be made for each additional 500 tons of each material delivered (imported) to the jobsite or suitable onsite material incorporated in select fill or structure backfill. One additional gradation test shall be performed for each additional 2,000 tons of general fill material delivered to the jobsite or suitable onsite material incorporated in general fill. In addition, one set of initial Atterberg Limits test shall be made for each fill material containing more than 20 percent by weight pass the No. 200 sieve and for materials specified by Atterberg Limits. One additional Atterberg Limits test shall be made for each additional 500 tons of each material delivered to the job site or otherwise incorporated in select fill or structure backfill. One additional Atterberg Limits test shall be made for each additional 2,000 tons of general fill material delivered to the jobsite or suitable onsite material incorporated in general fill.

B. Field Testing Expense

1. All moisture-density (Proctor) tests and relative density tests on the materials, and all in-place field density tests, shall be made by an independent testing laboratory at the expense of Owner.Contractor shall provide access to the materials and work area and shall assist the laboratory as needed in obtaining representative samples.

C. Required Field Tests

1. For planning purposes, the Owner's testing laboratory will use the following general guidelines for frequency of field tests. Additional tests will be performed as necessary for job conditions and number of failed tests.

    a. For area fills and embankments, an in-place field density and moisture test for each 1000 cubic yards of material placed.
    b. One in-place field density and moisture test for every 100 to 200 cubic yards of structure backfill or select fill.
    c. One in-place density and moisture test whenever there is a suspicion of a change in the quality of moisture control or effectiveness of compaction.
    d. At least one test for every full shift of compaction operations on mass earthwork.

PART 3 - EXECUTION

3.1 SITE PREPARATION

A. All sites to be occupied by permanent construction or embankments shall be cleared of all logs, trees, roots, brush, tree trimmings, and other objectionable materials and debris. All stumps shall be grubbed. Subgrades for fills and embankments and sites to be occupied by permanent construction shall be cleaned and stripped of all surface vegetation, sod, and organic topsoil. All waste materials shall be removed from the site and disposed of by and at the expense of Contractor.

3.2 EXCAVATION

A. General

1. Permanent excavations shall conform to the lines and grades indicated on the Drawings. Temporary excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.

2. Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.

B. Temporary Excavations

1. Except where excavation side slopes are cut to a stable slope, excavations for structures and trenches shall be supported as necessary to prevent caving or sliding. Temporary earth retention systems shall be furnished and installed as necessary to limit the extent of excavations for the deeper structures and necessary backfill under adjacent shallower structures, and to protect adjacent structures and facilities from damage due to excavation and subsequent construction.

2. Design of excavations by a professional engineer retained by Contractor is required when necessary to protect adjacent existing facilities, or when design by an engineer is required by the OSHA regulations cited herein. The Contractor's professional engineer shall be

licensed in the state of the Project and is responsible for design of entire excavation (both the sloping and supported portions of the excavation). The design of temporary earth retention shall comply with the paragraph of this specification titled, "Temporary Earth Retention."

3. Before starting construction on a temporary excavation requiring design by a professional engineer in compliance with requirements of this specification (to protect existing structures, utilities, and other facilities), the Contractor shall ensure that the temporary excavation design engineer shall complete the Temporary Excavation Design Certificate (Figure 1 – 02200) and the Contractor shall submit the certificate along with proof of professional liability insurance for the temporary excavation designer. The Contractor shall use the temporary excavation design. The Contractor shall submit a separate certificate for each unique design.

C. Classification of Excavated Materials

1. Classification of excavated materials shall be made as follows:

a. Rock. Rock is defined as being sandstone, limestone, flint, granite, quartzite, slate, hard shale, hard chert, or similar material in masses more than 1 cubic yard in volume or in ledges 4 inches or more in thickness.

Should rock be encountered in two or more ledges, each ledge being not less than 3 inches thick and with interlying strata of earth, clay, or gravel not more than 12 inches thick in each stratum, the entire volume between the top of the top ledge and the bottom of the bottom ledge will be classified as rock.

b. Earth. All material not classified as rock.

D. Preservation of Trees

1. No trees shall be removed outside excavated or filled areas, unless their removal is authorized by Owner. Trees left standing shall be adequately protected from damage by construction operations.

E. Unauthorized Excavation

1. Except where otherwise authorized, indicated, or specified, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations shall be replaced with concrete or lean concrete at the expense of Contractor. If structural concrete replacement is chosen, it shall be with concrete placed at the same time and monolithic with the concrete foundation.

F. Blasting

1. Blasting or other use of explosives for excavation will not be permitted.

G. Dewatering

1. Dewatering equipment shall be provided to remove and dispose of all surface water and groundwater and all water, regardless of the source, entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

2. All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level to the minimum depth of 24 inches, beneath such excavations. The specified dewatering depth shall be maintained below the prevailing bottom of excavation at all times.

3. Surface water shall be diverted or otherwise prevented from entering excavations or trenches to the greatest extent possible without causing damage to adjacent property.

4. Contractor shall be responsible for the condition of any pipe or conduit used for drainage purposes, and all such pipe or conduit shall be left clean and free of sediment.

H. Temporary Earth Retention

1. Temporary excavations shall be supported with temporary earth retention systems when excavation side slopes cannot be excavated to a stable slope.

2. If the soldier pile and lagging method is used for temporary earth retention, the soldier piles shall be installed by drilling. The lagging shall be seasoned hardwood, with maximum board width (vertical height) of 12 inches. The lagging boards shall be installed from the top down as the excavation advances.

3. The use of the following devices or systems are prohibited for use as temporary earth retention systems when the retention system is required to limit ground movement to protect structures, utilities, and other adjacent facilities.

   a. soldier piles with plate lagging
   b. slide rail systems
   c. trench shields i.e. trench boxes (trench shields are considered worker protection only, not temporary earth retention systems)

4. The above prohibition does not prevent Contractor from using soldier piles with plate lagging, slide rail systems, and trench shields to protect workers in an excavation.

5. Excavation support systems and sheeting and shoring shall be all removed after completion of work.

6. Unless the excavation support is required to be left in place the, design of the excavation support system shall be such as to permit complete removal while maintaining safety and stability in the excavation at all times. Excavation support systems to be left in place shall be designed and constructed of only steel. No additional payment above the Contract Price will be made for excavation support components left in place. Excavation support elements left in place, shall be cut off 24 inches minimum below the finish grade indicated on the Drawings.

I. Foundation Subgrade Preparation

1. Subgrades for foundations shall be prepared using the same procedure as required for fills and embankments, except that the subgrade shall not be scarified and moisture conditioned. The clearwell subgrade shall be overexcavated to the minimum depths shown on the drawings and replaced with Granular Fill and Class 7 Select fill as specified herein. After preparation, foundation subgrades shall be firm, dense, and thoroughly compacted and consolidated; and shall be sufficiently stable to remain firm and intact under the feet of the workers. Reinforcing steel and concrete shall be placed as soon as possible after subgrade preparation. Subgrades that are disturbed due to weather or other conditions shall be repaired by removing the disturbed material and replacing with crushed rock select fill. Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.

J. Roadway Excavation

1. This operation shall include any reshaping and wetting or drying required to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material.

3.3 FILLS AND EMBANKMENTS

A. Fills and embankments shall be constructed to the lines and grades indicated on the Drawings. Fills and backfills placed beneath and around structures shall comply with the requirements of this specification for select fill and structure backfill, respectively. Construction of fills and embankments shall begin from the lowest elevation in each excavation or area and progress upward. Materials shall be deposited in approximately horizontal layers not to exceed 8 inches in uncompacted thickness. Unless otherwise specified herein, the following governing standards apply:

1. Test method to determine maximum density and moisture : ASTM D698.

2. Relative compaction : 95%.

3. Moisture content relative to the optimum : -3% to +3%.

B. Where new fill is placed adjacent to an existing sloping surface steeper than 5 horizontal to 1 vertical, the existing slope shall be benched in advance of placement of new fill. The bench shall be of sufficient width to allow compaction of the junction between the new fill and existing earth surface.

C. Backfilling of excavations and construction of fills and embankments during freezing weather shall not be done. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill, fill, or embankment.

D. Subgrade Preparation

1. After preparation of the fill or embankment site, the subgrade shall be scarified and moisture conditioned to a minimum depth of 6 inches , leveled and compacted to the same relative compaction and moisture content relative to optimum as specified for fill.

2. Unless otherwise directed by Engineer, the subgrade shall be proof-rolled by a rubber-tired roller, a loaded dump truck, or other suitable rubber-tired equipment acceptable to Engineer. A minimum of four passes of the proof-rolling equipment shall be provided such that the last two passes are made perpendicular to the first two passes.

3. All soft, yielding, or otherwise unsuitable material shall be removed and replaced with compacted fill.

E. Placement and Compaction

1. All fill and embankment materials shall be placed in approximately horizontal layers not to exceed 8 inches in un-compacted thickness. Material deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled before compaction.

2. Each layer of material shall have the best practicable moisture content for satisfactory compaction. The material in each layer shall be wetted or dried to achieve the moisture content relative to optimum as specified above, and shall be thoroughly mixed to ensure uniform moisture content and adequate compaction. Each layer shall be thoroughly compacted to the required degree of compaction at the required moisture content. If the material fails to meet the density specified, compaction methods shall be altered. The changes in compaction methods shall include, but not be limited to, changes in compaction equipment, reduction in uncompacted lift thickness, increase in number of passes, and better moisture control.

3. Wherever a pipe is to installed within a fill or embankment, the fill or embankment material shall be placed and compacted to an elevation not less than 12 inches above the top of pipe elevation before the trench for pipe installation is excavated.

4. Fills and embankments over reservoir or basin roof slabs shall be placed and compacted by using methods that will not damage or overload the structure; compaction in addition to that attained by placement operations will not be required. Rubber-tired equipment shall be used insofar as possible. Individual items of equipment operated on reservoir or basin roof slabs shall not have loaded weight in excess of 14,000 lbs and shall be so operated that no impact loads are imposed on the structure. Fill material shall not be piled on the roof slab to a depth greater than 12 inches above finished grade elevation. Fill construction shall begin at the walls, and construction equipment shall operate on a layer of fill material at least 12 inches deep. Special care shall be taken to avoid damaging or disturbing any roofing membrane, tile drains, or granular fill material.

F. Borrow Pits

1. Borrow pits are not permitted.

3.4 FILL AND BACKFILL FOR STRUCTURES

A. Earth and aggregate materials placed for structures include granular fill, structure backfill, and select fill. In addition to the specific requirements specified herein, all requirements for placement of fills and embankments shall apply to granular fill, structure backfill, and select fill. These requirements include, but are not limited to subgrade preparation, lift thickness, and moisture conditioning requirements. All fills and backfills for structures shall be constructed to the lines and grades indicated on the Drawings. Backfilling and construction of fills during freezing weather shall not be done. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill, fill, or embankment.

B. Granular Fill

1. Granular fills shall be provided where indicated on the Drawings. Granular fills shall be placed on suitably prepared sub-grades in uncompacted lift thickness of 6 inches or less and compacted by vibration. Granular fills shall be compacted to not less than 70 percent relative density as determined by ASTM D4253 and D4254. If the thickness of the granular fill is less than 6 inches, the compaction shall be by a minimum four passes (round trips) of a self-propelled or walk-behind type vibratory roller operating in full vibration mode in accordance with manufacturer's instructions.

C. Structure Backfill

1. Backfill materials shall be deposited in approximately horizontal layers not to exceed 8 inches in uncompacted thickness and shall meet the following requirements:

   a. Test method to determine maximum density and moisture : ASTM D698.
   b. Relative compaction : 95%.
   c. Moisture content relative to the optimum : -3 % to +3%, 0% to +3% for clay cap structure backfill.

2. Compaction of structure backfill shall be performed in such a manner that damage to the structure is prevented. The compaction equipment used within 8 feet of the walls and for the top 8 feet [2.4 m] of backfill shall have no restriction on type. Limit of equipment weight shall be1 ton. Compaction of structure backfill by inundation with water will not be permitted.

3. No backfill shall be deposited or compacted in water.

4. Care shall be taken to compact structure backfill which will be beneath pipes, drives, roads, parking areas, walks, curbs, gutters, or other surface construction or structures. In addition, wherever a pipe is to be installed within structure backfill, the structure backfill shall be placed and compacted to an elevation not less than 12 inches above the top of pipe before the trench for pipe installation is excavated. Compacted areas, in each case, shall be adequate to support the item to be constructed or placed thereon.

D. Select Fill

1. Select fill shall be placed in approximately horizontal layers in uncompacted lift thickness of 8 inches or less and shall meet the following requirements:

    a. Test method to determine maximum density and moisture : ASTM D698.
    b. Relative compaction : 95%.
    c. Moisture content relative to the optimum : -3 % to +3%.

3.5 FILTER FABRIC INSTALLATION

A. Filter fabric shall be placed as specified herein and at the locations specified or otherwise indicated on the Drawings.

B. Filter fabric shall be protected from contamination by foreign material and damage. Any contaminated or damaged filter fabric shall be replaced with new filter fabric at no additional cost to the Owner. The fabric shall be covered within 7 calendar days after placement.

C. The subgrade for placement of filter fabric shall be smooth and free of irregularities and undulations. Filter fabric shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. Type A and B filter fabric shall be overlapped a minimum of 2 feet between adjacent roll ends and adjacent strips.

D. All filter fabric placed shall be fixed to the subgrade to prevent filter fabric slippage or movement during placement of subsequent materials. Pins or staples shall not be used to fix the filter fabric to the subgrade when a geomembrane is to be placed on top of the filter fabric.

E. The Contractor shall exercise care during filter fabric installation to prevent damage to the prepared supporting subgrade surface. The Contractor shall exercise care to prevent the entrapment of rocks, clods of earth or other material which could damage the filter fabric, clog the filter fabric or hamper seaming. Filter fabric damaged or distressed by foreign objects shall be repaired or replaced.

F. No foot traffic will be allowed on the filter fabric except with approved smooth-sole shoes. The Contractor shall not use the filter fabric surface as a work area or storage area for tools and supplies.

G. Tracked or rubber tired construction equipment shall not be operated directly upon the filter fabric until a minimum thickness of 6 inches of the cover material is placed over the filter fabric. Turning of construction vehicles shall be minimized to avoid distorting or damaging the filter fabric. All damaged filter fabric shall be replaced at Contractor's expense.

3.6 FINAL GRADING AND PLACEMENT OF TOPSOIL

A. After other outside work has been finished, and backfilling and embankments completed and settled, all areas which are to be graded shall be brought to grade at the indicated elevations, slopes, and contours. All cuts, fills, embankments, and other areas which have been disturbed or damaged by construction operations shall be surfaced with topsoil to a depth of at least 4 inches . Topsoil shall be of a quality at least equal to the existing topsoil in adjacent areas, free

from trash, stones, and debris, and well suited to support plant growth. Any additional topsoil required to provide the required minimum thickness shall be at no additional cost to the Owner.

B. Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and equivalent to manual methods. All surfaces shall be graded to secure effective drainage. Unless otherwise indicated, a slope of at least 1 percent shall be provided.

C. Final grades and surfaces shall be smooth, even, and free from clods and stones, weeds, brush, and other debris. Seeding and sod placement shall be in accordance with the Seeding and Sodding section.

3.7 DISPOSAL OF EXCAVATED MATERIALS

A. Suitable excavated materials may be used in fills and embankments as needed. Excess material shall be disposed of at the locations indicated on the Drawings; all such material shall be graded for drainage, distributed in 12-inch lifts and compacted to the requirements listed below, with slopes no greater than 4:1..

1. Test method to determine maximum density and moisture : ASTM D698.

2. Relative compaction : 90%.

3. Moisture content relative to the optimum : -3% to +3%.

B. All debris, stones, logs, stumps, roots, and other unsuitable materials shall be removed from the site and disposed of by, and at the expense of, Contractor.

3.8 SETTLEMENT

A. Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within the correction period stipulated in the General Conditions.

B. Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from Engineer or Owner.

End of Section

TEMPORARY EXCAVATION
DESIGN CERTIFICATE – Figure Figure 1-31 23 11

I, the undersigned professional engineer licensed in the state where the earthwork is located, hereby certify that the temporary excavation for the _____(structure name) excavation at _____ (structure location) has been designed by me, is appropriate for the _____ (structure name), as represented to me, and is in compliance with the Contract Documents (including protecting adjacent structures, utilities, and other facilities from damage, and not providing a temporary earth retention design to Contractor that includes soldier piles with steel plate lagging, slide rail systems, and trench shields).

Name: _____ State of License: _____

Signature: _____ P.E. Number _____

Date: _____

_____
(Seal)

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Section 31 23 33 - TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 SCOPE

A. This section covers clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching; tunneled (trenchless construction) crossings; the handling, storage, transportation, and disposal of all excavated material; all necessary sheeting, shoring, and protection work; preparation of subgrades; pumping and dewatering as necessary; protection of adjacent property; backfilling; pipe embedment; surfacing and grading; and other appurtenant work.

1.2 GENERAL

A. With reference to the terms and conditions of the construction standards for excavations set forth in OSHA "Safety and Health Regulations for Construction", Chapter XVII of Title 29, CFR, Part 1926, Contractor shall employ a competent person and, when necessary based on the regulations, a licensed or registered professional engineer, to act upon all pertinent matters of the work of this section.

1.3 SUBMITTALS

A. Drawings and Data – General

1. Drawings, specifications, and data covering the proposed materials shall be submitted in accordance with the Submittals Procedures section.

B. Certifications.

1. At least 30 days before starting construction on the sheeting and shoring, and in accordance with the OSHA requirements identified above, the Contractor shall ensure that the sheeting and shoring design engineer shall complete and submit to Engineer the WTR-FM-EN-1001, Protective System Design Certificate -2 and the Contractor shall use the sheeting and shoring design. If required by the OSHA requirements identified above or to protect existing facilities, the Contractor shall submit a separate certificate for each unique design. If required for protection of existing facilities or as required by the OSHA regulations identified above, the certificate(s) shall be signed and sealed by the registered professional engineer that designed the protection system.

C. Embedment and Backfill Materials

1. Complete test results covering tests performed by an independent commercial testing laboratory retained by the Contractor for all materials described in the Materials Testing section shall be submitted.

1.4 BASIS FOR PAYMENT

A. Trench Sheeting

1. No additional payment above the Contract Price will be made for trench sheeting left in place.

1.5 INSURANCE

A. Professional liability insurance shall be provided as specified in the General Conditions section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Polyethylene Film

1. Polyethylene film beneath concrete slabs or slab base course material shall be Product Standard PS17, 6 mil minimum thickness.

B. Backfill Materials

1. Job Excavated Material

a. To the maximum extent possible, job excavated material should be used for either uncompacted or compacted trench backfill when the job excavated material is finely divided and free from debris, organic material, cinders, corrosive material, and stones larger than 1.5 inches in greatest dimension. Masses of moist, stiff clay shall not be used. Only separately stockpiled material classified as GC or CL per ASTM D2487 with a liquid limit less than 45, a maximum plasticity index (PI) of 18 and a maximum particle size of 1.5 inches shall be used.

2. Graded Gravel Fill

a. Graded gravel for compacted trench backfill shall conform to the following gradation:
   1) Sieve Size 1 inch % Passing by Weight 100
   2) Sieve Size 3/4 inch % Passing by Weight 85 – 100
   3) Sieve Size 3/8 inch % Passing by Weight 50 – 80
   4) Sieve Size No. 4 % Passing by Weight 35 – 60
   5) Sieve Size No. 40 % Passing by Weight 15 – 30
   6) Sieve Size No. 200 % Passing by Weight 5 – 10

b. The gravel mixture shall contain no clay lumps or organic matter. The fraction passing the No. 4 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 5.

3. Granular Fill

a. Granular fill material shall be crushed rock or gravel suitable for use as a free draining subbase beneath slabs and foundations. Granular fill shall be free from dust, clay, and trash; hard, durable, non-friable; and shall be graded 1-1/2 inch to No. 8 as defined in ASTM C33 for No. 57 coarse aggregate. Granular fill shall meet the quality requirements for ASTM C33 coarse aggregate. The edges of granular fill shall be confined, either by placing against an excavation face or other fill.

C. rePipe Embedment Material

1. Pipe embedment material shall be placed as indicated in Figure 1- 31 23 33 .

2. Granular Embedment

a. Granular embedment shall consist of crushed rock and crushed gravel, meeting the quality and gradation requirements of coarse aggregate size number 7 of ASTM C33.

2.2 MATERIALS TESTING

A. Preliminary Review of Materials

1. As stipulated in the Quality Control section, all tests required for preliminary review of materials shall be made by an acceptable independent testing laboratory at the expense of Contractor. Two initial gradation tests shall be made for each type of embedment, fill, backfill, or other material, and one additional gradation test shall be made for each additional 500 tons of each material delivered to the site. In addition, one set of initial Atterberg Limits test shall be made for each fill materials containing more than 20 percent by weight passing the No. 200 sieve . One additional Atterberg Limits test shall be made for each additional 500 tons of each material delivered to the site.

2. All material testing on CLSM shall be made by an independent testing laboratory at the expense of Contractor.

B. Field Testing Expense

1. All moisture-density (Proctor) tests and relative density tests on the materials, and all in-place field density tests, shall be made by an independent testing laboratory at the expense of Owner. Contractor shall provide access to the materials and work area and shall assist the laboratory as needed in obtaining representative samples.

C. Required Tests

1. For planning purposes, the following guidelines shall be used for frequency of field tests. Additional tests shall be performed as necessary for job conditions and number of failed tests. Test results shall be submitted as specified in the Submittals Procedures section.

a. Two moisture density (Proctor) tests in accordance with ASTM D698 (or, when required, ASTM D1557), or two relative density tests in accordance with ASTM D4253 and D4254 for each type of general fill, designated fill, backfill, or other material proposed.
b. In-place field density and moisture tests (ASTM D6938) at intervals of 200 feet maximum along the trench.
c. One in-place field density and moisture test (ASTM D6938) for every 200 cubic yards of backfill.
d. One in-place density and moisture test (ASTM D6938) whenever there is a suspicion of a change in the quality of moisture control or effectiveness of compaction.
e. Additional gradation, Proctor, and relative density tests whenever the source or quality of material changes.
f. Testing of CLSM shall be as follows:
    1) Compressive Strength. For every 200 cubic yards of CLSM placed, fill four 6 by 12 inch plastic cylinder molds to overflowing and then tap sides lightly. Cure cylinders in the molds covered until time of testing, at least 14 days. Strip the cylinders carefully using a knife to cut away the plastic mold. Cap the cylinders with high strength gypsum plaster or other capping process that will not break these low strength materials. Test cylinders in accordance with ASTM C39. Two cylinders shall be tested at 7 days and the other two cylinders shall be tested at 56 days.
    2) Flow of Fill. Once each day that CLSM is placed, test the fill material in accordance with ASTM C939 for the efflux time. Wet screening may be required to remove coarse particles.
    3) Unit Weight and Yield. Once each day that CLSM is placed, determine unit weight and yield in accordance with ASTM C138.
    4) Air Content. Once each day that CLSM is placed, determine air content in accordance with ASTM C231.
    5) Penetration Resistance. Once each day that CLSM is placed, determine early bearing strength in accordance with ASTM C403 penetration procedure.

PART 3 - EXECUTION

3.1 CLEARING

A. All clearing shall be performed as necessary for access, stringing of pipeline materials, and construction of the pipeline and appurtenant structures.

3.2 EXCAVATION

A. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.

B. Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.

C. Except where exterior surfaces are specified to be damp-proofed, monolithic concrete manholes and other concrete structures or parts thereof, which do not have footings that extend beyond the outside face of exterior walls, may be placed directly against excavation faces without the use of outer forms, provided that such faces are stable and also provided that a layer of polyethylene film is placed between the earth and the concrete.

D. Excavations for manholes and similar structures constructed of masonry units shall have such horizontal dimensions that not less than 6 inches clearance is provided for outside plastering.

E. Classification of Excavated Materials

1. Classification of excavated materials shall be made as follows:

a. Rock. Rock is defined as being sandstone, limestone, flint, granite, quartzite, slate, hard shale, hard chert, or similar material in masses more than 1 cubic yard in volume or in ledges 4 inches or more in thickness.
Should rock be encountered in two or more ledges, each ledge being not less than 3 inches thick and with interlying strata of earth, clay, or gravel not more than 12 inches thick in each stratum, the entire volume between the top of the top ledge and the bottom of the bottom ledge will be classified as rock.

b. Earth. All material not classified as rock.

F. Preservation of Trees

1. No trees shall be removed outside excavated or filled areas, unless their removal is authorized by Owner. Trees left standing shall be adequately protected from permanent damage by construction operations.

G. Blasting

1. Blasting or other use of explosives for excavation will not be permitted.

H. Dewatering

1. Dewatering equipment shall be provided to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure or tunnel to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

2. All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level to the minimum depth of 24 inches , beneath such excavations. The specified dewatering depth shall be maintained below the prevailing bottom of excavation at all times.

3. Surface water shall be diverted or otherwise prevented from entering excavations or trenches to the greatest extent possible without causing damage to adjacent property.

4. Contractor shall be responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipe or conduit shall be left clean and free of sediment.

5. Contractor shall obtain from the appropriate agencies and authorities, the dewatering and stormwater discharge permits required to remove and dispose of groundwater, surface water, and any other water used in Contractor's operations. The permits shall be obtained prior to start of construction.

I. Sheeting and Shoring

1. Except where banks are cut back on a stable slope, excavations for structures and trenches shall be supported with steel sheet piling and shoring as necessary to prevent caving or sliding.

2. Sheet piling or other excavation support systems shall be installed as necessary to limit the extent of excavations for deeper structures and to protect adjacent structures and facilities from damage due to excavation and subsequent construction. Contractor shall assume complete responsibility for, and shall install adequate protection systems for prevention of damage to existing facilities.

3. Sheeting, shoring and excavation support systems shall be designed by a professional engineer registered in the state where the project is located.

4. Trench sheeting may be removed if the pipe strength is sufficient to carry trench loads based on trench width to the back of sheeting. Trench sheeting shall not be pulled after backfilling. Where trench sheeting is left in place, it shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed. Trench sheeting shall be removed unless, in the opinion of Engineer, removal of the sheeting will cause damage to the facility it is protecting or loss of necessary piping support from the piping embedment. If left in place, the sheeting shall cut off 12 inches below finished grade. The design of the support system shall be such as to permit complete removal while maintaining safety and stability at all times.

5. A movable trench support may be used, provided care is exercised in placing and moving the trench box or support bracing to prevent movement of the pipe and bedding and backfill material meets the required compaction without voids.

J. Stabilization

1. Sub-grades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workers.

2. Sub-grades for concrete structures or trench bottoms which are otherwise solid, but which become mucky on top due to construction operations, shall be reinforced with crushed rock or gravel as specified for granular fills. The stabilizing material shall be placed in a manner that no voids remain in the granular fill. All excess granular fill with unfilled

void space shall be removed. The finished elevation of stabilized sub-grades shall not be above sub-grade elevations indicated on the Drawings.

3.3 TRENCH EXCAVATION

A. No more trench shall be opened in advance of pipe laying than is necessary to expedite the work. One block or 400 feet , whichever is the shorter, shall be the maximum length of open trench on any line under construction.

B. Except where tunneling is indicated on the Drawings, is specified, or is permitted by Engineer, all trench excavation shall be open cut from the surface.

C. Prior to excavation, Contractor shall contact local underground alert hotlines, “Dig Safe” and/or individual utility owners for marking underground utilities. Once utilities are marked, Contractor shall hand dig or pothole to expose the existing utilities. A survey shall be made of the utility size, material, location, and elevation prior to trench excavation and information shall be recorded on the record Drawings maintained by the Contractor.

D. Alignment, Grade, and Minimum Cover

1. The alignment and grade or elevation of each pipeline shall be fixed and determined from offset stakes. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith, shall be in conformity with requirements of the section covering installation of pipe.

2. Where pipe grades or elevations are not definitely fixed by the Drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe of 36 inches over pipes below paved and graded streets and, of 36 inches over pipes in other locations. Greater pipe cover depths may be necessary on vertical curves or to provide adequate clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation, except where future surface elevations are indicated on the Drawings.

E. Minimum Trench Widths

1. Except when maximum trench width is required for certain conduits, trenches shall be excavated to the minimum trench widths indicated in the following table. Trenches shall be excavated to a width which will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment.

a. Nominal Pipe Size : Less than 27 in
   1) Minimum Trench Width : Pipe OD plus 24 in
   2) Clearance (minimum sidewall clearance): 12 in

b. Nominal Pipe Size : Less than 27 in through 60 in
   1) Minimum Trench Width : Pipe OD plus nominal pipe size
   2) Clearance (minimum sidewall clearance): ID/2

3) ID = Inside Diameter (or span) of conduit

c. Nominal Pipe Size : Greater than 60 in
1) Minimum Trench Width : Pipe OD plus 70 in
2) Clearance (minimum sidewall clearance): 35 in

2. Specified minimum sidewall clearances are not minimum average clearances but are minimum clear distances which will be required to the trench excavation or the trench protective system.

3. Cutting trench banks on slopes to reduce earth load to prevent sliding and caving shall be used only in areas where the increased trench width will not interfere with surface features or encroach on right-of-way limits.

F. Mechanical Excavation

1. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

2. Mechanical equipment used for trench excavation shall be of a type, design, and construction, and shall be so operated, that the rough trench excavation bottom elevation can be controlled, and that trench alignment is such that pipe, when accurately laid to specified alignment, will be centered in the trench with adequate sidewall clearance. Undercutting the trench sidewall to obtain sidewall clearance will not be permitted.

3. In locations where maximum trench widths are required for designated rigid conduits, mechanical equipment shall be operated so that uniform trench widths and vertical sidewalls are obtained at least from an elevation 12 inches above the top of the installed pipe to the bottom of the trench.

G. Cutting Concrete Surface Construction

1. Cuts in concrete pavement and concrete base pavements shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be started with a concrete saw in a manner which will provide a clean groove at least 1-1/2 inches deep along each side of the trench and along the perimeter of cuts for structures.

2. Concrete pavement and concrete base pavement over trenches excavated for pipelines shall be removed so that a shoulder not less than 6 inches in width at any point is left between the cut edge of the pavement and the top edge of the trench. Trench width at the bottom shall not be greater than at the top and no undercutting will be permitted. Pavement cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the center line of the trench.

3. Pavement removal for connections to existing lines or structures shall not exceed the extent necessary for the installation.

4. Where the trench parallels the length of concrete walks, and the trench location is all or partially under the walk, the entire walk shall be removed and replaced. Where the trench crosses drives, walks, curbs, or other surface construction, the surface construction shall be removed and subsequently replaced between existing joints or between saw cuts as specified for pavement.

H. Excavation Below Pipe Sub-grade

1. Except where otherwise required, pipe trenches shall be excavated below the underside of the pipe, as indicated on Figure 1-31 23 33, to provide for the installation of granular embedment.

2. Bell holes shall provide adequate clearance for tools and methods used for installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

I. Artificial Foundations in Trenches

1. Whenever unsuitable or unstable soil conditions are encountered, Contractor shall notify Engineer immediately. When authorized by the Engineer , trenches shall be excavated below grade and the trench bottom shall be brought to grade with suitable material. In such cases, adjustments will be made in the Contract Price in accordance with the provisions of the General Conditions.

J. Over-Excavation

1. Over-excavation carried below the grade, unless authorized by the Engineer, shall be backfilled to the required grade with material acceptable to the Engineer and compacted to the satisfaction of the Engineer, at no additional cost to the Owner.

3.4 PIPE EMBEDMENT

A. Embedment materials both below and above the bottom of the pipe, classes of embedment to be used, and placement and compaction of embedment materials shall conform to the requirements indicated on Figure 1-31 23 33 and to the following supplementary requirements.

B. Embedment material shall contain no cinders, clay lumps, or other material which may cause pipe corrosion.

C. Embedment Classes.

1. Class B Special Embedment.

a. Class B special embedment shall be used for HDPE, PVC, DIP,steel, or stainless steel pipe.

D. Embedment for Ductile Iron, Steel, and PVC Pipelines

1. Granular embedment for polyethlene tube protected ductile iron, coal tar or cement mortar coated steel, and PVC pipelines shall be crushed rock or crushed gravel with rounded or subrounded particles. Crushed rock or gravel with sharp edges which could cause significant scratching or abrasion of the pipe or damage to the coating or polyethylene tube protection shall not be used unless otherwise approved by Engineer and all damage is repaired to the satisfaction of Engineer.

E. Placement and Compaction

1. Granular Embedment

a. Granular embedment material shall be spread and the surface graded to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface by withdrawal of pipe slings or other lifting tackle.
b. After each pipe has been graded, aligned, and placed in final position on the bedding material, and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof by shovel slicing or other suitable methods to hold the pipe in proper position and alignment during subsequent pipe jointing and embedment operations.
c. Placing and compaction of embedment material shall not damage the pipe coating or polyethylene encasement. Embedment material shall not be dumped directly on the pipe or polyethylene encasement unless a suitable temporary isolation layer such as a 60 mil HDPE sheeting, is used to cover the pipe and polyethylene encasement.
d. Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement.
e. Granular embedment shall be placed in layers not more than 6 inches deep and compacted as specified.
f. Each lift of granular embedment material shall be vibrated with a mechanical probe type vibrator or shovel sliced during placement to ensure that all spaces beneath the pipe are filled. Granular embedment shall be placed in maximum lift thickness of 6 inches and compacted. Each lift of embedment material shall be compacted with three passes (round trip) of a platform type vibrating compactor and to at least 70 percent relative density as determined by ASTM D4253 and D4254.
g. Where indicated on the Drawings or where silt, fine sand, or soft clay soils are encountered below groundwater, migration of soil into the embedment material shall be prevented by installing filter fabric Type A, or by using graded gravel in place of granular embedment. Filter fabric shall be placed on the trench surfaces so that it completely surrounds the embedment material. Joints shall be lapped 12 inches .

2. Compacted Embedment

a. Compacted embedment shall be placed in uniform layers not more than 8 inches thick and compacted to not less than 95% maximum density as determined by ASTM D698.

b. Where Class C embedment is required, compacted embedment shall be placed to the top of the pipe in all areas where compacted trench backfill is specified and around restrained pipe sections. Placing and compaction of embedment shall not damage the pipe or coating.

F. Groundwater Barrier

1. Continuity of embedment material shall be interrupted by low permeability groundwater barriers to impede passage of water through the embedment. Groundwater barriers for sewer lines that contain manholes with cast-in-place bases shall be compacted soil around each manhole, extending through any granular material beneath the manhole, and meeting ASTM D2487 soil classification GC, SC, CL, or ML-CL and shall be compacted to at least 95 percent of maximum density with moisture content within 2 percent of the optimum moisture content (ASTM D698). Material may be finely divided, suitable job excavated material, free from stones, organic matter, and debris.

3.5 TRENCH BACKFILL

A. All trench backfill above pipe embedment shall conform to the following requirements.

B. A layer of backfill material not more than 8 inches deep may be placed over concrete arch encasement or concrete thrust blocking after the concrete has reached its initial set, to aid curing. No additional backfill shall be placed over arch encasement or blocking until the concrete has been in place for at least 3 days.

C. Compacted Backfill

1. Compacted backfill will be required for the full depth of the trench above the embedment in the following locations:

a. Where beneath pavements, surfacings, driveways, curbs, gutters, walks, or other surface construction or structures.
b. Where in street, road, or highway shoulders.
c. In established lawn areas.

2. The top portion of backfill beneath established lawn areas shall be finished with at least 12 inches of topsoil corresponding to, or better than that which is underlying adjoining lawn areas.

3. Trench backfill material shall be suitable job excavated material or graded gravel and shall be as specified herein.

4. Job Excavated Material

a. Job excavated materials shall be placed in uniform layers not exceeding 8 inches in uncompacted thickness. Each layer of material shall have the best possible moisture content for satisfactory compaction. The material in each layer shall be wetted or dried as needed and thoroughly mixed to ensure uniform moisture content and adequate compaction. Increased layer thickness may be permitted for

noncohesive material if Contractor demonstrates to the satisfaction of Engineer that the specified compacted density will be obtained. The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe. Job excavated material shall be compacted to 95 percent of maximum density at a moisture content within 3 percent of the optimum moisture content as determined by ASTM D698 when that test is appropriate, or to 70 percent relative density as determined by ASTM D4253 and D4254 when those tests are appropriate.

5. Graded Gravel

   a. Gravel backfill shall be deposited in uniform layers not exceeding 12 inches in uncompacted thickness. The backfill shall be compacted with a suitable vibratory roller or platform vibrator to at least 70 percent relative density as determined by ASTM D4253 and D4254.
   b. Groundwater barriers specified under pipe embedment shall extend to the top of the graded gravel backfill.

D. Ordinary Backfill

1. Compaction of trench backfill above pipe embedment in locations other than those specified will not be required except to the extent necessary to prevent future settlement. Contractor shall be responsible for backfill settlement as specified.

2. Ordinary earth backfill material to be placed above embedments shall be free of brush, roots more than 2 inches in diameter, debris, cinders, and any corrosive material, but may contain rubble and detritus from rock excavation, stones, and boulders in certain portions of the trench depth.

3. Backfill material above embedments shall be placed by methods which will not impose excessive concentrated or unbalanced loads, shock, or impact on installed pipe, and which will not result in displacement of the pipe.

4. Compact masses of stiff clay or other consolidated material more than 1 cubic foot in volume shall not be permitted to fall more than 5 feet into the trench, unless cushioned by at least 2 feet of loose backfill above pipe embedment.

5. No trench backfill material containing rocks or rock excavation detritus shall be placed in the upper 18 inches of the trench, nor shall any stone larger than 6 inches in its greatest dimension be placed within 3 feet of the top of pipe. Large stones may be placed in the remainder of the trench backfill only if well separated and so arranged that no interference with backfill settlement will result.

E. Water-Settled Earth Backfill

1. Settlement or consolidation of trench backfill using water jetting or ponding shall not be performed.

F. Structure Backfill

1. Backfill around manholes and small concrete vaults shall meet the requirements specified for structure backfill specified in the Excavation and Fill for Structures section.

G. Controlled Low Strength Material (CLSM)

1. CLSM shall not be placed on frozen ground. Batching, mixing, and placing of CLSM may be started when weather conditions are favorable and when the temperature is at least 34°F and rising. At time of placement, CLSM shall have a temperature of at least 40°F . Mixing and placing shall stop when the temperature is 38°F and falling. Each filling stage shall be as continuous an operation as is practicable.

2. CLSM shall be discharged from the mixer by an acceptable procedure into the area to be filled. CLSM shall be placed to limits indicated on the Drawings. Mixing CLSM with in-situ soil shall be avoided.

3. When CLSM is placed as backfill against structures, the fill shall be placed in lifts of 2 to 3 feet and the next lift shall not be placed until the previous lift has taken initial set and at least 16 hours have elapsed from the end of placement. Lift thickness shall be reduced as necessary to prevent floatation of the structure.

4. When CLSM is placed over culverts or pipelines, they shall be anchored to prevent flotation during the placement of CLSM. Unless otherwise required, CLSM shall be placed to one foot below subgrade elevation if the subgrade elevation is not more than 5 feet over the top of the culvert or pipe. If the subgrade is more than 5 feet over the top of the culvert or pipe, CLSM shall be placed to an elevation 2 feet over the top of the culvert or pipe, and the remainder shall be backfilled with soil designated by Engineer.

3.6 DRAINAGE MAINTENANCE

A. Trenches across roadways, driveways, walks, or other trafficways adjacent to drainage ditches or watercourses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the trafficway, to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. All material deposited in roadway ditches or other watercourses crossed by the line of trench shall be removed immediately after backfilling is completed, and the original section, grades, and contours of ditches or watercourses shall be restored. Surface drainage shall not be obstructed longer than necessary.

3.7 PROTECTION OF TRENCH BACKFILL IN DRAINAGE COURSES

A. Where trenches are constructed in ditches or other watercourses, backfill shall be protected from surface erosion. Where the grade of the ditch exceeds 1 percent, or as otherwise required, ditch checks shall be installed. Unless otherwise indicated on the Drawings, ditch checks shall be concrete. Ditch checks shall extend at least 2 feet below the original ditch or watercourse bottom for the full bottom width and at least 18 inches into the side slopes, and shall be at least 12 inches thick.

3.8 FINAL GRADING AND PLACEMENT OF TOPSOIL

A. After other outside work has been finished, and backfilling and embankments completed and settled, all areas which are to be graded shall be brought to grade at the indicated elevations, slopes, and contours. All cuts, fills, embankments, and other areas which have been disturbed or damaged by construction operations shall be surfaced with topsoil to a depth of at least 4 inches . Topsoil shall be of a quality at least equal to the existing topsoil in adjacent areas, free from trash, stones, and debris, and well suited to support plant growth. Topsoil required to provide the minimum thickness shall be imported and placed at no additional cost to the Owner.

B. Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and equivalent to manual methods. All surfaces shall be graded to secure effective drainage. Unless otherwise indicated, a slope of at least 1 percent shall be provided.

C. Final grades and surfaces shall be smooth, even, and free from clods and stones, weeds, brush, and other debris.

3.9 DISPOSAL OF EXCESS EXCAVATED MATERIALS

A. Disposal of excess material from trench excavations on plant and major facility construction sites shall be accomplished as specified in the Excavation and Fill for Structures section of the Specifications for the major construction.

B. Broken concrete and other debris resulting from pavement or sidewalk removal, excavated rock in excess of the amount permitted to be installed in trench backfill, debris encountered in excavation work, and other similar waste materials shall be disposed of away from the site.

3.10 RESODDING

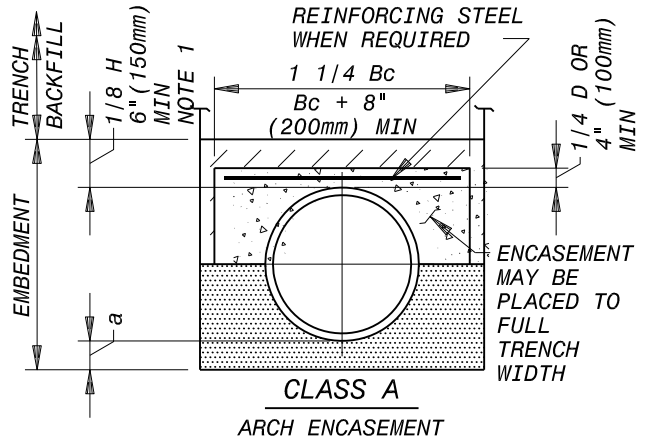
A. Seeding and sodding shall be as specified in the Seeding and Sodding Section.

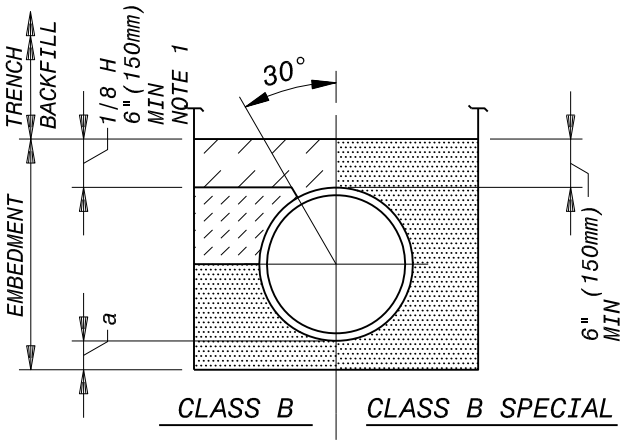
3.11 SETTLEMENT

A. Contractor shall be responsible for all settlement of trench backfill which may occur within the correction period stipulated in the General Conditions.

B. Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from Engineer or Owner.

End of Section





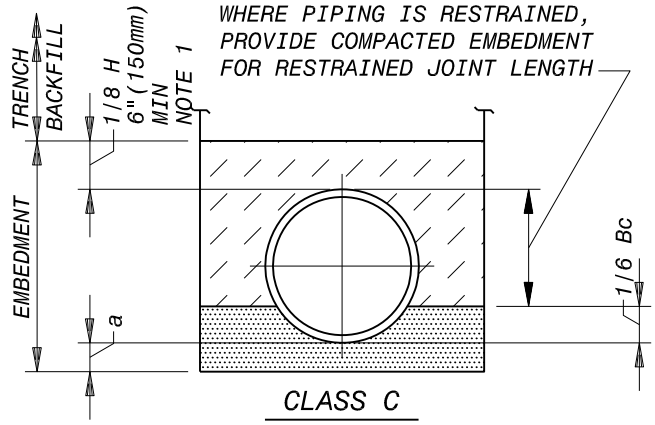


TABLE OF EMBEDMENT DEPTHS BELOW PIPE

D	a MIN SOIL		a MIN ROCK	
	in	mm	in	mm
27"(675 mm) & SMALLER	3	75	6	150
30"(750 mm) TO 60"(1500 mm)	4	100	9	225
66"(1650 mm) & LARGER	6	150	12	300

NOTES:

1. EMBEDMENT ABOVE THE TOP OF THE PIPE SHALL BE AN UNCOMPACTED LAYER FOR ALL INSTALLATIONS.
2. REFER TO SPECIFICATIONS FOR GEOTECHNICAL FABRIC OR SPECIAL EMBEDMENT REQUIREMENTS FOR TRENCHES IN FINE SOILS EXTENDING BELOW GROUNDWATER LEVEL.
3. TRENCH OUTLINES DO NOT INDICATE ACTUAL TRENCH EXCAVATION SHAPE, SOIL CONDITIONS, OR PRESENCE OF SHEETING LEFT IN PLACE. EMBEDMENT MATERIAL SHALL EXTEND THE FULL WIDTH OF THE ACTUAL TRENCH EXCAVATION.
4. FOR RESTRAINED JOINT PIPE LENGTH WITH CLASS C EMBEDMENT THE BACKFILL ABOVE THE GRANULAR EMBEDMENT AND BELOW THE TOP OF THE PIPE SHALL BE COMPACTED EMBEDMENT.

LEGEND

Bc OUTSIDE DIAMETER OF PIPE
H COVER ABOVE TOP OF PIPE
D NOMINAL PIPE SIZE
a EMBEDMENT BELOW PIPE (SEE TABLE)

HAND PLACED EMBEDMENT *

COMPACTED EMBEDMENT *

GRANULAR EMBEDMENT

CONCRETE

* OR GRANULAR EMBEDMENT

EMBEDMENTS FOR CONDUITS

BLACK & VEATCH	TRENCHING AND BACKFILLING	FIG 1-31 23 33

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PROTECTIVE SYSTEM
DESIGN CERTIFICATE – 2

I, the undersigned professional engineer registered in the state where the Project is located, hereby certify that the protection system for _____(trench location) has been designed by me, is appropriate for the (trench location) as represented to me, and is in compliance with the Contract Documents.

Name: _____ State of Registration: _____

Signature: _____ P.E. Number _____

Date: _____

_____
(Seal)

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SECTION 31 25 00 – EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and perform all installation, maintenance, removal and area cleanup related to erosion and sedimentation control work required to meet federal, State and Local permit requirements and for work shown on the Drawings and as specified herein. Erosion and sedimentation control shall include, but not be limited to: installation of temporary access ways and staging areas, installation of sediment fence, installation of sediment traps, sediment removal and disposal, sediment and stormwater control device maintenance, removal of temporary control devices, temporary mulching, and final cleanup.

1.2 RELATED WORK

A. Excavation and backfill are included in Sections 31 23 11 and 31 23 33.

B. Seeding and sodding is included in Section 32 92 21.

1.3 SUBMITTALS

A. Submit, in accordance with Section 01 33 00, technical product literature for all commercial products to be used for erosion and sedimentation control.

B. Prior to the start of work, prepare and submit for information purposes only, a Stormwater Pollution Prevention Plan (SWPPP) [also called an erosion control plan] prepared in accordance with the U.S. Environmental Protection Agency (EPA) National Pollution Discharge Elimination System (NPDES) General Permit, and Arkansas Department of Environmental Quality (ADEQ) General Stormwater Permit as required for this work.

1.4 REFERENCE STANDARDS

A. EPA document titled: “Stormwater Management for Construction Activities – Developing Pollution Prevention Plans and Best Management Practices” document number EPA 832-R-92-005, dated 1992, or most recent edition.

B. Arkansas State Highway and Transportation Department Erosion and Sediment Control Design and Construction Manual, latest edition.

C. State or appropriate County Conservation District standards may be substituted for the EPA standard if the State or County Conservation District standard is equal to, or more detailed than, the EPA standard.

D. ArDOT Statewide Storm Water Management Program, latest edition.

1.5 QUALITY ASSURANCE

A. Be responsible for the timely installation and maintenance of all control devices necessary to prevent the movement of sediment from the construction site to off site areas or into streams or wetlands via surface runoff or underground drainage systems. Measures identified in the SWPPP and other measures as needed to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at the expense of the Contractor. No additional charges to the District will be considered for regular maintenance of erosion and sediment controls.

B. Erosion and sedimentation control measures shall conform to the requirements, standards and guidelines presented in the Reference Standards.

C. Where the Contractor's efforts to control erosion and sedimentation have been demonstrated to be ineffective or potentially ineffective in the opinion of the Owner or Engineer, the Engineer may order that additional measures be implemented and constructed at no additional cost to the District.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Crushed Rock
   1. Crushed rock for temporary access ways, staging areas, stabilized construction entrance, stone filter berms, setting bed for rip-rap, and sediment filtration devices shall conform to specification 31 23 11.

B. Riprap
   1. Rip-rap shall be sound, durable rock which is roughly rectangular shape and of suitable quality to insure permanence in the condition in which it is to be used. Rounded stones, boulders, sandstone or similar soft stone will not be acceptable. Material shall be free from overburden, spoil, shale and organic material, and be well graded within the following limits:

Weight of Stone	Percent Finer by Weight
40 lb	100
12 lb	50
3 lb	0

C. Sediment Fence
   1. Wood posts shall be a minimum of 5-ft in length, 2-in by 2-in.
   2. Silt fence fabric shall be a woven, polypropylene, ultraviolet resistant material such as Mirafi 100X as manufactured by Mirafi, Inc., Charlotte, NC or equal.
   3. Prefabricated commercial silt fence may be substituted for built-in-field fence. Pre-fabricated silt fence shall be "Envirofence" as manufactured by Mirafi Inc., Charlotte, NC or equal.

D. Temporary mulch shall be applied in areas which cannot be seeded because of the season, or are otherwise unfavorable for plant growth to protect areas against washouts and erosion. Material shall be organic such as straw, wood chips, bark and wood fiber mulch or other plant residue material as follows:
   1. Wood chip mulch shall be utilized on all newly graded subgrade areas to protect against erosion in exposed soil areas. Wood chip mulch shall be a mixture of chipped

trunks, branches and stumps obtained from areas on site where vegetation is to be cleared and grubbed. Chipped material shall have a uniform consistency and be free of rock, soil and other unacceptable materials. Contractor may substitute bark mulch for chips.

2. Straw mulch shall be utilized on all newly graded areas to protect areas against washouts and erosion. Straw mulch shall be comprised of threshed straw of oats, wheat, barley, or rye that is free from noxious weeds, mold or other objectionable material. The straw mulch shall contain at least 50 percent by weight of material to be 10-in or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment.

E. Hay bales shall be bales made of straw of oats, wheat, barley, rye or natural hay and shall be utilized to control sediment runoff during construction activities. Each bale shall be either wire-bound or string-tied. Furnish oak wood stakes as indicated.

F. Biodegradable erosion control blanket/matting shall be installed in all seeded drainage swales and ditches as shown on the Drawings, on all slopes equal to or steeper than 3 horizontal to 1 vertical, or as directed by the Engineer. Erosion control blanket shall be 100 percent agricultural straw matrix stitch bonded with degradable thread between two photodegradable polypropylene nettings such as Model S150 Double Net Short-Term Blanket (10 months) by North American Green, Evansville, IN or equal.

G. Latex acrylic copolymer or organic tackifier shall be a commercial product specifically manufactured for use as straw mulch tackifier. Asphalt tackifier shall not be used.

H. Sediment traps shall be settling ponds used to collect and store sediment produced by construction activities. Traps shall be constructed by excavating a pond or by placing an earthen embankment across a low area or drainage swale. An outlet or spillway shall be constructed using aggregate to slow the release of runoff. Traps shall be sized to detain sediment laden runoff for a long enough time to allow sediment to settle out.

PART 3 - EXECUTION

3.1 GENERAL

A. Location of sediment traps, sediment fence, outlet protection, hay bale check dams and all other erosion and sediment control measures shall be located on the erosion control plans prepared in accordance with the Submittal requirements above. Contractor shall stake locations of all erosion control facilities in the field for review by the Engineer prior to installation.

B. Install and maintain all erosion and sedimentation control devices necessary to prevent the movement of sediment from the construction site to off site areas or into the surface water or wetlands resource areas via surface runoff, wind blown dust or underground drainage systems. Measures, in addition to those indicated, necessary to prevent the movement of sediment as a result of the Contractors activities shall be installed, maintained, removed, and cleaned up at no additional cost to the District.

C. The Contractor is responsible for implementation of any additional or modified erosion/sedimentation controls deemed necessary by the District, or as stipulated in the Construction General Permit at no additional cost to the District.

3.2 INSTALLATION

A. Sediment Fence Installation
   1. Sediment fence shall be positioned as necessary to prevent off site movement of sediment produced by construction activities.
   2. Dig trench approximately 6-in wide and 6-in deep along proposed fence lines.
   3. Drive wood-stakes, 8-ft on center (maximum) at back edge of trenches. Stakes shall be driven 2-ft (minimum) into ground
   4. Install pre-fabricated silt fence according to manufacturer's instructions.
   5. Backfill trench with excavated material and tamp.
   6. Do not install sediment fence across streams, ditches or waterways.
   7. To reduce maintenance, a shallow sediment storage area may be excavated on the up slope side of fence where sedimentation is expected.

B. Sediment Trap
   1. Install sediment traps in areas indicated.
   2. Clear, grub and strip all vegetation and root mat from area of embankment constructed of common fill.
   3. Place embankment fill in 9-in compacted lifts, maximum. Construct side slopes 2:1 or flatter (3:1 recommended for backslope to improve stability of stone spillway).
   4. Outlet crest elevation should be at least one foot below the top of the embankment.
   5. Excavate trapezoidal stone outlet section from compacted embankment. Allow for thickness of stone side slopes (21-in minimum).
   6. Install filter fabric under the setting bed of riprap. Extend fabric up the sides to top of embankment.
   7. Place specified stone to lines, grades and layered depths as shown in the erosion control plan submittal.
   8. Cover inside face of stone outlet section with 12-in crushed stone.

C. Where staging areas and access ways are not located on paved surfaces, they shall be surfaced with a minimum depth of 4-in of crushed rock underlain by filter fabric.

D. Riprap at Pipes and Swales
   1. Install riprap in areas indicated.
   2. Subgrade for riprap shall be cleared and grubbed to remove all roots, vegetation, and debris and prepared to the lines and grades indicated.
   3. Install filter fabric on smooth subgrade and overlap edges at least 12-in with anchor pins spaced 3-ft along overlap. Install crushed stone setting bed. Do not dump riprap from heights greater than 3-ft. Damaged areas of the fabric shall be repaired at no additional cost to the District by placing a piece of fabric over the damaged area with 12-in overlaps.
   4. Where riprap is used for pipe inlet or outlet or swale protection, install riprap in conjunction with construction of pipes or swales so that it is in place when the pipe or swale begins to operate.

E. Erosion Control Matting
   1. Erosion control matting shall be installed on all slopes equal to or steeper than 3 vertical to 1 horizontal or greater as shown on the Drawings and as directed by the Engineer in accordance with manufacturer's instructions. The area to be covered shall be properly prepared, fertilized and seeded with permanent vegetation before the blanket is applied. When the blanket is unrolled, the netting shall be on top and the fibers in contact with the soil over the entire area. The blankets shall be applied in the direction of water flow and stapled. Blankets shall be stapled together in accordance with manufacturer's instructions. Side overlaps shall be 4-in

minimum. The staples shall be made of wire, .091-in in diameter or greater, "U" shaped with legs 10-in in length and a 1-1/2-in crown. The staples shall be driven vertically into the ground, spaced approximately two linear feet apart, on each side, and one row in the center alternately spaced between each size. Upper and lower ends of the matting shall be buried to a depth of 4-in in a trench. Erosion stops shall be created every 25-ft by making a fold in the fabric and carrying the fold into a silt trench across the full width of the blanket. The bottom of the fold shall be 4-in below the ground surface. Staple on both sides of fold. Where the matting must be cut or more than one roll length is required, turn down upper end of downstream roll into a slit trench to a depth of 4-in. Overlap lower end of upstream roll 4-in past edge of downstream roll and staple.

2. To ensure full contact with soil surface, roll matting with a roller weighing 100 lbs/ft of width perpendicular to flow direction after seeding, placing matting and stapling. Thoroughly inspect slope after completion. Correct any areas where matting does not present a smooth surface in full contact with the soil below.
3. Inspect regularly for cracks, tears, or breaches and repair immediately at no additional cost to the District.

F. Surface Roughening
1. Roughen bare soil surfaces with horizontal grooves running across the slope, stair stepping or tracking with construction equipment to aid the establishment of vegetative cover from seed, and to reduce velocity and increase infiltration of stormwater.
2. Perform this activity on bare soil surfaces prior to all forecasted storm events and before leaving the job site for more than 2 days. If roughening is washed away in a heavy storm, re-rough the surface and apply new seed.

G. Temporary Seeding shall be performed in accordance with requirements of Section 32 92 21 herein, and as follows:
1. Apply temporary seed and mulch in areas including, but not limited to, topsoil stockpiles and other disturbed areas where construction activity ceases for more than 21 days after last construction activity in the area.
2. Apply in areas where diversion berms, sediment traps, temporary banks and stockpile areas are constructed.
3. Topsoil is not necessary for temporary seeding, however, successful growth requires that the soil be loosened or tilled before seed is applied.
4. Apply seed in quantities to protect seed bed and encourage plant growth. Apply water as needed to ensure adequate moisture for germination and vegetation establishment. Control amounts to prevent runoff.
5. Apply temporary seed, mulch, fertilizer mixture in a manner so as not to create nitrate problems in surface water or wetlands resource areas.
6. Apply temporary seed with temporary mulch.

H. Temporary Mulching
1. Apply temporary mulch to areas where rough grading has been completed but final grading is not anticipated to begin within 7 days of the completion of rough grading.
2. Straw mulch shall be applied at the rate of 100lbs/1000 sq ft and tackified with latex acrylic copolymer at a rate of 1 gal/1000 sq ft diluted in a ratio of 30 parts water to 1 part latex acrylic copolymer mix.

I. Stabilized Construction Entrance
1. Install stabilized construction entrance with materials specified herein and in locations indicated.

2. Maintain in a condition that will prevent tracking or flowing of sediment onto the public right of way. Topdress with additional stone to maintain surface. Replace when construction entrance becomes completely clogged.

3.3 MAINTENANCE AND INSPECTIONS

A. Inspections
   1. Make a visual inspection of all control devices once per week and promptly after every rainstorm of ½ inch or greater. If such inspection reveals that additional measures are needed to prevent movement of sediment to offsite areas or into drainage systems, promptly install additional devices as needed. Sediment controls in need of maintenance shall be repaired promptly.

B. Device Maintenance
   1. Sediment Fence and Hay Bale Barriers
      a. Remove and dispose of accumulated silt once it builds up to 1/2 of the height of the barrier.
      b. Replace damaged materials. Patch fabrics with a 2-ft minimum overlap.
      c. Make other repairs as necessary to ensure that the barrier is filtering all runoff directed to the barrier.
   2. Sediment Trap
      a. Muck out trapped sediment when it has built up to within 6-in of the top of the stone outlet.
      b. Replace crushed rock filter when saturated with silt.
   3. Add crushed rock to access ways and staging area as necessary to maintain a firm surface free of ruts and mudholes.

3.4 REMOVAL AND FINAL CLEANUP

A. Once the site has been permanently stabilized against erosion, remove and dispose of sediment control devices and all accumulated sediment. Dispose of waste materials in a legal, proper manner. Regrade all areas disturbed during this process and stabilize against erosion with surfacing materials as indicated in the erosion control plan.

End of Section

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the furnishing of labor, materials and equipment for the construction of asphaltic concrete base or binding course, bituminous tack coat, and asphaltic concrete surface or wearing course for the roadway, driveways and parking area as indicated on the Drawings.

B. Subgrade preparation shall be as indicated in the Excavation and Fill for Structures section, unless otherwise specified in the governing standards or herein.

C. Asphaltic concrete paving shall be constructed to the lines, grades, and cross sections indicated on the drawings. Type of construction shall be as indicated on the Drawings and as specified herein.

1.2 GENERAL

A. Governing Standards

1. Except as otherwise specified or indicated, materials, equipment, details, and construction methods shall comply with the applicable Arkansas DOT provisions.

B. Coordination

1. Contractor shall coordinate the construction of asphaltic concrete paving with the excavation, the construction of concrete curb and gutters and other construction.

1.3 SUBMITTALS

A. Design Mix Reports

1. All submittals of design mix reports including design mix test results and other data, shall be in accordance with the Submittals Procedures section.

B. Submittal Schedule.

1. Design mix data as specified below.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The sources of materials shall be acceptable to Engineer. Except as modified herein, materials shall conform to the requirements of the governing standards. Delivery tickets for all materials delivered to the site shall be submitted to Engineer at the end of each day during the progress of the work.

B. Asphaltic concrete materials shall be as follows:

Base.

Aggregate designation.	*Table 303-1 of Arkansas 2014 Standard Specification for Highway Construction*
Aggregate Class.	*Class 7*

Surface.

Asphalt concrete mix designation.	*Table 407-1 of Arkansas 2014 Standard Specification for Highway Construction*
Asphalt cement designation.	*PG 76-22, 64-22, & 70-22 (1/2")*

Tack coat.

Designation.	*Rapid curing cut-back or emulsified asphalt*
Rate.	*0.30 gallon per square yard*

2.2 DESIGN MIXES

A. A design mix for the asphalt base course and for the surface course, based upon the aggregates to be furnished, shall be determined by an independent testing laboratory at the expense of Contractor and shall be submitted to Engineer for review.

B. The design mixes shall be based on the Superpave Mix Design Method, and upon acceptance by Engineer, shall be the basis for the mixes to be used in asphaltic concrete pavement construction. The proposed design mix data submitted for review shall include at least the following:

1. Gyrations
    a. Nini
    b. Ndes
    c. Nmax
2. Effective voids (%)
3. Voids in mineral aggregate (%)
4. Minimum Asphalt Cement Content (%)

PART 3 - EXECUTION

3.1 EQUIPMENT

A. Equipment and facilities for storage, measuring, mixing, heating, transporting, spreading, compacting, and other operations shall be in accordance with the applicable requirements of the governing standards. Improved or modernized equipment which will produce results equal in quality to those which would result from the specified equipment will be considered for use. All equipment and facilities shall be acceptable to Engineer.

3.2 SUBGRADE PREPARATION

A. As a minimum, the top *6* inches of the subgrade shall be compacted to *95* percent of standard proctor density at optimum moisture content as determined by governing standards. In addition, the stability of subgrades shall be such that when materials for construction are deposited on the subgrade no rutting or displacement of the subgrade by material hauling vehicles will occur. No materials shall be placed on subgrades which are muddy, frozen, or have frost, snow, or water thereon. Subgrades shall be thoroughly compacted and properly shaped before any surfacing materials are placed. All subgrade and surfacing shall be sloped toward drains or outer edges.

3.3 PAVEMENTS

A. Unless otherwise specified, the new pavements to be constructed shall consist of an asphaltic concrete base course and an asphaltic concrete surface course, each of the thickness indicated on the Drawings. Asphaltic concrete base course shall be placed in compacted lifts no greater than 4 inches. Asphaltic concrete surface course shall be placed in compacted lifts no greater than 2 inches.

B. Grade control shall be maintained by Contractor by means of automatic screed controls on the paving machine and by use of erected and mobile string lines as applicable. The use of the automatically controlled paver may be waived by Engineer on irregular sections. Finished surfaces shall conform to the lines and grades indicated on the Drawings.

C. Asphaltic concrete pavements shall be constructed on previously prepared subgrades in accordance with the sections, in compliance with the governing standards.

D. Asphalt mixtures may be spread and finished by hand methods only where machine methods are impractical as determined by Engineer. Hand placed mixtures shall not be cast or otherwise manipulated in such manner that segregation occurs.

E. Minimum temperatures under which asphaltic concrete pavements may be constructed shall be as stipulated in the governing standards.

3.4 REPAIR OF DEFECTS

A. Contractor shall remove and replace defective areas by cutting to the full depth of the course. Cuts shall be made perpendicular and parallel to the direction of traffic with edges vertical.

B. A tack coat shall be applied to all exposed surfaces. The area shall be filled with fresh hot asphaltic concrete mix in lifts of the same depths as the adjacent area, then compacted by rolling to specified surface density and smoothness.

3.5 CLEANING

A. After completion of paving operation, all areas shall be cleaned of excess spilled asphalt materials to the satisfaction of Engineer.

3.6 PROTECTION

A. In addition to the requirements for protection stipulated in the governing standards, Contractor shall protect all adjacent concrete and masonry so that no damage will occur as the result of subsequent construction operations. All damage or discoloration shall be repaired to the satisfaction of Engineer before final acceptance by Owner.

B. Special care shall be taken to prevent tack or other asphalt materials from spraying or splashing. Adjacent construction shall be protected by covering with suitable fabric or paper.

End of Section

SECTION 32 16 16 - CONCRETE SIDEWALK, CURB, AND GUTTER

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the construction of concrete sidewalks, curb and gutter. This section also covers the reconstruction of concrete sidewalks, curb, and gutter.

B. Subgrade preparation shall be as indicated in the Excavation and Fill for Structures section, unless otherwise specified in the governing standards or herein.

1.2 GENERAL

A. All existing sidewalks, and curb and gutters disturbed or damaged during construction of new work, or indicated on the Drawings to be demolished and replaced shall be reconstructed to the lines, grades, and cross sections indicated on the Drawings. Damaged curbs, sidewalks and/or gutters shall be to restored to their original locations, cross sections, and style unless indicated otherwise on the Drawings.

B. Contractor shall be responsible to remove, construct, reconstruct, and adjust as necessary all existing or new manhole tops, curb and gutter, and area drainage structures to match new grades as needed.

C. Governing Standards

1. Except as otherwise specified or indicated on the Drawings, materials, equipment, details, and construction methods shall comply with the applicable Arkansas DOT standards.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The sources of materials shall be acceptable to Engineer. Except as otherwise modified herein, materials shall conform to the requirements of the governing standards.

B. Concrete materials shall be as follows:

Sidewalks, Curbs, and Gutters

Concrete designation.	*City of Springdale Standard Specification Section Division 600 Class A*
Portland cement designation.	*AASHTO M85 Type 1*
Membrane curing compound.	*AASHTO M148, Type I-D or Type 2*

2.2 DESIGN MIXTURE DATA

A. The design mixture shall be as follows:

Cement content.	*5.5*	bag/yd³
Water content.	*6.5*	gallons/bag
Consistency (slump).	*1-4*	
Compressive strength (28 days).	*3,000*	

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

A. As a minimum, the top 6 inches of the subgrade shall be compacted to a 95 percent of standard proctor density at optimum moisture content as determined by governing standards. In addition, the stability of subgrades shall be such that when materials for construction are deposited on the subgrade no rutting or displacement of the subgrade by material hauling vehicles will occur. No materials shall be placed on subgrades which are muddy, frozen, or have frost, snow, or water thereon. Subgrades shall be thoroughly compacted and properly shaped before any surfacing, curb and gutter, or sidewalk materials are placed. All subgrade and surfacing shall be sloped as indicated on the Drawings, and as needed to achieve a uniform slope between new and existing surfaces. Sidewalks shall slope toward one edge.

3.2 CONCRETE SIDEWALKS

A. Concrete shall be placed, vibrated, and finished as described in the governing standards.

B. One-half inch expansion joints shall be provided where sidewalks abut a curb, structure, existing sidewalk, at changes in directions, and at intervals of not more than 40 feet . Expansion joints shall be filled to within 3/4 inch of the surface with bituminous expansion joint material, and then filled flush to the surface with self-leveling caulking in accordance with the Joint sealant section. The joint sealing compound shall be finished slightly concave, and shall not be allowed to overflow the joint.

C. Concrete sidewalks shall be screeded to the proper elevation and contour. All aggregates shall be completely embedded in mortar. Screeded surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance, with no unnecessary working of the surface. A second floating at the time of initial set shall follow initial floating.

D. Floated surfaces shall be given a light broom finish, using a horsehair broom, to provide a nonslip surface. Brooming shall be at right angles to the length of the curb, walk, or gutter.

E. Sidewalks shall be edged using a 3 to 4 inch wide edging tool with a 1/8 inch corner radius. Edger lap marks at corners of each slab shall be carefully removed. False joints shall be provided at right angles to the length of the walk, using a grooving tool with 1/8 inch radius and a depth of 1.2 inch . The finished edge on each side of the joint shall be the same width as the edging tool used. False joints shall divide each sidewalk into square sections.

F. The finished surface of all sidewalks shall be neat in appearance, shall be sloped to drain, and shall not pond water.

G. The finished concrete shall be cured and protected as stipulated in the governing standards.

3.3 CONCRETE CURB AND GUTTER

A. New concrete curb and gutter shall be as indicated on the Drawings and specified herein. Replacement concrete curb and gutter shall match the existing curb and gutter. Unless otherwise authorized by Engineer, adjacent and enclosed curbs, drainage structures, and gutters shall be placed before placement of pavement sections.

B. Expansion and contraction joints shall be formed at right angles to the alignment of the curb and/or gutter and to the depths as specified, as indicated on the Drawings, and in conformance with the governing standards. One half inch wide expansion joints shall be placed full depth using a premolded expansion joint material, cut to the configuration of the full size of the section, being secured so that they are not moved by depositing, compacting or finishing the concrete at these joints. The edges of these joints shall be rounded by an edging tool of 1/8 inch radius.

C. Expansion joints shall be placed at the beginning and end of radii, where curbs and gutters abut structures, and at intervals of approximately 45 feet .

D. Contraction joints shall be a minimum of 1-1/2 inches deep on all sides, shall be spaced at approximately 15 foot intervals, and shall be formed by a 1/8 inch thick steel template, cut to the configuration of the section. These templates shall be secured so they are not moved by depositing, compacting or finishing the concrete.

E. Unless otherwise indicated on the drawings, and as soon as the concrete has hardened sufficiently, the templates shall be removed from all contraction joints. The edges of the joint shall be rounded with an edging tool having a maximum radius of 3/8 inch .

F. All expansion and contraction joints shall be filled flush to the surface with joint sealing compound. The joint sealing compound shall be finished slightly concave and shall not be allowed to overflow the joint.

G. <u>Forms</u>

1. Forms shall be in conformance with the governing standards. All forms shall be in good condition, with not more than 1/8 inch variation in horizontal and vertical alignment for each 10 feet in length. Side forms shall have a depth at least equal to the edge thickness of the concrete being formed. The forms shall be set true to line and grade and shall be adequately supported to stay in position while depositing and consolidating the concrete.

Forms shall be designed and constructed so as to permit their removal without damage to the concrete.

H. Joints

1. Expansion and contraction joints shall be formed at right angles to the alignment of the curb and gutter and to the depths as specified, as indicated on the Drawings, and in conformance with the governing standards.

   a. Expansion Joints. One half inch wide expansion joints shall be placed full depth using a premolded expansion joint material, cut to the configuration of the full size of the Curb and Gutter section, being secured so that they are not moved by depositing and compacting the concrete at these joints. The edges of these joints shall be rounded by an edging tool of 1/8 inch radius.

      Expansion joints shall be placed at the beginning and end of radii, where curbs and gutters abut structures, and at intervals of approximately 45 feet .

   b. Contraction Joints. Contraction joints shall be a minimum of 1-1/2 inches deep on all sides, shall be spaced at approximately 15 foot intervals, and shall be formed by a 1/8 inch thick steel template, cut to the configuration of the Curb section. These templates shall be secured so that they are not moved by depositing and compacting the concrete.

      Unless otherwise indicated on the Drawings, and as soon as the concrete has hardened sufficiently, the templates shall be removed from all contraction joints. The edges of the joint shall be rounded with an edging tool having a maximum radius of 3/8 inch .

2. All expansion and contraction joints shall be filled flush to the surface with joint sealing compound. The joint sealing compound shall be finished slightly concave and shall not be allowed to overflow the joint.

I. Finishing

1. Curb and gutter shall be finished to the shape indicated on the Drawings. After the forms have been removed, all exposed edges shall be rounded, using an edging tool with a 1/8 inch corner radius. Exposed surfaces shall be float finished and given a light broom finish applied at right angles to the curb at the time of initial set, using a horsehair broom. Mortar or dryer shall not be used to remove imperfections. In all cases, the resulting surface shall be smooth and of uniform color with all rough spots, projections, and form stakes removed. No plastering of the concrete will be allowed. The finished curb shall have a true surface, free from sags, twists, or warps; shall have a uniform appearance; and shall be true to the original lines, grades, and configurations indicated on the Drawings.

3.4 PROTECTION

A. In addition to the requirements for protection set forth in the governing standards, Contractor shall protect all adjacent concrete and masonry so that no damage will occur as the result of subsequent construction operations. All damage or discoloration shall be repaired to the satisfaction of Engineer before final acceptance by Owner.

B. Special care shall be taken to prevent bituminous materials from spraying or splashing. Adjacent construction shall be protected by covering with suitable fabric or paper.

End of Section

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SECTION 32 92 21 - SEEDING AND SODDING

PART 1 - GENERAL

1.1 SCOPE

A. This section covers seeding and sodding to be performed after backfilling and final grading are complete. All areas disturbed by construction operations shall be treated as specified herein.

B. All lawn, ditch, and street shoulder areas within street right-of-way and temporary construction easements that are damaged during the Work shall be restored, after completion of construction, to the complete satisfaction of Owner. All areas disturbed by Contractor outside the temporary construction easements shall be restored, at Contractor's expense, to the satisfaction of the property owner, except that if the temporary construction easement through the ownership is sodded all disturbed areas outside the construction easement shall also be sodded. Occupying areas outside temporary construction easements, street right-of-way, and utility easements for any purpose shall be done only with the written approval of the property owner.

1.2 GENERAL

A. Governing Standard

1. The governing standard for the seeding and sodding work shall be the *Arkansas State Plant Board*.

B. Experience

1. All Work shall be performed by a licensed landscaping Contractor who is licensed in the State of *Arkansas*.

2. Work shall be performed by a contractor acceptable to the Engineer, with at least four years seeding and sodding experience.

C. Completion

1. Seeding Work shall be completed during the period of *March 15 to August 31*. At Owner's option, a portion of the final payment not to exceed one (1) percent of the contract price may be retained until an acceptable stand for all grass/ground cover is established. Seeding requirements are as follows:

a. Locations to be seeded. Areas disturbed by construction and as indicated on the Drawings.

2. Sodding shall be completed during the period of *March 15 to August 31*. Sodding requirements are as follows:

a. Locations to be sodded. Areas within 20’ of asphalt or concrete pavement, waterways, and locations with a finished slope of 4:1 or steeper.

1.3 SUBMITTALS

A. Soil Test

1. Soil shall be tested to determine nutrient needs by the state Extension Service or an independent agricultural soil testing lab. Composite sample(s) shall be collected and submitted in accordance with lab instructions. Lab report and nutrient recommendations shall be provided to the Engineer.

B. Invoices and Analysis Labels

1. A copy of supplier’s invoices for all seed, mulch, and fertilizer which shows the quantity by weight purchased for the project and representative labels bearing the manufacturer’s or vendor’s guaranteed statement of analysis shall be submitted to Engineer for review and approval to assure compliance with specified requirements for quality and application rates.

1.4 GUARANTEE

A. Seeding

1. Contractor shall guarantee a uniform stand of seeding, free of weeds to the extent practical, and acceptable to Owner.

B. Sodding

1. Contractor shall guarantee the sodding Work to the extent that all transplanted sod shall be uniform in color, leaf texture, shoot density, and reasonably free of visible imperfections at acceptance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

B. Prior to use, all products shall be kept dry and in a weatherproof location so that their effectiveness will not be impaired.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials shall conform to the requirements of the Governing Standard, except where otherwise specified.

B. Starter Fertilizer

1. Fertilizer shall be a complete pelleted or granulated fertilizer. The analysis in percent by weight shall be as follows:

	Seeded Areas
Nitrogen	*10%*
Phosphorus	*20%*
Potassium	*10%*

C. Seed

1. The seed species and the mixture shall be *as follows, in accordance with the Governing Standard.*

	Seed Type	LB/AC
March 15-June 15	Turf Fescue	250
	Bermuda Grass (common) unhulled	10
	Annual Rye	50
June 15-August 31	Turf Fescue	200
	Bermuda Grass (common) unhulled	5
	Bermuda Grass (common) unhulled	10
August 31-March 15	Turf Fescue	250
	Annual Rye	50

D. Sod

1. Sod shall have been planted on cultivated agricultural land and grown specifically for sod purposes and shall conform to the quality standards of Nursery Grown Sod as defined by the Turfgrass Producers International. Sod shall be free of objectionable grassy and broad leaf weeds. Sod shall be considered free of such weeds if less than five such plants are found per 100 square feet of area. The sod species shall be *Bermuda, Zoysia, or St. Augustine grass.*

E. pH Adjustment

1. If laboratory soil testing indicates the need for increased soil pH the Contractor shall add agricultural lime as a soil amendment. Addition rate(s) shall be determined by analysis of soil sample(s) subjected to laboratory testing. Addition rate(s) shall be as recommended by state Extension Service guidelines and/or local horticultural agencies and as approved by Engineer. If laboratory soil testing indicates the need for decreased soil pH the Contractor shall add agricultural sulfur, aluminum sulfate or iron sulfate as a soil amendment. Addition rate(s) shall be determined by analysis of soil sample(s) subjected to laboratory testing. Addition rate(s) shall be as recommended by state Extension Service guidelines and/or local horticultural agencies and as approved by Engineer.

F. Topsoil

1. Topsoil shall be fertile, natural soil, typical of the locality, free from stones, roots, sticks, clay, peat, weeds, and sod, and obtained from naturally well drained areas. It shall not be excessively acidic or alkaline nor contain toxic material harmful to plant growth. Stockpiled topsoil may be used but the Contractor shall furnish additional topsoil at his own expense if required.

G. Mulch

1. Mulch shall be a specially processed cellulose fiber containing no growth or germination inhibiting factors, or shall consist of straw from hay and shall include a tackifier. Mulch for hydroseeding operation shall be a wood mulch or combination wood and paper mulch in accordance with the Governing Standard.

PART 3 - EXECUTION

3.1 GENERAL

A. Execution of seeding and sodding Work shall conform to the Governing Standard, or shall be as specified herein, whichever is the most stringent.

B. Clearing

1. Prior to finish grading, areas to be seeded or sodded shall be cleared to remove stumps, stones larger than 3 inches , roots, cable, wire, debris or other materials that might hinder seeding and/or sodding and future turf maintenance.

C. Finish Grading

1. Seeding and/or sodding shall not be started until all earthwork has been substantially completed. Backfills and fills shall be allowed to settle, the topsoil spread, and finish grading completed before the Work is started. Finish grading shall result in a surface conforming to the contours indicated on the Drawings.

D. Application of Fertilizer and pH Adjustment

1. After finish grading, any fertilizer or chemicals for pH adjustment specified shall be applied uniformly to areas to be seeded.

2. Fertilizer application rate shall be *43* lbs/acre. Chemicals for pH adjustment shall be applied at a rate based on a soil test for pH. The rate shall be adequate to neutralize the soil.

E. Final Preparation

1. Following application of additives and/or fertilizers the areas to be seeded and/or sodded shall be tilled to a true depth of 6 inches by disking, harrowing, or other accepted methods to thoroughly incorporate the additives and fertilizer, destroy vegetation, and pulverize the soil. After tilling, the bed shall be smoothed by dragging or floating. The surface shall be cleared of all stones, stumps or other objects larger than 1-1/2 inches in thickness or diameter; roots, wire, grade stakes, and other objects that might hinder future turf maintenance operations.

2. When results are not satisfactory because of drought, excessive moisture or other causes, the Work shall be stopped until such conditions have improved or have been corrected.

3. When possible, operations shall be performed parallel to the contour lines and operations uphill and downhill shall be avoided.

3.2 SEEDING

A. Seed Application

1. Seed shall be applied within 72 hours after preparation of the seedbed. Seed shall be applied with equipment designed to give uniform application. Any method or combination of methods which uniformly distributes the seed directly in contact with the soil, covers the seed, and firms the bed, may be selected. Seed shall be placed approximately 1/4 inch below the surface.

B. Mulching

1. All seeded areas shall be mulched within 24 hours following seed application. The mulching operation shall be in accordance with the Governing Standard. Mulch shall be placed at a rate of *800* lbs/acre. Mulch shall be placed to a thickness of approximately 2 inches.

3.3 HYDROSEEDING

Specifier. Consult with Owner and/or local horticultural agencies to determine optimum rate mulch application. These rates usually vary from 1500 to 2000 lbs per acre.

A. Seed Application

1. Seed shall be applied within 72 hours after preparation of the seedbed. The wood cellulose fiber mulch shall be applied at the minimum rate of *2000* lb/acre in two separate operations. Ten percent of the specified rate of fiber mulch shall be applied with the seed and the remainder applied after seeding.

3.4 SODDING

A. Application of Sod

1. Sod shall be placed within 72 hours after preparation of the sod bed. Sod shall be cut and moved only when the soil moisture conditions are such that favorable results can be expected. When the soil is too dry, the sod shall be cut only after Contractor has watered the sod sufficiently to moisten the soil to the depth at which the sod is to be cut.

2. Care shall be exercised at all times to retain the native soil on the roots of the sod during the process of stripping, transporting, and planting. Dumping from vehicles will not be permitted.

3. The sod shall be transplanted within 24 hours from the time of stripping, unless stored in a satisfactory manner. During delivery and while in stacks, the sod shall be kept moist and shall be protected from exposure to the air and sun.

4. Sod shall be laid smoothly, edge-to-edge, and with staggered joints. The sod shall be immediately pressed firmly into contact with the sod bed by tamping or rolling with acceptable equipment so as to eliminate all air pockets, provide a true and even surface, and assure knitting.

5. Staking is not required, except in ditch flow lines; however, Contractor will be responsible for replacing all sod that is displaced by erosion during the maintenance period. Only wooden (lath) stakes shall be used.

3.5 WATERING

A. Seeded Areas

1. Watering for seeded areas will not be required.

B. Sodded Areas

1. Contractor shall provide all water, labor, and equipment for watering sodded areas. Sodded areas representing one day’s planting shall be watered sufficiently to wet the sod pads and at least 2 inches of the sod bed. Thereafter, in the absence of adequate rainfall,

watering shall be performed daily and as often as necessary to keep the sod pads moist at all times. Watering of sod shall continue as needed until final acceptance.

3.6 REPLANTING

A. Seeded Areas

1. Unacceptably seeded areas shall be overseeded or completely reseeded as instructed by Engineer. Unless otherwise permitted by Engineer, reseeding shall be performed during the next planting season.

B. Sodded Areas

1. Prior to acceptance, sodded areas that show signs of substantial desiccation as evident by a loss of color and a distinct yellowing shall be resodded and shall continue to be resodded until an acceptable sod cover is obtained. Replanting operations shall be as specified except that fertilizer and lime shall be deleted from the operation.

3.7 MAINTENANCE

A. All areas shall be maintained until final acceptance of the project.

B. Seeded Areas

1. Maintenance shall include any necessary reseeding, repair of erosion damage, and replacement of displaced mulch until covered with seedlings. In the event erosion occurs from either watering operations or rainfall, such damage shall be repaired.

C. Sodded Areas

1. Original grades of the sodded areas shall be maintained after commencement of planting operations and until acceptance. Any damage to the finished surface shall be repaired. In the event erosion occurs from either watering operations or rainfall, such damage shall be repaired. Ruts, ridges, tracks, and other surface irregularities shall be corrected and areas resodded.

2. During the maintenance period prior to acceptance, all sodded areas shall be mowed to height of 3 inches as soon as, and each time that, the grass reaches an average height of 5 inches . Clippings shall be collected and removed from the Site.

End of Section

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SECTION 33 1313 - CLEANING AND DISINFECTION OF WATER PIPELINES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers cleaning and disinfection of all water pipelines installed under this Contract.

B. Pipeline pressure and leakage testing is covered in the Pipeline Pressure and Leakage section.

C. Disinfection of structures is covered in the Cleaning and Disinfection of Structures section.

1.2 GENERAL

A. Coordination

1. Contractor shall coordinate cleaning and disinfection work with adjacent work as necessary to preclude work interferences or duplication of effort and to expedite the overall progress of the work.

2. Contractor shall provide all necessary piping, piping connections, temporary valves, backflow preventers, flowmeters, sampling taps, pumps, disinfectant, neutralization agents, chlorine residual test apparatus, and all other items of equipment or facilities necessary to complete the cleaning and disinfection work.

3. Water for cleaning and disinfection work will be provided as stipulated in the Temporary Facilities and Controls section.

4. In all cases where it is necessary to interrupt service, permission of Owner shall be obtained at least two days before the service will be interrupted. In all cases where it is necessary to interrupt service to water customers, permission of the Owner shall be obtained and each customer affected shall be notified of the proposed service interruption and its possible duration in accordance with the Work Covered by Contract Documents section.

5. Unless otherwise specified, final cleaning and disinfection work shall not be performed until after hydrostatic testing of the pipelines and any resulting repair work completed.

6. Contractor shall notify Owner and Engineer prior to the work to allow their representatives to be present during cleaning and/or disinfection of the pipelines.

B. Related Work

1. Other sections directly related to work covered in this section are the Pipeline Pressure and Leakage Testing section.

C. Governing Standard

1. All disinfection work shall conform to the requirements of ANSI/AWWA C651, ANSI/AWWA C652 as specified herein, and the requirements of Arkansas Department of Health (ADH), except as modified herein. If any State or local requirements conflict with the provisions of this section, the State and local requirements shall govern.

2. Contractor shall notify Federal, State, and local regulatory agencies to determine if any special procedures or permits are required for disposal of neutralized or diluted chlorinated water from the final flushing of pipelines and to identify acceptable locations for disposal of the flushing water. All requirements and costs associated with notification and obtaining any discharge permits shall be the responsibility of the Contractor.

D. Experience

1. The disinfection work shall be performed by a subcontractor specialized in such work, or with the permission of Engineer, Contractor may provide the necessary equipment and do the work with his own personnel. In either case, all work shall be done under the direct supervision of a competent and experienced specialist in such work.

2. Personnel performing the disinfection shall demonstrate a minimum of 5 years experience in the chlorination and dechlorination of similar pipelines.

E. Special Cleaning and Disinfection Requirements

1. Special cleaning and disinfections requirements include the following:

a. Initial high-pressure washing and cleaning of pipeline.
b. Filling pipeline.
c. Hydrostatic pressure and leakage testing.
d. Disinfection.
e. Final cleaning, flushing, and neutralization of heavily chlorinated water.
f. Fill with potable water. Allow 24 hours before first bacteriological test.
g. Bacteriological tests, first set.
h. Bacteriological tests, second set (24 hours after first bacteriological tests)
i. Final test results 48 hours after second bacteriological test, unless time falls on a weekend or holiday, in which case the final results will be available on the next business day.
j. Re-disinfection, if required.

1.3 SUBMITTALS

A. Cleaning and Disinfection Plan

1. Unless otherwise specified, Contractor shall submit a detailed cleaning and disinfection plan to Engineer 30 days prior to starting any cleaning and disinfection work. The plan shall cover the method and procedure proposed, necessary coordination, qualification of personnel performing the disinfection work, sequence of operations, the limits of the pipelines to be cleaned and disinfected, the positions of all valves, location of temporary

bulkheads, materials and quantities of each to be used, equipment to be used, manner of filling and flushing the pipelines, chlorine injection points, sample points, bacteriological testing location and schedule, potable water source, method of metering the water if required, neutralization and disposal of wasted water, and all other methods and procedures to be followed in performing the cleaning and disinfection work.

B. Testing

1. Bacteriological testing shall be performed by Owner's staff.

2. Contractor shall provide all items of equipment, piping, and other facilities necessary to assist with the collection of the samples as required. Locations for bacteriological sampling shall be in accordance with the governing standards or as acceptable to the Owner.

3. The chlorine residual tests shall be performed by Contractor. The test logbook shall be made available to Owner or Engineer upon request and shall be submitted to Engineer upon completion of all chlorine residual testing.

1.4 QUALITY ASSURANCE

A. Chlorine Residual Tests

1. Contractor shall provide the necessary apparatus for making the chlorine residual tests by the drop dilution method in Appendix A of ANSI/AWWA C651 or Appendix A of ANSI/AWWA C652 as applicable to the disinfection method specified herein. Test results shall be recorded in a logbook that includes for each test: the location, date, time, test results, and test kit manufacturer.

B. Bacteriological Tests

1. Sampling and testing of water in the pipelines shall be performed after final flushing in accordance with Section 5 of ANSI/AWWA C651. Two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected and standard heterotrophic plate counts measured for each sample.

C. Redisinfection

1. Should the bacteriological tests indicate the presence of coliform organisms at any sampling point, the pipelines shall be reflushed, resampled and retested in accordance with Section 5 of ANSI/AWWA C651. If check samples show the presence of coliform organisms, then the pipelines shall be rechlorinated until acceptable results are obtained.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials furnished by Contractor shall conform to the requirements of ANSI/AWWA C651 and shall be clean and free of debris which could infer questionable test results.

B. Liquid Chlorine

1. Liquid chlorine shall conform to AWWA B301.

C. Calcium Hypochlorite (Dry)

1. Calcium hypochlorite shall conform to AWWA B300.

D. Sodium Hypochlorite (Solution)

1. Sodium hypochlorite shall conform to AWWA B300.

E. Chlorine Residual Test Kit

1. Chlorine residual concentration shall be measured using an appropriate range, drop count titration kit or an orthotolidine indicator comparator with wide range color discs. The color disc range shall be selected to match chlorine concentration limits. Test kits shall be maintained in good working order and available for immediate test of residuals at point of sampling. Test kits manufactured by Hach Chemical or Orbeco-Hellige are acceptable.

PART 3 - EXECUTION

3.1 APPLICATION

A. Cleaning

1. Pipelines, including all associated valves and fittings, shall be cleaned to the satisfaction of Owner and Engineer.

2. Pipelines less than 30-inches in diameter shall be cleaned by flushing with water at the maximum velocity which can be developed, but not less than 3.0 feet per second , unless otherwise permitted by Engineer. Flushing shall continue until the pipeline is free of dirt, debris, and other foreign materials. Cleaning shall precede disinfection.

3. Pipelines greater than or equal to 30-inch in diameter shall be cleaned with a hose, or cleaned by other methods acceptable to Engineer in accordance with ADH requirements. Cleaning methods shall continue until the pipeline is free of dirt, debris, and other foreign materials. Cleaning shall precede disinfection.

4. Flushing shall be accomplished through the installed valves or fittings, blow-offs or through temporary flushing connections installed for that purpose and in accordance with any details indicated on the Drawings. Contractor shall provide all temporary piping and fittings required to supply, and dispose of, flushing water. Drainage of flushing water to building drainage systems is not acceptable.

5. Booster pumps shall be used if needed to obtain the necessary volume or velocity of water. Pumping equipment installed under this Contract shall not be used for flushing, nor shall the flushing water be passed through them or other installed equipment; temporary bypass piping at each pump or installed equipment shall be provided as needed.

B. Disinfection Procedure

1. The pipelines shall be disinfected by the Chlorination Method 2 in accordance with ANSI/AWWA C652 for large diameter pipelines. The tablet method or slug method shall be used for the Fayetteville transmission main. Potable water shall be used in conjunction with the chlorination agent.

2. For the continuous feed or slug method, the chlorination agent shall be injected into the line at the supply end of each new pipeline or valved section thereof.

3. Admission of disinfectant solution into or the flushing thereof through existing piping shall be held to the minimum possible, and then only after adequate measures have been taken to prevent any such solution of chlorinated wastewater from entering branch service connections to water customers or other piping systems.

4. During disinfection, all valves and hydrants shall be operated to ensure that all appurtenances are disinfected. Valves shall be operated such that the chlorine solution in the pipeline being chlorinated will not flow back into the supply line. Check valves shall be used if needed.

5. Existing pipelines which may become contaminated during work requiring connections to the new pipeline, involving either tapping or cutting into operations, shall be flushed and disinfected in accordance with Section 4 of ANSI/AWWA C651.

C. Final Flushing

1. Upon completion of chlorination, but before sampling and bacteriological testing, all heavily chlorinated water shall be removed from the lines by flushing with potable water until the chlorine residual in the lines is not higher than that generally prevailing in the adjacent existing system or as acceptable to the Owner.

2. Final flushing shall be accomplished as specified for cleaning of pipelines.

D. Disposal of Chlorinated Wastewater

1. All chlorinated wastewater to be discharged shall be neutralized by chemical treatment and disposed in accordance with Section 4 of ANSI/AWWA C651, ANSI/AWWA C655 and the requirements of the governing agency specified herein. Schedule, rates of flow,

and locations of discharge of disinfection and flushing water shall be coordinated with Owner, Engineer, and applicable State and local regulatory agencies and in accordance with all applicable rules and regulations.

End of Section

SECTION 33 13 14 - CLEANING AND DISINFECTION OF STRUCTURES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the cleaning and disinfection of all structures as specified herein.

B. Unless otherwise specified, disinfection work shall not be started until cleaning and leakage testing of structures has been completed. Leakage testing of structures is covered in the Tightness Testing of Structures section.

C. Disinfection of water pipelines is covered in the Cleaning and Disinfection of Water Pipelines section.

1.2 GENERAL

A. Coordination

1. Contractor shall coordinate cleaning and disinfection work with adjacent work under contract as necessary to preclude work interference or duplication of effort and to expedite the overall progress of the work.

2. Contractor shall provide all necessary piping, piping connections, temporary valves, backflow preventers, flowmeters, sampling taps, pumps, disinfectant, neutralization agents, chlorine residual test apparatus, and all other items of equipment or facilities necessary to complete the disinfection work.

3. Water required for cleaning and disinfection of structures will be provided as stipulated in Temporary Facilities and Controls section.

4. In all cases where it is necessary to interrupt service, permission of Owner shall be obtained at least 30 days before the service will be interrupted. In all cases where it is necessary to interrupt service to water customers, permission of the Owner shall be obtained and each customer affected shall be notified of the proposed service interruption and its possible duration in accordance with the Work Covered by Contract Documents section.

5. Unless otherwise specified, final cleaning and disinfection work shall not be performed until after tightness testing of the structures and any resulting repair work completed.

6. Contractor shall notify Owner and Engineer prior to the work to allow their representatives to be present during cleaning and/or disinfection of the structures.

B. Related Work

1. Other sections directly related to work covered in this section are the Tightness and Testing of Structures section.

C. Governing Standard

1. Cleaning and disinfection shall conform to the requirements of ANSI/AWWA C650, C652, and C653 and the requirements of Arkansas Department of Health (ADH). If any State or local requirements conflict with the provisions of this section, the State and local requirements shall govern.

2. Contractor shall notify Federal, State, and local regulatory agencies to determine if any special procedures or permits are required for disposal of neutralized or diluted chlorinated water from the final flushing of pipelines and to identify acceptable locations for disposal of the flushing water. All requirements and costs associated with notification and obtaining any discharge permits shall be the responsibility of the Contractor.

D. Experience

1. The disinfection work shall be performed by a subcontractor specialized in such work, or with the permission of Engineer, Contractor may provide the necessary equipment and do the work with his own personnel. In either case, all work shall be done under the direct supervision of a competent and experienced specialist in such work.

2. Personnel performing the disinfection shall demonstrate a minimum of 5 years experience in the chlorination and dechlorination of similar structures.

E. Special Cleaning and Disinfection Requirements

1. Special cleaning and disinfection requirements include the following:

a. Initial cleaning of structures.
   1) Vent and overflow screens should be installed following initial cleaning.

b. Tightness testing in accordance with the Tightness and Testing of Structures section.
c. Disinfection.
d. Final cleaning, flushing, and neutralization of heavily chlorinated water.
e. Fill with potable water. Allow 24 hours before first bacteriological test
f. Bacteriological tests, first set.
g. Bacteriological tests, second set (24 hours after first bacteriological tests)
h. Final test results 48 hours after second bacteriological test, unless time falls on a weekend or holiday, in which case the final results will be available on the next business day.
i. Redisinfection, if required

1.3 SUBMITTALS

A. Cleaning and Disinfection Plan

1. Prior to starting any disinfection work, Contractor shall submit a detailed cleaning and disinfection plan to the Engineer 30 days prior to starting the cleaning disinfection work. The plan shall cover the method and procedure proposed, necessary coordination, qualification of personnel performing the disinfection work, sequence of operations, equipment to be used, the position of all valves, location of temporary bulkheads, materials and quantities of each to be used, chlorine injections points, sample points, bacteriological testing location and schedule, manner of filling and flushing each structure specified herein to be disinfected, including method of metering water if required, the neutralization and disposal of wasted water, and all other methods and procedures in performing the cleaning and disinfection work.

B. Testing

1. Bacteriological testing shall be performed by Owner's staff.

2. Contractor shall provide all items of equipment, piping, and other facilities necessary to assist with the collection of the samples as required. Locations for bacteriological sampling shall be in accordance with the governing standards or as acceptable to the Owner.

3. The chlorine residual test shall be performed by Contractor. The test log shall be made available to Owner or Engineer upon request and shall be provided to Engineer upon completion of all chlorine residual testing.

1.4 QUALITY ASSURANCE.

A. Chlorine Residual Tests

1. Contractor shall provide the necessary apparatus for making the chlorine residual tests by the drop dilution method as set forth in Appendix A of ANSI/AWWA C652. Test results shall be recorded in a logbook that includes for each test: the location, date, time, test results, and test kit manufacturer.

B. Bacteriological Tests

1. Sampling and testing of water in the structures shall be performed after the chlorination procedure is complete in accordance with Section 5 of ANSI/AWWA C652. Two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected and standard heterotrophic plate counts measured for each sample.

C. Redisinfection

1. Should the bacteriological tests indicate the presence of coliform organisms at any sampling point, the structure shall again be subject to disinfection in accordance with Section 5 of ANSI/AWWA C652.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials furnished by Contractor shall conform to the requirements of ANSI/AWWA C652 and shall be clean and free of debris which could infer questionable test results.

B. Liquid Chlorine

1. Liquid chlorine shall conform to ANSI/AWWA B301.

C. Calcium Hypochlorite (Dry)

1. Calcium hypochlorite shall conform to ANSI/AWWA B300.

D. Sodium Hypochlorite (Solution)

1. Sodium hypochlorite shall conform to ANSI/AWWA B300.

E. Chlorine Residual Test Kit

1. Chlorine, residual concentration shall be measured using an appropriate range, drop count, titration kit or an orthotolidine indicator comparator with wide range color discs. The color disc range shall be selected to match chlorine concentration limits. Test kits shall be maintained in good working order and available for immediate test of residuals at point of sampling. Test kits manufactured by Hach Chemical or Orbeco-Hellige are acceptable.

PART 3 - EXECUTION

3.1 CLEANING

A. General

1. Unless otherwise specified, final cleaning work shall not be performed until after the hydrostatic testing of the structures, and any repair work occasioned thereby, have been completed.

2. All water used in cleaning the structures shall be wasted and disposed of in a manner acceptable to the Engineer, and shall not be allowed to enter other parts of the system.

3. The sequence of cleaning of the various structures and pipelines shall be acceptable to the Engineer.

B. Cleaning of Structures

1. All structures designed to contain water shall be kept clean at all times. Under no circumstances shall body excrement be permitted to come into contact with any surfaces

of these structures. All dirt, debris, and rubbish shall be removed from the interior of these structures. All structures shall be kept clean until they have been placed in service or until final acceptance by the Owner.

2. All interior floor, ceiling, and wall surfaces of the structures to be disinfected shall be thoroughly scrubbed and hosed down. All water remaining in the structures after the scrubbing and hosing operations have been completed shall be removed by means of dewatering pumping equipment or other methods acceptable to the Engineer. All scrubbing and hosing down of the structures shall have been completed and the resulting water removed before the disinfection work is started.

3.2 DISINFECTION

A. Structures to be Disinfected

1. The following structures shall be disinfected as specified herein:

a. Clearwell and associated wall pipes.

B. Disinfection Procedures

1. Clearwell

a. The Clearwell structure shall be disinfected after the completion of all cleaning and hydrostatic testing. The structure shall be disinfected by Chlorination Method 2 or 3 in accordance with ANSI/AWWA C652. Potable water shall be used in conjunction with the chlorination agent.

3.3 DISPOSAL OF CHLORINATED WASTEWATER

A. All chlorinated wastewater to be discharged shall be neutralized by chemical treatment and disposed in accordance with the requirements of the governing standard specified herein. Contractor shall schedule and coordinate rates of flow and locations of discharge of disinfection and flushing water with the Engineer and cognizant State and local regulatory agencies and in accordance with all applicable rules and regulations.

End of Section

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SECTION 33 14 00 - PIPELINE PRESSURE AND LEAKAGE TESTING

PART 1 - GENERAL

1.1 SCOPE

A. This section covers field hydrostatic pressure and leakage testing of piping. The term "piping" shall be used in this section to refer to piping systems, pipelines, or sections thereof.

B. Testing of other piping is covered in the Miscellaneous Piping and Accessories Installation section. Cleaning and disinfection of piping is covered in the Cleaning and Disinfection of Water Pipelines section.

1.2 GENERAL

A. Contractor shall coordinate pressure and leakage testing with adjacent work as necessary to preclude work interferences or duplication of effort and to expedite the overall progress of the work.

B. Contractor shall provide all necessary piping, piping connections, temporary valves, backflow preventers, and all other items of equipment or facilities necessary to complete the pressure and leakage testing.

C. In all cases where it is necessary to interrupt service, permission of Owner shall be obtained at least two days before the service will be interrupted. In all cases where it is necessary to interrupt service to water customers, permission of the Owner shall be obtained and each customer affected shall be notified of the proposed service interruption and its possible duration in accordance with the Work Covered by Contract Documents section.

D. Contractor shall notify federal, state, and local regulatory agencies to determine if any special procedures or permits are required for disposal of water used for pressure and leakage testing and to identify acceptable locations for disposal of the water. All requirements and costs associated with notifications and obtaining any discharge permit or approvals shall be responsibility of Contractor.

E. Engineer or Engineer's representative shall be present during testing and shall be notified of the time and place of testing at least 3 days prior to commencement of testing. All testing shall be performed to the satisfaction of Engineer, and in accordance with all governing standards and regulations.

F. Testing Schedule and Procedure

1. A testing schedule and procedure shall be submitted to Engineer for review and acceptance not less than 21 days prior to commencement of testing. The schedule and procedure shall include, but not be limited to the following information for each pipe section to be tested:

a. limits of each pipe test section;
b. proposed time and sequence;
c. physical locations and set positions of all valves;
d. locations of temporary bulkheads, stops, caps, restraints, supports, and other temporary equipment needed;
e. manner of filling and source of water;
f. method and location of metering volumes;
g. method and location of gauging pressures; and
h. method and location of disposal of test water.

G. Special Testing Requirements

1. Special testing requirements include the following:

2. Water for filling the pipeline from the Owner's existing facilities may not be available during the Owner's high water demand season from approximately April 1 to October 1.

3. Unless otherwise acceptable to Engineer, the general sequence of work for each pipeline, or valved or bulkheaded section thereof, shall be as follows:

a. Initial cleaning and flushing of pipeline.
b. Filling pipeline.
c. Hydrostatic pressure and leakage testing.
d. Disinfection.
e. Final flushing and neutralization of heavily chlorinated water.
f. Bacteriological tests.

4. Unless otherwise acceptable, during testing of the pipeline, all valves, except for auxiliary hydrant valve(s), shall be in the open position.

5. Unless otherwise acceptable, temporary bulkheads shall be provided during testing so that the test pressure is not applied to existing or new valves and hydrants, or to existing water lines, or to any portion of water lines installed under this Contract that have already been put into service.

6. Unless otherwise acceptable, a temporary pressure gauge shall be installed at each end of the limits of the pipeline to be tested.

7. Unless otherwise acceptable, tests shall be conducted before connections are made to existing water lines, or to any portion of water lines installed under this Contract that have already been put into service.

8. Unless otherwise acceptable, upon completion of testing and disinfection, connections made to existing water lines or to any portion of water lines installed under this Contract that have already been put into service, and any other portion of the pipeline not subject to the pressure test, shall be visually inspected for leakage after placing the water line into service and before backfilling the connection.

9. If testing is permitted against a valve, the maximum differential test pressure across the valve seat (gate) in the closed position shall not exceed the drip-tight rated pressure of the valve.

H. Water

1. Water for testing shall be furnished as stipulated in the Temporary Facilities and Controls section. Following completion of testing, the water shall be disposed of in accordance with the requirements of regulatory agencies and in a manner acceptable to Engineer.

1.3 SUBMITTALS

A. Test Procedures and Plans

1. Test plans and procedures shall be submitted as outlined in the GENERAL section of this specification.

B. Test Results and Reports

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. All necessary connections between the piping to be tested and the water source, together with pumping equipment, water meter, pressure gauges, backflow prevention, and all other equipment, materials, and facilities required to perform the specified tests, shall be provided. All required blind flanges, valves, bulkheads, bracing, blocking, and other sectionalizing devices shall also be provided. All temporary sectionalizing devices shall be removed upon completion of testing. Vents shall be provided in test bulkheads where necessary to expel air from the piping to be tested.

B. Test pressure shall be applied by means of a force pump sized to produce and maintain the required pressure without interruption during the test.

C. Water meters and pressure gauges shall be accurately calibrated and shall be subject to review and acceptance by Engineer.

D. Permanent or temporary gauge connections shall be installed at each location where test gauges are connected to the piping during the required test. Drilling and tapping of pipe walls will not be permitted. Upon successful completion of testing, each permanent gauge connection shall be fitted with an isolation valve and a permanent gauge, and each temporary gauge connection, if used, shall be fitted with a permanent sealed plug or cap acceptable to the Engineer.

E. Permanent or temporary fill and vent connections shall be installed as needed for the required test. Drilling and tapping of pipe walls will not be permitted. Upon successful completion of testing, each permanent fill and vent connection shall be fitted with the permanent fill or vent

piping, and each temporary fill and vent connection, if used, shall be fitted with a permanent sealed plug or cap acceptable to the Engineer.

PART 3 - EXECUTION

3.1 FILLING AND VENTING

A. Before filling the piping with water, care shall be taken to ensure that all air release valves and other venting devices are properly installed and operating properly. Hand-operated vent valves shall not be closed until an uninterrupted stream of water is flowing from each valve. The rate of filling the piping with water must not exceed the venting capacity of the installed air vent valves and devices.

3.2 BLOCKING AND BACKFILLING

A. Piping shall be adequately blocked, anchored, and supported before the test pressure is applied. Underground piping identified in the Pipeline Schedule shall be tested before the joints are covered. All other piping may be tested after backfilling.

3.3 PRESSURE TESTING

A. After the piping to be tested has been filled with water, the test pressure shall be applied and maintained without interruption within plus or minus 5 psi of test pressure for 2 hours plus any additional time required for Engineer to examine all piping being tested and for Contractor to locate any defective joints and pipe materials. The test pressure shall be in accordance with the requirements specified for pipeline or plant piping.

B. Plant Piping Test Pressure

1. Piping shall be subjected to the test pressure as indicated in the Pipeline Schedule.

3.4 PLANT PIPING LEAKAGE TESTING

A. All plant piping shall be watertight and free from leaks. Each leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.

End of Section

SECTION 33 39 13 - SANITARY UTILITY SEWERAGE MANHOLES, FRAMES, AND COVERS

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the furnishing and installation of standard and drop sewer and foundation drain manholes. Standard and drop manholes shall be constructed complete with covers, steps, fittings, and other appurtenances, in accordance with the details in the figures at the end of this section.

B. Where required, special manholes shall be constructed in accordance with the details indicated on the Drawings.

C. Steps, frames, and covers for structures other than sewer manholes are covered in other sections.

1.2 GENERAL

A. At the option of Contractor, standard and drop manholes may be constructed with cast-in-place concrete bases or precast concrete (developed) bases as indicated on the figures.

B. Only manholes which are required to have inside/outside pipe and fittings for dropping sewage into the lower line will be designated as drop manholes. Inside drop manholes where the incoming line discharges directly into the manhole and which do not require special fittings will be considered standard manholes.

1.3 SUBMITTALS

A. Drawings and Data

1. Drawings and data covering precast concrete sections and castings shall be submitted in accordance with the Submittals Procedures section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

B. Precast concrete sections shall not be delivered to the job until representative concrete control cylinders have attained a strength of at least 80 percent of the specified minimum.

C. Precast concrete sections shall be handled carefully and shall not be bumped or dropped. Hooks shall not be permitted to come in contact with joint surfaces.

PART 2 - PRODUCTS

2.1 MATERIALS

Precast Concrete Manholes and Reinforcement	ASTM C478, except as modified herein.
Cement	Cement type shall comply with ASTM C150, Type I or II. Water-cementitious materials ratio shall not exceed 0.40. Alternative materials proposed by Contractor that will provide equivalent corrosion protection and durability may be submitted subject to review and acceptance by Engineer.
Riser and Precast Base	Circular, uniform outside diameter.
Minimum Wall Thickness	1/12 of inside diameter, plus 1 inch .
Cone	Shape shall be eccentric as required; wall thickness as specified for riser sections.
Adjusting Rings	Circular, with shear keys.
Cast-in-Place Concrete Bases	Materials, handling, forms, finishing, curing, and other work as specified in the cast-in-place concrete section.
Nonshrinking Grout	L&M "Crystex", BASF Master Builders "Masterflow 713 " or "Set Grout", Sauereisen Cements "Grout No. F-100 Level Fill Grout", , or Five Star Products "Five Star Grout".
Resilient Manhole/Pipe Connectors	A-LOK Premium manhole pipe seal.
Mastic Fill	Butyl rubber compatible with resilient connector material.
Gaskets	
Mastic	ASTM C990; Hamilton-Kent "Kent-Seal No. 2", , or Henry Company "Ram-Nek". Cross-sectional area as recommended by manhole manufacturer.
Rubber	ASTM C361, Section 6.9, except gasket shall be synthetic, with hardness of 40 ± 5 when measured by ASTM D2240, Type A durometer. Natural rubber will not be acceptable.
Coal Tar Epoxy	High-build coal tar epoxy; Ameron "Amercoat 78HB Coal Tar Epoxy", Carboline "Bitumastic 300M", or Tnemec "46H-413 Hi-Build Tneme-Tar".

Castings	ASTM A48, Class 35B or better.
Manhole Rings and Covers	Clay and Bailey "No. 2032" or Neenah Foundry "R-1769-A".
Manhole Encapsulation System	ANSI/AWWA C216, Canusa-CPS "WrapidSeal" Manhole Encapsulation System.

2.2 MANUFACTURE

A. The first riser sections for use with cast-in-place bases shall be provided with horseshoe-shaped boxouts for connecting piping to be grouted in, or with circular openings with continuous, circular, resilient connectors cast into the riser wall. Boxouts for grouting, if used, shall have surfaces grooved or roughened to improve grout bond.

B. Precast base sections shall be provided with circular openings, with continuous, circular, resilient connectors cast into the wall.

C. Resilient connectors shall be installed in accordance with the manufacturer's recommendations, except that connectors shall be positioned so that sealing or resealing operations may be accomplished from inside the manhole.

D. Precast sections may be provided with lifting notches on the inside faces of walls to facilitate handling. Lifting notches shall be not more than 3 inches deep; holes extending through the wall will not be acceptable.

E. If precast concrete base sections are used, part of the concrete invert fill may be furnished with the precast unit; however, a rough surface shall be provided to improve bond with the final invert fill. At least the top 2 inches of the concrete invert fill shall be installed in the field.

PART 3 - EXECUTION

3.1 INSPECTION

A. Precast concrete sections shall be inspected when delivered and all cracked or otherwise visibly defective units shall be rejected.

3.2 CONSTRUCTION

A. Bases

1. If cast-in-place concrete bases are used, concrete shall be placed on undisturbed earth in accordance with applicable requirements of the Concrete section.

2. If precast concrete (developed) bases are used, the subgrade materials shall be excavated to undisturbed earth and to a uniform elevation which will permit at least 4 inches of granular embedment material, as specified in the Excavation and Fill for Structures section, to be installed and compacted. The surface of the granular material shall be carefully graded and the base section accurately set so that connecting pipes will be on proper line and grade. The elevation of the granular material shall be adjusted until proper grade and alignment of the base section has been attained.

3. No wedging or blocking under precast concrete bases will be permitted.

4. When resilient connectors are used with cast-in-place bases, the concrete fill under the connecting pipe outside the manhole shall be deleted and shall be replaced with granular embedment material to undisturbed earth.

5. In no case shall the invert section through a manhole be greater than that of the outgoing pipe. The shape of the invert shall conform exactly to the lower half of the pipe it connects. Side branches shall be connected with a radius of curve as large as practicable. All inverts shall be troweled to a smooth, clean surface.

B. Riser and Cone Sections and Precast Concrete Adjusting Rings

1. Circular precast sections and rings shall be provided with a rubber or mastic gasket to seal joints between sections and rings. Mastic gaskets shall be used only at temperatures recommended by the manufacturer. Lifting notches in manhole walls shall be filled with nonshrinking grout.

2. Manhole steps are not required.

C. Connecting Piping

1. The space between connecting pipes and the wall of precast sections shall be completely filled with non-shrink grout, except where resilient connectors are provided.

2. When resilient connectors are used, the connecting pipe shall be carefully adjusted to proper line and grade, and the bedding material shall be compacted under the haunches and to the spring line of the pipe for a distance of at least 6 feet from the manhole wall and to at least the minimum trench width. The pipe shall be installed in the resilient connector prior to backfilling outside the manhole and shall be resealed after completion of the manhole and backfill. All visible leakage shall be eliminated.

3. The connecting pipe for installation with resilient connectors shall be plain-end, square cut spigots and shall not protrude more than 1 inch inside the manhole wall. A clear distance of at least 1 inch from the end of each connecting pipe and around the pipe shall be provided when the concrete invert fill is installed. After completion of the manhole, the boxout shall be filled with mastic filler material, completely filling the space beneath the pipe and extending to at least the spring line. The filler material shall provide a smooth, uniform surface between the inside diameter of the pipe and the manhole invert.

3.3 EXTERIOR COATING

A. Damproofing

1. Before backfilling is started, the outside surfaces of each manhole shall be coated with one heavy coat of dampproofing as specified in the dampproofing section. Surfaces to receive coating shall be dry. Dampproofing may be applied to precast units in the shop. If the shop coating is damaged during construction, a touchup coat shall be applied and allowed to dry prior to backfilling.

B. Manhole Encapsulation System

1. A manhole encapsulation system shall be provided. The manhole encapsulation system shall be a heat-shrinkable, wraparound sleeve designed to cover joints in manhole structures. Once installed, the system creates a barrier to water infiltration. The materials shall be stored in accordance with manufacturer's instructions, but not less than keeping the containers and packaging sealed until ready for use; stored at temperature less than 95°F and more than -4°F ; from exposure to direct sunlight, rain, snow, dirt, and dust; and off the ground in a ventilated area.

2. The system shall encapsulate the bottom ring of the manhole casing ring, the adjusting rings or bricks, and to at least 5 inches below the joint of the top precast manhole section or a minimum of 4 feet below grade. The surface of the manhole and casing shall be prepared in accordance with manufacturer's instructions. Surfaces shall be clean, dry, and free of frost, surface rust, foreign objects, sharp edges, and projections that could damage manhole encapsulation.

3.4 CASTING COATING

A. Prior to installation, one coat of coal tar epoxy shall be applied to all castings. Before coating, castings shall be thoroughly cleaned and properly supported. All loose rust shall be removed by wire brushing. Castings shall not be handled until the coating is dry and hard.

End of Section

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SECTION 40 05 05.11 - MISCELLANEOUS PIPING AND ACCESSORIES INSTALLATION

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the installation of piping and accessories as indicated on the Drawings for the following piping sections:

1. Miscellaneous Piping and Accessories
2. Stainless Steel Pipe and Alloy Pipe, Tubing, and Accessories
3. Miscellaneous Steel Pipe, Tubing, and Accessories
4. Miscellaneous Plastic Pipe, Tubing, and Accessories

B. Contractor shall furnish all necessary jointing materials, coatings, and accessories that are specified herein.

C. Pipe supports and anchors shall be furnished by Contractor, and are covered in the Pipe Supports section. Pipe trenching and backfilling are covered in the Trenching and Backfilling section.

1.2 GENERAL

A. Coordination

1. Materials installed under this section shall be installed in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the manufacturer, unless exceptions are noted by Engineer.

1.3 SUBMITTALS

A. Drawings and Data

1. Complete specifications, data, and catalog cuts or drawings shall be submitted in accordance with the Submittals Procedures section. Items requiring submittals shall include, but not be limited to, the following:

a. Chlorine tank car unloading connection.
b. Cleaning procedure for metal chlorine piping.
c. Watertight/dusttight pipe sleeves.
d. Materials as specified herein.

B. Welder Certification

1. Prior to the start of the work, Contractor shall submit a list of the welders he proposes using and the type of welding for which each has been qualified. Copy of certification and identification stamp shall be submitted for each welder. Qualification tests may be waived if evidence of prior qualification is deemed suitable by Engineer.

1.4 QUALITY ASSURANCE

A. Welding and Brazing Qualifications

1. All welding and brazing procedures and operators shall be qualified by an independent testing laboratory in accordance with the applicable provisions of Section IX of the ASME Code. All procedure and operator qualifications shall be submitted to the Engineer for review.

B. Tolerances

1. These tolerances apply to in-line items and connections for other lines.

2. The general dimension, such as face-to-face, face or end-to-end, face- or end-to center, and center-to-center shall be 1/8 inch .

3. The inclination of flange face from true in any direction shall not exceed 3/64 inch per foot .

4. Rotation of flange bolt holes shall not exceed 1/16 inch .

1.5 DELIVERY, STORAGE, AND HANDLING

A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section. All materials shall be stored in a sheltered location above the ground, separated by type, and shall be supported to prevent sagging or bending.

B. Plastic pipe, tubing, and fittings shall be stored between 40°F and 90°F .

C. Coated Pipe

1. Handling methods and equipment used shall prevent damage to the protective coating and shall include the use of end hooks, padded calipers, and nylon or similar fabric slings with spreader bars. Bare cables, chains, or metal bars shall not be used. Coated pipe shall be stored off the ground on wide, padded skids. Plastic-coated pipe shall be covered or otherwise protected from exposure to sunlight.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

A. Pipe, tubing, and fittings covered herein shall be installed in the services indicated in the various pipe sections.

2.2 MATERIALS.

A. Threaded Fittings

1. Anti-Seize Thread Lubricant: Jet-Lube "Nikal," John Crane "Thread Gard Nickel," Never-Seez "Pure Nickel Special," or Permatex "Nickel Anti-Seize."

2. Teflon Thread Sealer: Paste type; Hercules "Real-tuff", John Crane "JC-30", or Permatex "Thread Sealant with Teflon."

3. Teflon Thread Tape: Hercules “Tape Dope” or John Crane “Thread Tape.”

B. Solvent Welded Fittings

1. Solvent Cement for PVC Systems: ASTM D2564.

2. Solvent Cement for CPVC Systems: ASTM F493.

a. Sodium Hypochlorite, Sodium Hydroxide, and Sodium Bisulfate Service: IPS Corporation “Weld-On 724.”

3. Primer for PVC Systems: ASTM F656.

C. Solder or Brazed Fittings

1. Solder: Solid wire, ASTM B32, ANSI/NSF 61 certified; Alloy Grade Sb5, (95-5).

2. Soldering Flux: Paste type, ASTM B813.

3. Brazing Filler Metal: AWS A5.8, BCuP-5; Engelhard “Silvaloy 15,” Goldsmith “GB-15,” or Handy & Harman “Sil-Fos.”

4. Brazing Flux: Paste type, Fed Spec O-F-499, Type B.

D. Insulating Fittings

1. Threaded: Dielectric steel pipe nipple, ASTM A53, Schedule 40, polypropylene-lined, zinc plated, Perfection Corp. “Clearflow Fittings.”

2. Flanged: Epco “Dielectric Flange Unions” or Central Plastics “Insulating Flange Unions.”

E. Pipe Insulation: See Mechanical Insulation section.

F. Watertight/Dusttight Pipe Sleeves: O-Z Electrical Manufacturing “Thruwall” and “Floor Seals,” or Thunderline “Link Seals,” with modular rubber sealing elements, nonmetallic pressure plates, and galvanized bolts.

1. Pipe Sleeve Sealant: Polysulfide or urethane, as specified in the Caulking section or as indicated in the Drawings.

G. Protective Coatings

1. Tape Wrap: ANSI/AWWA C209, except single ply tape thickness shall not be less than 30 mils ; Protecto Wrap “200” or Tapecoat “CT.”

2. Primer: As recommended by the tape manufacturer.

3. Coal Tar Epoxy: High build coal tar epoxy; PPG Amercoat “Amercoat 78HB Coal Tar Epoxy,” Carboline “Bitumastic 300 M,” Tnemec “46H-413 Hi-Build Tneme-Tar,” or Sherwin-Williams “Hi-Mil Sher-Tar Epoxy.”

PART 3 - EXECUTION

3.1 INSPECTION

A. All piping components shall be inspected for damage and cleanliness before being installed. Any material damaged or contaminated in handling on the job shall not be used unless it is repaired and recleaned to the original requirements by Contractor. Such material shall be segregated from the clean material and shall be inspected and approved by Owner or his representative before its use.

3.2 PREPARATION

1. Field Measurement

a. Pipe shall be cut to measurements taken at the site, not from the Drawings. All necessary provisions shall be made in laying out piping to allow for expansion and contraction. Piping shall not obstruct openings or passageways. Pipes shall be held free of contact with building construction to avoid transmission of noise resulting from expansion.

3.3 INSTALLATION

A. <u>General</u>

1. All instruments and specialty items shall be installed according to the manufacturer's instructions and with sufficient clearance and access for ease of operation and maintenance.

2. Flat faced wrenches and vises shall be used for copper tubing systems. Pipe wrenches and vises with toothed jaws will damage copper materials and shall not be used. Bends in soft temper tubing shall be shaped with bending tools.

B. Pipe Sleeves

1. Piping passing through concrete or masonry shall be installed through sleeves that have been installed before the concrete is placed or when masonry is laid. Pipe sleeves installed through floors with a special finish, such as ceramic or vinyl composition tile, shall be flush with the finished floor surface and shall be provided with nickel or chromium plated floor plates. Unless otherwise indicated on the Drawings, in all other locations where pipes pass through floors, pipe sleeves shall project not less than 1 inch nor more than 2 inches above the floor surface, with the projections uniform within each area. In the case of insulated pipes, the insulation shall extend through pipe sleeves. Where the Drawings indicate future installation of pipe, sleeves fitted with suitable plastic caps or plugs shall be provided.

2. Holes drilled with a suitable rotary drill will be considered instead of sleeves for piping which passes through interior walls and through floors with a special finish.

3. Unless otherwise indicated on the Drawings, all pipes passing through walls or slabs which have one side in contact with earth or exposed to the weather shall be sealed watertight with special rubber-gasketed sleeve and joint assemblies, or with sleeves and modular rubber sealing elements.

C. Pipe Joints

1. Pipe joints shall be carefully and neatly made in accordance with the indicated requirements.

2. Threaded

a. Pipe threads shall conform to ANSI/ASME B1.20.1, NPT, and shall be fully and cleanly cut with sharp dies. Not more than three threads at each pipe connection shall remain exposed after installation. Ends of pipe shall be reamed after threading and before assembly to remove all burrs. Unless otherwise indicated, threaded joints shall be made up with teflon thread tape, thread sealer, or a suitable joint compound.

b. Threaded joints in plastic piping shall be made up with teflon thread tape applied to all male threads. Threaded joints in stainless steel piping shall be made up with teflon thread sealer and teflon thread tape applied to all male threads. Threaded joints in steel piping for chlorine service shall be made up with teflon thread tape or litharge and glycerine paste applied to all male threads.

3. Compression

a. Ends of tubing shall be cut square and all burrs shall be removed. The tubing end shall be fully inserted into the compression fitting and the nut shall be tightened not less than 1-1/4 turns and not more than 1-1/2 turns past fingertight, or as recommended by the fitting manufacturer, to produce a leaktight, torque-free connection.

4. Flared

a. Ends of annealed copper tubing shall be cut square, and all burrs shall be removed prior to flaring. Ends shall be uniformly flared without scratches or grooves. Fittings shall be tightened as needed to produce leaktight connections.

5. Soldered and Brazed

a. Where solder fittings are specified for lines smaller than 2 inches , joints may be soldered or brazed at the option of Contractor. Brazing alloy shall contain no tin.
b. Surfaces to be joined shall be thoroughly cleaned with flint paper and coated with a thin film of flux. At each joint, tubing shall enter to the full depth of the fitting socket.
c. Care shall be taken to avoid overheating the metal or flux. Each joint shall be uniformly heated to the extent that filler metal will melt on contact. While the joint is still hot, surplus filler metal and flux shall be removed with a rag or brush.

6. Solvent Welded

a. Solvent welded connections shall only be used for PVC or CPVC pipe. All joint preparation, cutting, and jointing procedures shall comply with the pipe manufacturer's recommendations and ASTM D2855. Pipe ends shall be beveled or chamfered to the dimensions recommended by the manufacturer. Newly assembled joints shall be suitably blocked or restrained to prevent movement during the setting time recommended by the manufacturer. Pressure testing of solvent welded piping systems shall not be performed until the applicable curing time, as set forth in Table X2.1 of ASTM D2855, has elapsed. Solvent welding shall be performed by bonding operators who have met the requirements of ASME B31.3 and A328.

7. Epoxy and Adhesive Bonded

a. Epoxy and adhesive bonded joints shall only be used for FRP pipe. All joint preparation, cutting, and jointing procedures shall comply with the pipe manufacturer's recommendations. Adhesive shall be mixed and applied in accordance with the manufacturer's recommendations. After joining, either the pipe or the fitting shall be rotated approximately one-half turn to uniformly distribute adhesive. A slight fillet of adhesive at the bond line is desirable, but all excess adhesive shall be wiped off immediately. Newly assembled joints shall be suitably blocked or restrained to prevent movement during the curing period recommended by the manufacturer.

8. Heat Fusion Bonded

a. Heat fusion bonded joints shall be used for polyethylene pipe with socket and butt fusion fittings. All joint preparation, cutting, jointing equipment, and jointing procedures shall comply with the pipe manufacturer's recommendations. The heating time, temperature, pressure applied to the joint during bonding, and cooling time shall consistently produce leaktight joints as strong as the pipe being joined.

9. Flanged

a. Flange bolts shall be tightened sufficiently to slightly compress the gasket and effect a seal, but shall not be torqued less than the minimum value required by the gasket manufacturer. Flange bolts shall not be so tight as to fracture or distort the flanges. A plain washer shall be installed under the head and nut of bolts connecting plastic pipe flanges. Anti-seize thread lubricant shall be applied to the threaded portion of all stainless steel bolts during assembly.

b. Flange bolt holes shall be oriented as follows, unless otherwise indicated on the spool drawings:
   1) Vertical flange face: Bolt holes to straddle the vertical centerline.
   2) Horizontal flange face: Both holes shall be aligned with connecting pipe.

c. Pipe sealants, thread compounds, or other coatings shall not be applied to flange gaskets unless recommended by the gasket manufacturer for the specified service and approved by Engineer.

d. Welds at orifice flanges shall have internal surfaces ground smooth to the pipe wall.

e. Slip-on flanges shall be welded inside and outside. There shall be a distance of approximately 1/16 to 1/8 inch between the edge of the fillet weld and the face of the flange. The seal weld shall be applied so that the flange face shall be free of weld spatter and does not require refacing.

f. Flat-faced flanges shall be used when mating to Class 125 flanges. Full-face gaskets shall be used with flat-faced flanges and ring gaskets shall be used with raised faced flanges.

g. Weld neck flanges shall be used with butt-weld fittings. The bore of weld neck flanges shall match the pipe wall thickness.

h. Insulating joints connecting submerged (buried) piping to exposed piping shall be installed above the maximum water surface elevation and before the first pipe support not having coated anchor bolts or adhesive-bonded concrete anchors. All submerged (buried) metallic piping shall be isolated from the concrete reinforcement. Insulating flanges shall be tested for electrical isolation after installation and bolt-up but prior to introduction of conducting fluid.

10. Welded

a. Welding shall conform to the specifications and recommendations contained in the "Code for Pressure Piping", ANSI B31.1.

b. Weld cross-sections shall be equal to or greater than the pipe wall thickness. Welds shall be smooth and continuous and shall have interior projections no greater than 1/16 inch . Backing strips or rings shall not be used except with specific prior review by Engineer as to use, material, and design. Root gap inserts

that are completely melted and consumed in the weld bead are acceptable only when reviewed in advance by Engineer.

c. Stainless steel welding shall be inert gas tungsten arc (TIG) or the direct current, straight polarity, inert gas metal arc process (MIG).

d. Carbon steel welding shall be made by the shielded metal arc process.

e. For socket weld joints, fully engage the two pipe ends, then separate them by 1/16 inch prior to welding to all space for shrinkage.

11. Grooved Couplings

a. Grooves for grooved couplings shall be cut with a specially designed grooving tool. Grooves cut in steel pipe shall conform to flexible grooving dimensions, as set forth in AWWA C606, and shall be clean and sharp without burrs or check marks.

12. Push-on

a. Gasket installation and other jointing procedures shall be in accordance with the recommendations of the manufacturer. Each spigot end shall be suitably beveled to facilitate assembly. All joint surfaces shall be lubricated with a heavy vegetable soap solution immediately before the joint is completed. Lubricant shall be suitable for use in potable water, shall be stored in closed containers, and shall be kept clean.

13. Rubber-Gasketed

a. Rubber-gasketed joints for hub and spigot type cast iron soil pipe shall have plain spigot ends, without beads. Cut ends of all pipe shall be cut square, beveled, and all burrs shall be removed. Spigot ends shall be coated with a lubricant recommended by the gasket manufacturer and fully seated in the gasket. Clamps for hubless cast iron soil pipe shall be installed in accordance with the manufacturer's recommendations.

14. Other Pipe Joints

a. Coupled joints in tempered glass pipe, plastic joints in vitrified clay pipe, and other proprietary type joints shall be made in accordance with the manufacturer's recommendations and to the satisfaction of Engineer.

D. Pipe

1. Pipe shall be installed as specified, as indicated on the Drawings, or, in the absence of detail piping arrangement, in a manner acceptable to Engineer.

2. Piping shall be installed without springing or forcing the pipe in a manner which would induce stresses in the pipe, valves, or connecting equipment.

3. Piping shall be supported in conformance with the Pipe Supports section.

4. Piping shall be connected to equipment by flanges or unions as specified in the various piping sections. Piping connecting to equipment shall be supported by a pipe support and not by the equipment.

5. Water, gas, and air supply piping shall be provided with a shutoff valve and union at each fixture or unit of equipment, whether or not indicated on the Drawings, to permit isolation and disconnection of each item without disturbing the remainder of the system. Air supply piping shall be provided with sectionalizing valves and valved air inlet connections as needed for isolation of portions of the system for periodic testing. Gas supply lines to buildings shall be provided with a shutoff valve and union located above grade immediately outside the building. A capped drip leg shall be provided at the bottom of the vertical riser of gas supply piping adjacent to gas-fired appliances.

6. A union shall be provided within 2 feet [600 mm] of each threaded-end valve unless there are other connections which will permit easy removal of the valve. Unions shall also be provided in piping adjacent to devices or equipment which may require removal in the future and where required by the Drawings or the Specifications.

7. All air piping shall be graded to points of drainage collection where drip legs and drain valves shall be provided. Air piping shall be sized for the service conditions, with the indicated minimum sizes:

Service	Minimum Size
Air signal	1/4 inch OD
Power air	1/2 inch OD
Air supply	1/2 inch OD
Bubbler drop pipes	3/4 inch
Buried piping	3/4 inch

8. Water supply piping within structures shall be arranged, and facilities provided, for complete drainage. All piping serving metering equipment shall be uniformly graded so that air traps are eliminated and complete venting is provided.

9. Stuffing box leakage from water sealed pumps shall be piped to the nearest point of drainage collection.

10. Taps for pressure gauge connections on the suction and discharge of pumping units shall be provided with a nipple and a ball type shutoff valve.

11. Drilling and tapping of pipe walls for installation of pressure gauges or switches will not be permitted.

12. In all piping, insulating fittings shall be provided to prevent contact of dissimilar metals, including but not limited to, contact of copper, brass, or bronze pipe, tubing, fittings, valves, or appurtenances, or stainless steel pipe, tubing, fittings, valves, or appurtenances with iron or steel pipe, fittings, valves, or appurtenances. Insulating fittings shall also be provided to prevent contact of copper, brass, or bronze pipe, tubing, fittings, valves or appurtenances with stainless steel pipe, tubing, fittings, valves, or appurtenances.

13. Branch connections in horizontal runs of steam, air, and gas piping shall be made from the top of the pipe.

14. Buried PVC piping shall be "snaked" in the trench and shall be kept as cool as possible during installation. PVC pipe shall be kept shaded and shall be covered with backfill immediately after installation.

15. All chemical piping shall be installed so that lines are readily accessible for cleaning. Tees shall be provided at regular intervals in all chemical piping except chlorine piping, with extra openings plugged, to facilitate cleaning. Teflon thread tape or teflon thread sealer shall be applied to the threads of the plugs so that they can be easily removed. At each point where hose or reinforced plastic tubing is connected to rigid piping, a quick-disconnect coupling shall be provided.

16. Vent and gas piping for anhydrous ammonia, chlorine and sulfur dioxide gas shall be installed so that liquid traps are avoided. The open end of each vent line shall elbow down and shall be provided with a corrosion-resistant insect screen.

17. Double-contained chemical feed piping shall be installed according to the manufacturer's recommendations. Joints shall be solvent cemented. Splitting and rewelding of fittings will not be acceptable. Suitable drains and vents shall be provided to permit complete drainage of both the primary and secondary containment piping. Interstitial supporting devices shall be designed to allow continuous drainage in the annular space to the drain ports. Drain fittings shall be designed to allow a valve attachment to be made so that the secondary containment compartment can be readily drained and manually inspected for leaks.

18. Polyethylene piping shall be installed in accordance with the manufacturer's recommendations. A continuous 12 AWG THHN insulated copper tracer wire shall be placed 6 inches above all portions of the buried pipe, but no more than 18 inches below the ground surface. Where the pipe extends above grade, a 2 foot length of wire shall be coiled and attached to the pipe.

19. Piping adjacent to flow sensors shall be installed in accordance with the requirements of the manufacturer of the flow sensor and commonly accepted design practices of the appropriate straight pipe runs both upstream and downstream.

20. Drains required for operation are shown on the Drawings. However, vents at all high points and drains at all low points in the piping that are required for complete draining for pressure test may not be shown on these Drawings. Contractor shall add such items as found to be necessary during detail piping design and/or piping installation.

E. Reducers

1. Eccentric reducers shall be installed flat on the bottom for steam, condensate return and digester gas services.

F. Valves

1. Isolation valves provided with equipment and instruments shall be located in a manner which will allow ease of access and removal of the items to be isolated. Prior to soldering or brazing valves, teflon and elastomer seats and seals shall be removed to prevent damage.

3.4 PIPING ASSEMBLY

A. General

1. Contractor shall only use labor that has been qualified by training and experience to capably perform the specified activities required to accomplish the work in a satisfactory manner

2. Any deviations from the Specifications or piping locations shown on the Drawings require prior review and approval by Engineer.

3.5 PROTECTIVE COATING

A. Standard weight steel pipe in buried locations will have exterior surfaces protected with a shop applied plastic coating.

B. Where specified in the Miscellaneous Steel Pipe, Tubing, and Accessories section, extra strong steel pipe in buried locations will have exterior surfaces protected with a shop applied plastic coating or a shop applied tape wrap. Where not specified to be shop coated or wrapped in the Miscellaneous Steel Pipe, Tubing and Accessories section, a tape wrap shall be field applied. The exterior surfaces of all fittings, couplings, specials, and other portions of buried piping not protected with plastic coating shall be tape-wrapped in the field.

C. All surfaces to be tape-wrapped shall be thoroughly cleaned and primed in accordance with the tape manufacturer's recommendations immediately before wrapping. The tape shall be applied by two-ply (half-lap) wrapping or as needed to provide a total installed tape thickness of at least 60 mils . Joints in plastic-coated pipe shall be cleaned, primed, and tape-wrapped after installation.

D. Joints in galvanized steel piping in underground locations shall be field painted with two coats of coal tar epoxy coating.

E. Inspection

1. All shop-applied plastic coatings and tape wrap on pipe or fittings shall be inspected for holidays and other defects after receipt of the pipe or fitting on the job and immediately before installation. All field-applied tape wrap on pipe, joints, fittings, and valves shall be inspected for holidays and other defects following completion of wrapping. Inspection of plastic coatings after installation of the pipe or fitting in the trench shall be made where, in the opinion of Engineer, the coating may have been damaged during installation. Holidays and defects disclosed by inspection shall be repaired in accordance with the recommendations of the coating or tape wrap manufacturer, as applicable.

2. The inspection shall be made using an electrical holiday detector. The detector and inspection procedures shall conform to the requirements of Section 4.4 of ANSI/AWWA C209.

3.6 PRESSURE AND LEAKAGE TESTING

A. All specified tests shall be made by and at the expense of Contractor in the presence, and to the satisfaction of Engineer. Each piping system shall be tested for at least 1 hour with no loss of pressure. The Contractor shall coordinate this section with the Pipeline Pressure and Leakage Testing section. Piping shall be tested at the indicated pressures:

Service	Test Pressure	Test Medium
Water supply	1-1/2 times working pressure but not less than 120 psi	Water
Other piping	1-1/2 times working pressure but not less than 50 psi	Suitable fluid or gas; for distilled water piping, distilled water or filtered oil-free compressed air may be used

B. Compressed air or pressurized gas shall not be used for testing plastic piping unless specifically recommended by the pipe manufacturer.

C. Leakage may be determined by loss-of-pressure, soap solution, chemical indicator, or other positive and accurate method acceptable to Engineer. All fixtures, devices, or accessories which are to be connected to the lines and which would be damaged if subjected to the specified test pressure shall be disconnected and the ends of the branch lines plugged or capped as needed during the testing.

D. Unless otherwise required by the applicable codes, drainage and venting systems shall be water tested. For water testing, the drainage and venting system shall be filled with water to the level of the highest vent stack. For air testing, the system shall be charged with air to a minimum pressure of 5 psig . Openings shall be plugged as necessary for either type of test. To be considered free of leaks, the system shall hold the water or air for 30 minutes without any drop in the water level or air pressure.

E. All necessary testing equipment and materials, including tools, appliances and devices, shall be furnished and all tests shall be made by and at the expense of Contractor. Contractor shall give Engineer 5 working days advanced notice of scheduled testing.

F. All joints in piping shall be tight and free of leaks. All joints which are found to leak, by observation or during any specified test, shall be repaired, and the tests repeated.

G. Air Pressure Tests

1. Pressure tests shall be performed on all air piping systems as specified herein to conform to ASME B31.1.

2. The test pressure shall be as specified herein and shall not exceed the maximum allowable test pressure of any non-isolated component, such as vessels, compressors, blowers, or valves, in the system. The pressure in the system shall gradually be increased to not more than one-half of the test pressure, after which the pressure shall be increased in steps of approximately one-tenth of the test pressure until the required test pressure has been reached. The pressure shall be continuously maintained for a minimum duration of 10 min. It shall then be reduced to the blower rated discharge pressure held for such time as may be necessary to conduct the examination for leakage.

3. Examination for leakage detected by soap bubble or equivalent method shall be made at all joints and connections. The piping system, exclusive of possible localized instances at the compressor, blower, or valve packing, shall show no evidence of leaking.

4. Contractor shall be responsible for ensuring that all air piping is free of leaks. All joints which are found to be leaking shall be repaired and the test repeated.

3.7 CLEANING

A. The interior of all pipe, valves, and fittings shall be smooth, clean, and free of blisters, loose mill scale, sand, dirt, and other foreign matter when installed. Before being placed in service, the interior of all lines shall be thoroughly cleaned, to the satisfaction of Engineer.

B. Tin-lined copper tubing for distribution of distilled water shall be flushed and cleaned with distilled water in accordance with the tubing manufacturer's recommendations.

3.8 ACCEPTANCE

A. Owner reserves the right to have any section of the piping system which he suspects may be faulty cut out of the system by Contractor for inspection and testing. Should the joint prove to be sound, Owner will reimburse Contractor on a time-and-material basis as specified in the Contract. Should the joint prove to be faulty, the destructive test will continue joint by joint in all directions until sound joints are found. Costs for replacement of faulty work and/or materials shall be the responsibility of Contractor.

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SECTION 40 05 07 – PIPE SUPPORTS

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the furnishing and installation of pipe hangers, brackets, supports, bracing, anchorage, and the design for the pipe support system for pipes 12 inches and smaller. Pipe supports shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, and other accessories. This section also covers the spacing of expansion joints in pipes 12 inches in diameter and smaller. Expansion joint products and materials are covered in the respective piping sections.

B. This section covers pipe supports for the following pipe materials:

1. Cast or ductile iron
2. Stainless Steel
3. Steel
4. PVC/CPVC Schedule 80

1.2 GENERAL

A. Contractor shall provide pipe supports, anchors, flexible couplings, and expansion joints for all piping systems. The Drawings indicate pipe supports, anchors, flexible couplings, and expansion joints for pipes larger than 12 inches in diameter, and in special cases for pipes that are 12 inches and smaller. Contractor shall design anchors, pipe supports, expansion joints, and flexible couplings not already shown on the Drawings, in accordance with the requirements specified herein.

B. Contractor’s design shall include pipe supports, bracing, and anchorage adjacent to expansion joints, couplings, valves, in-line devices, equipment, wyes and tees, or changes in direction as required for dismantling piping, removing valves or other in-line devices, disconnecting piping from equipment, and pipe support, in addition to supports in accordance with the maximum spacing specified herein. The pipe support system design by Contractor shall rigidly support pipe so there is no visible movement or visible sagging between supports. The system shall comply with specified piping code requirements.

C. Contractor shall not delete or relocate the supports, expansion joints, or couplings indicated on the Drawings without written approval of Engineer.

D. General Equipment Stipulations

1. The General Equipment Stipulations shall apply to all supports furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1.3 SUBMITTALS

A. General Drawings and Data.

1. Complete data, catalog information, and drawings covering fabricated pipe supports, fabricated inserts, and stainless steel, galvanized, and copper-plated and plastic-coated pipe supports shall be submitted in accordance with the Submittals Procedures section.

B. Intended Use and Location Schedule.

1. Data shall include a listing of the intended use and general location of each item submitted.

C. Meteorological and Seismic Certification.

1. When a wind and/or seismic design is required, Contractor shall submit confirmation of compliance with the Meteorological and Seismic Design Criteria section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Unless otherwise indicated, all pipe supports shall comply with ANSI/MSS SP-58. Materials of construction for fabricated steel supports are covered in the Structural and Miscellaneous Metals section. All pipe support materials shall be packaged as necessary to ensure delivery in satisfactory condition.

B. Unless otherwise specified or indicated on the Drawings, pipe supports shall be fabricated of manufacturer's standard materials and provided with manufacturer's standard finish.

C. Design loads for inserts, brackets, clamps, and other support items shall not exceed the manufacturer's recommended loads.

D. Pipe supports shall be manufactured for the sizes and types of pipe to which they are applied. Strap hangers will not be acceptable. Threaded rods shall have sufficient threading to permit the maximum adjustment available in the support item. Continuously threaded rod is not acceptable for hanger rods over 12 inches in length.

E. Unless accepted by Engineer, the use of supports which rely on stressed thermoplastic components to support the pipe will not be permitted.

F. Contact between dissimilar metals, including contact between stainless steel and carbon steel, shall be prevented. Portions of pipe supports which come into contact with other metals that are dissimilar shall be rubber or vinyl coated.

G. Supports for brass or copper pipe or tubing shall be copper plated or plastic coated.

H. Stainless steel supports shall be AISI Type 304 or 316 stainless steel, except for stainless steel supports fabricated by welding which shall be AISI Type 304L or 316L. Stainless steel supports shall be provided in the Flow Meter Vault.

I. Pipe support types and application shall comply with Table 1.

2.2 WIND AND SEISMIC LOADS

A. Wind and seismic loads for worst case conditions of either full, partially full, or empty pipes shall be considered in the design. Seismic design requirements for products specified herein shall be as indicated in the Meteorological and Seismic Design Criteria section.

PART 3 - EXECUTION

3.1 APPLICATION

A. Concrete inserts or anchor bolts shall be used to support piping from new cast-in-place concrete. Fastening of supports to existing concrete and masonry shall be in accordance with the Anchorage in Concrete and Masonry section.

B. Anchorage shall be provided to resist thrust due to temperature changes, changes in diameter or direction, or dead-ending. Anchors shall be located as specified to force expansion and contraction movement to occur at expansion joints, loops, or elbows, and as needed to prevent excessive bending stresses and opening of mechanical couplings. Anchorage for temperature changes shall be centered between elbows and mechanical joints used as expansion joints. Anchorage for bellows type expansion joints may be located adjacent to the joint.

C. When expansion joints are required, pipe guides shall be provided adjacent to bellows type expansion joints. Guides will not be required where mechanical couplings are permitted as expansion joints. Guides shall be located on both sides of expansion joints, except where anchors are adjacent to the joint. Unless otherwise indicated on the Drawings, one guide shall be within four pipe diameters from the joint and a second guide within 14 pipe diameters from the first guide. Pipe supports shall allow adequate movement; pipe guides shall not be used for anchoring pipe against longitudinal forces. Pipe guides shall be provided at locations as recommended by the manufacturer.

3.2 TYPES OF SUPPORTS

A. The products for pipe supports shall be as indicated in Table 1 for the specified type and size of support. Where stainless steel is specified for pipe supports but is not available from the name

suppliers for the model specified in Table 1, Contractor shall provide a heavier duty support that is available in stainless steel.

TABLE 1 - TYPES OF SUPPORTS

Description and Service	MSS SP 58 Type (Note 1)	Specification
Hangers		
2-1/2 inch and smaller pipe		
Other services		
J-style	5	B-Line "B3690," Anvil "67," Unistrut "J Hanger," or Piping Technology & Products Fig. 67.
Clevis	1	B-Line "B3104," Anvil "260," or Piping Technology & Products Fig. 83.
3 Through 12 inch pipe (Note 3)		
Other services		
Clevis	1	B-Line "B3100" or Anvil "260" for steel pipe; B-Line "B3102," Anvil "590," or Piping Technology & Products Fig. 83 C. L. for cast iron pipe.
Concrete Inserts, Steel		
12 inch and smaller pipe	18	Channel 12 ga , galv, 1-5/8 by 1-3/8 inches , min. 8 inches 200 mm long, anchor lugs on 4 inch centers, at least three lugs, end caps, and filler strip.
Beam Clamps, Malleable Iron or Steel, 12 inch and smaller pipe	21	B-Line "3050" and "3055," Anvil "133" and "134," or Piping Technology & Products Fig. 130 and Fig. 130 (SP).
	28, 29	Anvil "292" or Piping Technology & Products Fig. 140.
	30	B-Line "3054," Anvil "228," or Piping Technology & Products Fig. 140.
Side Beam Bracket	34	B-Line "B3062," Anvil "202," or Piping Technology & Products Fig. 20L.

TABLE 1 - TYPES OF SUPPORTS

Description and Service	MSS SP 58 Type (Note 1)	Specification
Wall Supports and Frames, Steel, 12 inch and smaller pipe (Note 2)		
Brackets	32	B-Line "B3066," Anvil "195," or Piping Technology & Products Fig. 76.
	33	B-Line "B3067," Anvil "199," or Piping Technology & Products Fig. 76.
Prefabricated channels	--	12 ga , galv, 1-5/8 inches , with suitable brackets and pipe clamps.
Offset pipe clamp, 1-1/2 inch and smaller pipe	--	Galv, 1-1/4 by 3/16 inch steel, with 3/8 inch bolts.
Offset pipe clamp, 2 to 3-1/2 inch pipe	--	Galv, 1-1/4 by 1/4 inch steel, with 3/8 inch bolts.
Pipe Alignment Guides	--	B-Line "B3281" through "B3287," Anvil "255," or Piping Technology & Products Fig. 6.
Turnbuckles Steel	13	B-Line "B3202," Anvil "230," or Piping Technology & Products Fig. 30.
Hanger Rods, Carbon Steel, Threaded Both Ends, 3/8 inch minimum size	--	B-Line "B3205," Anvil "140," or Piping Technology & Products Fig. 128.
Weldless Eye Nut, steel	17	B-Line "B3200," Anvil "290," or Piping Technology & Products Fig. 40.
Insulation Protection Saddle	39	B-Line "B3160 Series," Anvil "160 Series," or Piping Technology & Products Fig. 184.

Table 1 Notes:

1. MSS SP-58 supports and hangers are illustrated on Figure 1-40 05 17.13.
2. Pipe clamps or other devices which rely on the application of a clamping force to the supported pipe in order to maintain the clamp position or location in a prefabricated channel or track will not be acceptable for use with nonmetallic pipe or tubing.
3. Alternatively, pipe hangers for 12 inch pipe may be saddle type as indicated on the Drawings.

3.3 SUPPORT SPACINGS

A. Pipe supports and expansion joints shall be spaced in accordance with Tables 2, 3, 4, and 5. The types of pipes to be supported are as specified herein. Table 2 covers spacings for the standard operating conditions specified for each pipe material. Tables 3 and 4 cover PVC and FRP pipe spacings where operating conditions are in excess of the temperature and specific gravity requirements covered in Table 2. Table 5 covers PVC and FRP pipe which carries air or liquids with a specific gravity other than 1.0. Spacing in the tables is the maximum spacing considering gravity loads. Where Contractor's design includes lateral and longitudinal forces due to seismic loads, wind loads, and other forces, the spacing requirement may be less than that indicated in the tables.

TABLE 2 – MAXIMUM PIPE SUPPORT SPACING AT STANDARD TEMPERATURES AND SERVICES

Type of Pipe	Pipe Support Max Spacing feet	Max Run Without Expansion Joint, Loop, or Bend (Note 1) feet	Expansion Joint Max Spacing (Note 2) feet	Type of Expansion Joints
Cast iron or Ductile iron	15	80	80	Note 6
Steel, for other services				
Over 4 inch	15	80	80	Note 6**]**
Stainless steel				
1-1/4 inch and smaller	7	30	100	Note 3
1-1/2 to 4 inch	10	30	100	Note 3
Over 4 inch	15	80	80	Note 3
[Copper, for hot water				
1 inch and smaller	5	20	100	Note 3
Over 1 inch	7	20	100	Note 3**]**
[Copper, for services other than hot water				
1 inch and smaller	5	--	--	Note 7
Over 1 inch	7	50	100	Note 3**]**
PVC, Schedule 80, for other services at a maximum temperature of 100° F and a maximum specific gravity of 1.0.				
1/8 and 1/4 inch	Continuous Support	20	60	Note 3

TABLE 2 – MAXIMUM PIPE SUPPORT SPACING AT STANDARD TEMPERATURES AND SERVICES

Type of Pipe	Pipe Support Max Spacing feet	Max Run Without Expansion Joint, Loop, or Bend (Note 1) feet	Expansion Joint Max Spacing (Note 2) feet	Type of Expansion Joints
1/2 inch	4	20	60	Note 3
3/4 inch	4-1/2	20	60	Note 3
1 and 1-1/4 inch	5	20	60	Note 3
1-1/2 and 2 inch	5-1/2	20	60	Note 3
2-1/2 inch	6	20	60	Note 3
3 inch	7	20	60	Note 3
4 inch	7-1/2	20	60	Note 3
6 inch	8-1/2	20	60	Note 3
8 inch	9-1/2	20	60	Note 3
10 inch	10	20	60	Note 3
12 inch	11	20	60	Note 3
PVC, Schedule 40, for services at a maximum temperature of 100° F , and a maximum specific gravity of 1.0.				
1/8 and 1/4 inch	Continuous Support	20	60	Note 3
1/2 inch	3-1/2	20	60	Note 3
3/4 and 1 inch	4	20	60	Note 3
1-1/4 and 1-1/2 inch	4-1/2	20	60	Note 3
2 inch	5	20	60	Note 3
2-1/2 inch	5-1/2	20	60	Note 3
3 inch	6	20	60	Note 3
4 inch	6-1/2	20	60	Note 3
6 inch	7-1/2	20	60	Note 3
8 inch	8	20	60	Note 3
10 inch	8-1/2	20	60	Note 3
12 inch	9-1/2	20	60	Note 3

TABLE 2 – MAXIMUM PIPE SUPPORT SPACING AT STANDARD TEMPERATURES AND SERVICES

Type of Pipe	Pipe Support Max Spacing feet	Max Run Without Expansion Joint, Loop, or Bend (Note 1) feet	Expansion Joint Max Spacing (Note 2) feet	Type of Expansion Joints

Table 2 Notes:

1. Unless otherwise acceptable to Engineer, an expansion joint shall be provided in each straight run of pipe having an overall length between loops or bends exceeding the maximum run specified herein.
2. Unless otherwise acceptable to Engineer, the spacing between expansion joints in any straight pipe run shall not exceed the maximum spacing specified herein.
3. Expansion joint fittings are specified in the respective piping sections.
4. At least two properly padded supports for each pipe section.
5. At least one support for each pipe section.
6. Expansion joints shall be mechanical couplings.
7. No expansion joints are required.
8. Supports for 5 and 10 foot long pipe sections shall be located within 18 inches of each joint. Supports shall be positioned to maintain the piping alignment and to prevent the piping from sagging.
9. References to specific gravity refer to liquid specific gravity and are referenced to water which is assumed to have a specific gravity of 1.0.

3.4 INSTALLATION

A. General

1. All piping shall be supported in a manner which will prevent undue stress on any valve, fitting, or piece of equipment. In addition, pipe supports shall be provided at changes in direction or elevation, and adjacent to flexible couplings. Pipe supports and hangers shall not be installed in equipment access areas.

2. Where horizontal piping is arranged with two or more parallel lines, trapeze hangers may be used in lieu of individual hangers. Trapeze assembly shall consist of structure attachments as previously specified with rod size dependent upon total weight supported. Spacing of assemblies shall be determined by the minimum pipe size included in the group supported. Trapeze horizontal assemblies shall be structural angle or channel section of sufficient size to prevent measurable sag between rods when pipes are full. All lines shall be attached to the horizontal with intermediate pipe guides and U-bolts or one-hole clamps. Pre-engineered support equipment may be used when selected and installed in accordance with the manufacturer's recommendations.

3. Where copper pipe is installed on a support system of dissimilar metal with other pipes, the copper pipe shall be galvanically isolated from the support using Neoprene strips or other material acceptable to Engineer.

4. No piping shall be supported from the pipe above.

5. Horizontal piping hanger support rods shall attach to steel beams with center-loading I-clamps, or welded beam clips. Hanger support rods shall attach to concrete slabs or beams with inserts.

6. Anchorage shall be provided to resist both lateral and longitudinal seismic forces.

B. Inserts

1. Concrete inserts or anchor bolts shall be used to support piping from new cast-in-place concrete. Fastening of supports to existing concrete and masonry shall be in accordance with the Anchorage in Concrete and Masonry section. Reference building structural concrete Drawings for concrete inserts. When not provided as part of the building concrete structure, provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

2. Where concrete slabs form finished ceilings, provide inserts flush with the slab surface.

3. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. NDE (Non-Destructive Evaluation) shall be used to locate existing reinforcing before drilling.

C. Pipe Hangers and Supports

1. Install hangers to provide a minimum 1/2 inch space between finished covering and adjacent work.

2. A hanger shall be placed within 18 inches of each horizontal elbow, and on both sides of all piping accessories and valves weighing 20 lbs or more.

3. Hangers shall have 1-1/2 inches minimum vertical adjustment.

4. Support horizontal cast iron, ductile iron and no-hub piping systems adjacent to each joint.

5. Support vertical piping at every floor using riser clamps.

6. Support riser piping independently of connected horizontal piping.

7. Hanger and hanger components shall be sized specifically for the pipe size it is to be used on.

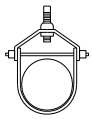
3.5 PLACEMENT

A. The maximum spacing for pipe supports and expansion joints shall be as indicated in Table 2.

B. Rubber hose and flexible tubing shall be provided with continuous angle or channel support.

C. Unless otherwise indicated on the Drawings or acceptable to Engineer, piping shall be supported approximately 1-1/2 inches out from the face of walls and at least 3 inches below ceilings.

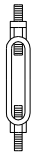
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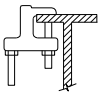
ADJ. STEEL CLEVIS
TYPE-1



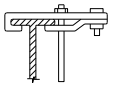
ADJ. STEEL
BAND HGR
TYPE-7



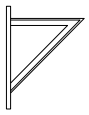
STEEL TURNBUCKLE
TYPE-13



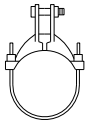
TOP BEAM
C-CLAMP
TYPE-19



TOP I-BEAM CLAMP
TYPE-25



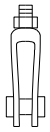
LIGHT WELDED
STEEL BRACKET
TYPE-31



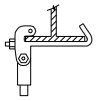
ALLOY STEEL
PIPE CLAMP
TYPE-2



EXTENSION PIPE ON
RISER CLAMP
TYPE-8



STEEL CLEVIS
TYPE-14



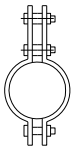
SIDE I-BEAM ON
CHANNEL CLAMP
TYPE-20



CLIP
TYPE-26

MEDIUM WELDED
STEEL BRACKET
TYPE-32

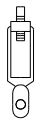
HEAVY WELDED
STEEL BRACKET
TYPE-33



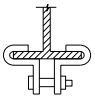
CARBON OR ALLOY
STEEL DOUBLE BOLT
PIPE CLAMP
TYPE-3



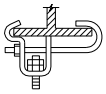
ADJUSTABLE
BAND HGR
TYPE-9



SWIVEL
TURNBUCKLE
TYPE-15



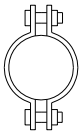
CENTER I-BEAM
TYPE-21



SIDE I-BEAM CLAMP
TYPE-27



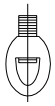
SIDE BEAM BRACKET
TYPE-34



STEEL PIPE CLAMP
TYPE-4



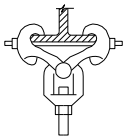
ADJ. SWIVEL RING
BAND TYPE
TYPE-10



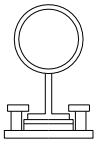
MALLEABLE
IRON SOCKET
TYPE-16



WELDED
ATTATCHMENT
TYPE-22
AS SHOWN OR
INVERTED LESS BOLT



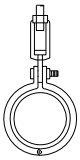
STEEL I-BEAM CLAMP
W/ EYE NUT
TYPE-28



PIPE SLIDE &
SLIDE PLATE
TYPE-35



PIPE HANGER
TYPE-5



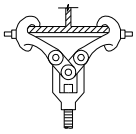
SPLIT PIPE W/WO
TURMBUCKLE ADJ.
TYPE-11



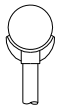
STEEL WELDLESS
EYE NUT
TYPE-17



C-CLAMP
TYPE-23



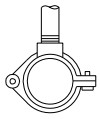
STEEL W.F. CLAMP
W/ EYE NUT
TYPE-29



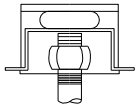
PIPE SADDLE
SUPPORT
TYPE-36



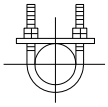
ADJ. SWIVEL PIPE RING
SPLIT RING TYPE OR
SOLID RING TYPE
TYPE-6



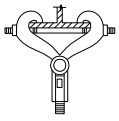
EXTENSION SPLIT
PIPE CLAMP
HINGED OR TWO BOLT
TYPE-12



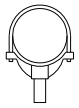
STEEL OR MALLEABLE
CONCRETE INSERT
TYPE-18



U-BOLT
TYPE-24



MALLEABLE BEAM CLAMP
W/EXTENSION PIECE
TYPE-30

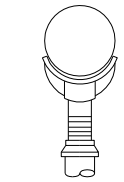


PIPE STANCHION
SADDLE
TYPE-37

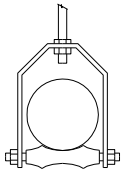
HANGERS AND SUPPORTS

Black & Veatch	PIPE SUPPORTS	FIG 1-40 05 17.13(A)

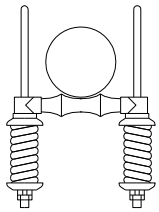
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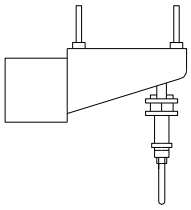
ADJUSTABLE PIPE
SADDLE SUPPORT
TYPE-38



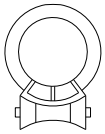
ADJUSTABLE ROLLER
HANGER W/WO SWIVEL
TYPE-43



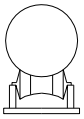
SPRING CUSHION ROLL
TYPE-49



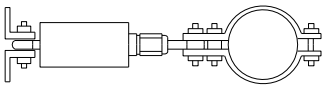
CONSTANT SUPPORT
HORIZONTAL TYPE
TYPE-54



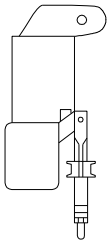
STEEL PIPE COVER
PROTECTION SADDLE
TYPE-39



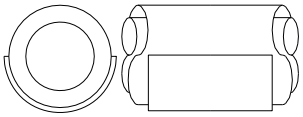
PIPE ROLL
COMPLETE
TYPE-44



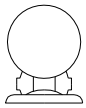
SPRING SWAY BRACE
TYPE-50



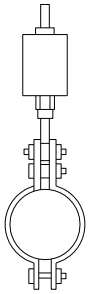
CONSTANT SUPPORT
VERTICAL TYPE
TYPE-55



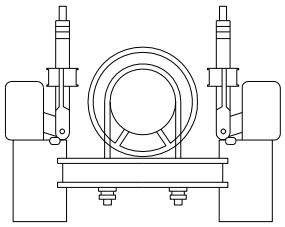
PROTECTION SHIELD
TYPE-40



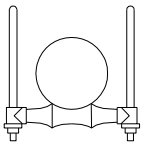
PIPE ROLL & PLATE
TYPE-45



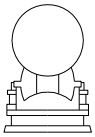
VARIABLE SPRING
HANGER
TYPE-51



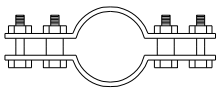
CONSTANT SUPPORT
TRAPEZE TYPE
TYPE-56



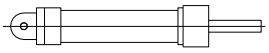
SINGLE PIPE ROLL
TYPE-41



ADJUSTABLE PIPE ROLL & BASE
TYPE-46



CARBON OR ALLOY STEEL
RISER CLAMP
TYPE-42



RESTRAINT CONTROL
DEVICE
TYPE-47



VARIABLE SPRING
BASE SUPPORT
TYPE-52

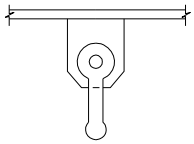
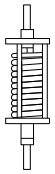
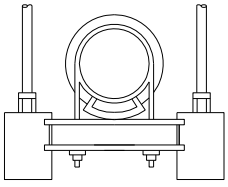


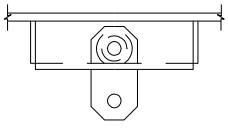
PLATE LUG
TYPE-57



SPRING CUSHION
TYPE-48



VARIABLE SPRING
TRAPEZE HANGER
TYPE-53



HORIZONTAL TRAVELER
TYPE-58

HANGERS AND SUPPORTS

Black & Veatch	PIPE SUPPORTS	FIG 1-40 05 17.13(B)

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SECTION 40 05 19 - DUCTILE IRON PIPE

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the furnishing and installation of ductile iron pipe. Ductile iron pipe shall be furnished complete with all fittings, specials, adapters, closure pieces, blowoffs, outlets, caps and plugs, temporary bulkheads, access manholes, jointing materials, pipe hangers and supports, anchors, blocking, encasement, appurtenances, and accessories specified and indicated on the Drawings, and as required for proper installation and functioning of the piping.

B. The size, service, and locations of ductile iron pipelines are covered in the Ductile Iron Pipe Schedule. Steel pipe material will be permitted as an alternative to ductile iron pipe.

C. Piping furnished hereunder shall be complete with all joint gaskets, bolts, nuts and other jointing materials required for installation of any valves and equipment furnished by Owner or others for installation under this Contract.

D. Pipe hangers and supports, pressure and leakage testing, cathodic protection, and cleaning and disinfection are covered in other sections. Pipe trenching, embedment, and backfill are covered in the Trenching and Backfilling section.

1.2 GOVERNING STANDARDS

A. Except as modified or supplemented herein, all ductile iron pipe, fittings, and specials shall conform to the applicable requirements of the following standards and other standards named in this section:

ANSI/AWWA Standards	Title
C151	Ductile-Iron Pipe, Centrifugally Cast, For Water
C600	Installation of Ductile Iron Water Mains and Their Appurtenances
M41	Ductile Iron Pipe and Fittings - Manual of Water Supply Practices
C104	Cement Mortar Lining for Ductile Iron Pipe and Fittings
C105	Polyethylene Encasement for Ductile Iron Pipe Systems
C110	Ductile-Iron and Gray-Iron Fittings
C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

ANSI/AWWA Standards	Title
C115	Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
C153	Ductile-Iron Compact Fittings

1.3 PIPE MANUFACTURER AND FIELD SERVICES

A. All ductile iron pipe, fittings, specials, bolts, gaskets, other jointing materials, and appurtenances shall be fabricated, lined, coated, and furnished under the direction and management of one pipe manufacturer. The pipe manufacturer responsibilities, which shall include, at a minimum; coordinating and furnishing all pipe materials, gaskets, bolts, and other jointing materials, and pipe appurtenances (except for furnished coupled joints and other similar products by a specified manufacturer) for a complete piping system that meets the specified test pressures and service conditions; ensuring and certifying that all pipe, fittings, specials, and other pipe materials, pipe gaskets and bolts specified herein, are being manufactured in full accordance with the Contract Documents; preparing and submitting all submittal information and shop drawings; and making any corrections that may be required to submittal information and shop drawings.

B. The pipe manufacturer’s minimum required experience qualifications shall include manufacture of a pipeline at least 1 mile in length, of a diameter equal to or larger than the pipe to be provided, with joints, lining, and coating suitable for the same or higher pressure rating, which has performed satisfactorily for the past 5 years.

C. All ductile iron pipe shall be installed in accordance with the pipe manufacturer’s recommendations.

D. The pipe manufacturer shall provide the services of an experienced, competent, and authorized field service representative who is acceptable to Owner to perform all field services specified herein. The field service representative minimum required experience shall include 5 years of practical knowledge and experience installing ductile iron pipe with joints, lining, and coating of the pipe to be furnished. The resume of the proposed field service representative which meets the specified minimum required experience qualifications shall be submitted for review in accordance with the Submittals Procedures section.

E. The field service representative shall visit the site to advise and consult with the Contractor and inspect, check, instruct, and guide Contractor's procedures for pipe handling, laying, and jointing at the start of pipe installation for each crew and shall coordinate his services with Contractor. The field services representative shall not directly supervise the Contractor’s personnel. The Contractor shall remain responsible for the piping installation work. The field service representative shall revisit the site as often as necessary to perform an installation check.

F. The pipe manufacturer shall furnish a metal gauge to measure the restrained push-on joint grooves for pipe and fittings and each pipe or fitting shall be checked before installation. The

field service representative shall instruct the Contractor on how to fully extend each restrained joint as pipe laying is performed to minimize further take-up.

G. Contractor shall submit a written report prepared and furnished by the field service representative certifying that Contractor's installation personnel have been properly instructed and have employed the proper pipe handling and installation procedures. Contractor shall also submit a written report prepared and furnished by the field service representative of each site visit. All reports shall be submitted in accordance with the Submittals Procedures section.

H. All costs for these services shall be included in the Contract Price.

1.4 SUBMITTALS

A. General Submittals.

1. Drawings, details, specifications, and installation schedules covering all ductile iron pipe and accessories shall be submitted in accordance with the Submittals Procedures section. The drawings and data shall include, but shall not be limited to, the submittals listed in this section.

B. Experience Certification

1. Certification of pipe manufacturer’s experience requirements.

C. ANSI/AWWA Certification

1. Certification by manufacturer (affidavit of compliance) for each item furnished in accordance with the ANSI/AWWA Standards.

D. Restrained joints details.

E. Field Services Certification

1. Certification of pipe manufacturer’s field services, including a copy of the initial services, and all subsequent inspection reports.

F. Field service representative’s resume.

G. Emergency Repair Contact Info

1. Relevant contact information for emergency repair assitance, including names and telephone numbers of emergency contact persons.

H. Gasket Certifications

1. Certification of gaskets by pipe manufacturer, certifying that gasket material is suitable for test pressures and services intended.

I. ANSI/NSF 61 Certification.

1. Certification that all materials in contact with treated or potable water are ANSI/NSF 61 approved.

J. Certification of Joint Lubricant.

K. Joint Test Certification

1. Certification of proof-of-design tests for joints, including restrained joints.

L. Welded-on Outlet Certification

1. Certification of proof-of-design tests for welded-on outlets and experience documentation. Air test documentation for the welded-on outlets used for this project.

M. Fabrication Schedule.

1. Fabrication schedule covering each stage of the fabrication of the pipe.

N. Ground Elevation and Utility Locations:

1. Prior to preparation of the pipe laying schedule, Contractor shall verify the existing ground elevation and the location and depth of all underground utilities using centerline stakes set at no more than 100 feet intervals. Contractor shall carefully locate and excavate utility, survey, document and submit this information to the Engineer.

2. Engineer will review this information and if necessary make adjustment to the pipeline profile. Any plans sheets that are modified by the Engineer will be reissued to the Contractor.

O. Pipe Laying Schedule.

1. Pipe laying schedule complete with a sequence of laying and an explanation of all abbreviations used in the schedule. For long, straight pipe runs, the pipe laying schedule shall list the pipeline station and either the pipe centerline or invert elevation coordinated with the Drawings at least every 100 feet .

2. The annotated laying schedule showing all changes made during construction shall be submitted upon completion of the installation of the pipeline.

P. Encasement Samples

1. Two samples of the polyethylene encasement, each sample clearly identified as required by the Governing Standards and test results from an independent third party laboratory of the requirements specified in ANSI/AWWA C105/A21.5.

Q. Deflection Measurement

1. The method that the Contractor proposes to use for measuring deflection of pipe joints.

R. Other Data

1. Submittal data shall clearly indicate the country of origin of pipe, fittings, flanges, restraining devices, and accessories. When requested by Engineer, certified copies of physical and chemical test results as outlined in ANSI/AWWA C151/A21.51 shall be submitted for the materials to be provided.

S. Emergency Repair Manual

1. Contractor shall submit an emergency repair manual prepared and furnished by the pipe manufacturer. The manual shall include procedures for handling emergency calls and repairs; a list of stock replacement pipe sections, closures, and other parts needed for emergency repairs; names and emergency telephone numbers of pipe manufacturer's engineering staff and factory-trained field service representatives who can be contacted day or night during an emergency; response and delivery times; and installation instructions for the materials and methods used in making repairs.

T. Pre-Submittal Meeting Plan

1. Prior to the initial pipe submittal, a pre-submittal meeting will be held at a mutually agreed time and place. The meeting shall be attended by:

a. Representatives of Owner.
b. Contractor and Contractor's superintendent.
c. Contractor's pipe manufacturer's design engineer.
d. Representatives of Engineers.

2. Contractor shall bring to the meeting a preliminary schedule for the following:

a. Pipe installation sequencing.
b. Pipe fabrication and delivery.
c. Pipe shop drawings and data submittals as set forth in the Submittals Procedures section.

3. The purpose of the meeting is to review the preliminary schedules and submittal data requirements, to discuss the fabrication and delivery schedules, to review development of the pipe manufacturer's pipe laying schedule, and to establish procedure and coordinate efforts associated with the pipe submittals.

1.5 SHIPPING, HANDLING, AND STORAGE

A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section, and as specified herein.

B. Pipe, fittings, and accessories shall be handled in a manner that will ensure installation in sound, undamaged condition. Equipment, tools, and methods used in handling and installing pipe and fittings shall not damage the pipe and fittings. Hooks inserted in ends of pipe shall have broad, well-padded contact surfaces. Unpadded hooks, wire brushes or other abrasive tools shall not be permitted to come into contact with polyethylene lining if such lining is specified.

C. Contractor-furnished pipe and fittings in which the lining has been damaged shall be replaced by and at the expense of Contractor. With the concurrence of Engineer, small and readily accessible damaged areas may be repaired.

D. Contractor shall repair any damage to pipe coatings and linings before the pipe is installed.

PART 2 - PRODUCTS

2.1 PIPE CLASS

A. The class of ductile iron pipe shall be as indicated. The specified class includes service allowance and casting allowance.

Pipe Size		ANSI/AWWA Pressure Class
inches	mm	
64 thru 30	1600 thru 750	250

B. Pipe wall thickness for grooved and threaded end pipe shall be increased if necessary to comply with the following minimum thickness:

Pipe Size		Minimum Thickness Class	
inches	mm	Threaded Ends (1)	Grooved Ends (2)
4-16	100-400	53	53
18	450	53	54
20	500	53	55
24	600	53	56
30-54	750-1400	53	--
60 and 64	1500-1600	350 (3)	--

(1) Complies with ANSI/AWWA C115/A21.15 for minimum pipe wall thickness for threaded flanges.

(2) Complies with ANSI/AWWA C606 for grooved and shouldered joint ductile iron pipe.

(3) Minimum class for 60 and 64 inch pipe is pressure class 350.

2.2 MATERIALS

Pipe	Ductile iron, ANSI/AWWA C151/A21.51
Gaskets – All Joint Types	Synthetic rubber unless otherwise specified; natural rubber will not be acceptable. All gaskets shall be furnished by the pipe manufacturer unless another manufacturer's product is indicated. Pipe manufacturer shall submit certificates of gasket suitability certifying that the gasket materials are compatible with the joints specified, are recommended for the specified field test pressure and service conditions. Gaskets for treated or potable water service shall be certified for chlorinated and chloraminated potable water. Gas and oil-resistant gaskets shall be made of Nitrile (NBR [Acrylonitrile Butadiene]) rubber. The name of the material shall be permanently marked or molded on the gasket. Gaskets shall also be certified as suitable where soils may be contaminated with gas and oil products.
Joint Lubricant	Vegetable-based lubricant recommended by the pipe manufacturer. Petroleum or animal-based lubricants will not be acceptable. Lubricants that will be in contact with treated or potable water shall be certified as being in compliance with ANSI/NSF 61.
Fittings	ANSI/AWWA C110/A21.10 (except shorter laying lengths will be acceptable for U.S. Pipe), or ANSI/AWWA C153/A21.53, minimum working pressure rating as follows, unless indicated otherwise on the Drawings.

Fitting Size, inches	Material	Type	Min. Working Pressure Rating, psi
4 to 24	DI	Flanged joints	250
30 to 48	DI	All joints	250

All fittings shall be ductile iron and suitable for the rated working pressure plus a surge or test pressure allowance of 100 psi or 1.5 times rated working pressure, whichever is less, without leakage or damage.

Push-on Joints	ANSI/AWWA C111/A21.11
Restrained Push-on Joints, positive locking segments and/or rings, 30 inch through 48 inch , working pressure rating at least 250 psi .	American "Flex-Ring," or "Lok Ring"; U.S. Pipe or McWane "TR Flex"; U.S. Pipe HP LOK.

Restrained push-on joints shall be suitable for a test or working pressure plus surge pressure of the rated working pressure plus 100 psi

Flanged Joints	ANSI/AWWA C115/A21.15
Flanges	
Class 250	Ductile iron, flat faced, with ANSI/ASME B16.1, Class 250 diameter and drilling.

Flanges	All flanges shall be suitable for test pressure of 1.5 times rated pressure without leakage or damage.
Bolts	ASTM A307, chamfered or rounded ends projecting 1/4 to 1/2 inch beyond outer face of nut.
Nuts	ASTM A563, hexagonal, ANSI/ASME B18.2.2, heavy semifinished pattern.
Gaskets	ASTM D1330, Grade I rubber, full face type, 1/8 inch thick unless otherwise required by pipe manufacturer and accepted by Engineer. Pipe manufacturer shall submit certification of gaskets furnished as indicated above under Gaskets - All Joint Types.
Insulated Flanges	
Flanges	As specified herein, except bolt holes shall be enlarged as needed to accept bolt insulating sleeves.
Insulation Kits	As manufactured by Advanced Products or Pipeline Seal and Insulator, Inc.
Insulating Gaskets	Type E, G-10, 1/8 inch thick, with Nitrile or EPDM sealing element for water and air service and Viton sealing elements for wastewater service unless otherwise required by pipe manufacturer and accepted by Engineer. Pipe manufacturer shall submit certification of gaskets furnished as indicated above under Gaskets - All Joint Types.
Bolt Insulating Sleeves	G-10, 1/32 inch thick.
Insulating Washers	G-10, 1/8 inch thick, two for each flange bolt.
Backing Washers	Steel, 1/8 inch thick, two for each flange bolt.
Mechanical Joints	ANSI/AWWA C111/A21.11, with ductile iron glands
Restrained Mechanical Joints (factory prepared spigot), 4 inch through 48 inch , working pressure rating at least 250 psi .	American "MJ coupled Joints," or Griffin U.S. Pipe "Mech-Lok." (thru 36” size only)
Restrained Mechanical Joints, (field cut spigot), 4 inch through 48 inch , working pressure rating at least 250 psi .	EBAA Iron "Megalug" Series 1100, Sigma “One Lok” SLDE series, or Star Pipe Products “StarGrip 3000” without exception.
Restrained mechanical joints shall be suitable for a test or working pressure plus surge pressure of the rated working pressure plus 100 psi	

Wall Pipes or Castings	Mechanical joint with water stop and tapped holes; single casting or fabricated ductile iron pipe; holes sized in accordance with the details on the Drawings and provided with removable plugs.
Mechanical Joints with Tie Rods	As indicated in the Drawings.
Tie Rods	ASTM A307.
Steel Pipe	ASTM A53, Schedule 40 or 80 as indicated on the Drawings.
Washers	ANSI/ASME B18.22.1, plain steel.
Threaded Connections	ANSI/ASME B1.20.1, NPT; with boss or tapping saddle wherever wall thickness minus the foundry tolerance at the tapped connection is less than that required for 4-thread engagement as set forth in Table A.1, Appendix A, of ANSI/AWWA C151/A21.51.
Dismantling Joints	
Restrained 3 inch and larger Unless otherwise indicated on the Drawings, dismantling joints shall be restrained.	Romac "DJ400"; Dresser "Style 131 Dismantling Joint" or Viking Johnson. For use in potable water systems, coating to be in accordance with NSF-61.
Tapping Saddles	Ductile iron, with stainless steel straps and synthetic rubber sealing gasket, 250 psi pressure rating.
Watertight/Dusttight Pipe Sleeves	GPT " Link-Seal", insulating type with modular rubber sealing elements, nonmetallic pressure plates, and stainless steel bolts and nuts.
Shop Coating and Lining	
Cement Mortar Lining with Seal Coat	ANSI/AWWA C104/A21.4.
Universal Primer	Manufacturer’s standard. If in contact with treated or potable water, certify as being in compliance with ANSI/NSF 61.
Asphaltic Coating	Manufacturer’s standard.
Coal Tar Epoxy	Manufacturer’s standard.
Liquid Epoxy	ANSI/AWWA C210, non-coal tar modified, or when in contact with treated or potable water, certify as being in compliance with ANSI/NSF 61.

Anti-Seize Thread Lubricant	Jet-Lube "Nikal", John Crane "Thred Gard Nickel", Bostik/Never-Seez "Pure Nickel Special" or Permatex "Nickel Anti-Seize."
Corrosion Protection	
Polyethylene Encasement	Seamless, ANSI/AWWA C105/A21.5; LLDPE - 8 mil or HDCLPE - 4 mil .
Heat-shrinkable Coating and Primer (Shrink Sleeve)	ANIS/AWWA C216, cross-linked polyethylene sheeting precoated with adhesive; minimum 80 mils; type and recovery as recommended by Shrink Sleeve manufacturer; Canusa-CPS or Berry Plastics Water Wrap.
Wax Tape and Primer	ANSI/AWWA C217, cold-applied petroleum wax primer and cold-applied petroleum wax tape; Trenton Wax-Tape and Primer.
Medium Consistency Coal Tar	Carboline "Bitumastic 50" or Tnemec "46 465 H.B. Tnemecol."

2.3 OUTLETS

A. Where a 12 inch or smaller branch outlet is indicated and the diameter of the parent pipe is at least twice the diameter of the branch, a tee, a factory welded-on boss, or a tapping saddle will be acceptable.

B. Where a 4 inch or larger branch outlet is indicated on the Drawings and the diameter of the branch pipe for a given diameter of parent pipe is less than or equal to the maximum diameter listed herein, a factory welded-on outlet fabricated from centrifugally cast ductile iron pipe will be acceptable.

Parent Pipe Diameter Versus Maximum Branch Pipe Diameter for Welded-On Outlets

Parent Pipe Diameter, inches	Max Branch Pipe Diameter, inches	Parent Pipe Diameter, inches	Max Branch Pipe Diameter, inches
8	4	30	20
10	6	36	24
12	8	42	30
14	8	48	30
16	10	54	36
18	12	60	36
20	14	64	36
24	16		

C. All 30 inch and smaller branch pipe diameter welded-on outlets shall be rated for a working pressure of 250 psi , 36 inch branch diameter welded-on outlets shall be rated for a working pressure of 200 psi , and all outlets shall have a minimum factor of safety of 2.0. The pipe manufacturer shall provide test data and certification of proof of design. It is not necessary that these tests be performed on pipe manufactured specifically for this project. Certified reports covering tests made on other pipe of the same size and design as specified herein and manufactured from materials of equivalent type and quality may be accepted as adequate proof of design.

D. Welded-on outlets may be provided as a radial (tee) outlet, a tangential outlet, or a lateral outlet fabricated at a specific angle to the parent pipe (in 15 degrees increments between 45 degrees and 90 degrees from the axis of the parent pipe), as indicated on the Drawings. The fillet weld dimensions for welded-on outlets shall be as specified herein. Parent pipe and branch pipe shall meet hydrostatic test requirements in accordance with ANSI/AWWA C151/A21.51 prior to fabrication.

Welded-on Outlet Fillet Weld Dimensions for Specified Outlet Configurations

Radial and Lateral Outlets			Tangential Outlets		
Parent Pipe Diameter, inches	Branch Pipe Diameter, inches	Weld Fillet Size, inches	Parent Pipe Diameter, inches	Branch Pipe Diameter, inches	Weld Fillet Size, inches
30-48	24 and smaller	1-1/4 x 1-1/4	36-54	24 and smaller	1-1/2 x 1-1/2

E. All joints on welded-on branch outlets shall be made in accordance with the latest revision of ANSI/AWWA C111/A21.11 and/or ANSI/AWWA C115/A21.15, as applicable. All outlets shall be fabricated from centrifugally cast ductile iron pipe designed in accordance with ANSI/AWWA C150/A21.50 and manufactured and tested in accordance with ANSI/AWWA C151/A21.51. Ni-Rod FC 55® electrodes manufactured by International Nickel Corporation (or an electrode with equivalent properties) shall be used in the manufacture of the fillet welds. Carbon steel electrodes will not be acceptable. Special Thickness Class 53 pipe shall be used for all branch pipe and parent pipe in 4 to 54 inch sizes. After welding, each fabricated outlet shall be subjected to a 15 psi air test. A soap and water solution shall be applied during the testing procedure to inspect the weld for leakage. Any welds that show air seepage shall be refabricated and retested.

F. Welded-on outlets shall be fabricated by the pipe manufacturer at its production facilities. Manufacturers of welded-on outlets shall have at least 5 years of satisfactory experience in the manufacture and performance of these products. The manufacturer shall have a documented welding quality assurance system and shall maintain resident quality assurance records based on ANSI/AWS D11.2, the Guide for Welding Iron Castings. The manufacturer shall also maintain appropriate welding procedure specifications (WPS) and procedure qualification (PQR), and welder performance qualification (WPQR) records.

G. The type of pipe end for the branch outlet shall be as specified or indicated on the Drawings. The maximum size and laying length of the welded-on branch outlet shall be as recommended by the pipe manufacturer and shall be acceptable to Engineer for the field conditions and the connecting pipe or valve.

H. At locations acceptable to Engineer, drilling and tapping of the pipe wall for 2 inch and smaller pipe connections will also be acceptable, provided that the wall thickness, minus the casting allowance, at the point of connection equals or exceeds the wall thickness required for 4-thread engagement in accordance with Table A.1, Appendix A of ANSI/AWWA C151/A21.51.

2.4 JOINTS

A. Joints in buried and tunnel locations shall be mechanical or push-on type unless otherwise indicated on the Drawings or where required to connect to existing piping or to valves. Bells on wall castings and wall sleeves shall be mechanical joint type, with tapped holes for tie rods or stud bolts. All other joints shall be flanged unless otherwise indicated on the Drawings.

B. Certification of joint design shall be provided in accordance with ANSI/AWWA C111/A21.11, Performance Requirements, as modified herein. The joint test pressure shall be not less than 2 times the working pressure rating of the joint. The same certification and testing shall also be provided for restrained joints. For restrained joints, the piping shall not be blocked to prevent separation and the joint shall not leak or show evidence of failure. It is not necessary that such tests be made on pipe manufactured specifically for this project. Certified reports covering tests made on other pipe of the same size and design as specified herein and manufactured from materials of equivalent type and quality may be accepted as adequate proof of design. Any new proof-of-design testing to meet the requirements for this project shall be independently verified and the Owner shall be given the opportunity to witness the testing.

C. Unless otherwise indicated on the drawings or acceptable to the Engineer, field closure pieces shall be located away from the bends or dead ends beyond the length over which joints are to be restrained.

D. All installed piping shall have restrained joints.

E. Flanged Joints

1. Pipe shall extend completely through screwed-on flanges. The pipe end and flange face shall be finish machined in a single operation. Flange faces shall be flat and perpendicular to the pipe centerline.

F. Dismantling Joints

1. Dismantling joints shall be provided for restrained couplings 6 inch and larger piping where indicated on the Drawings and as specified herein. Dismantling joints shall comply with AWWA C219 and shall be restrained flange by flange couplings manufactured as a single unit. Unless otherwise indicated on the Drawings, dismantling joints shall be restrained.The inner and outer surfaces of dismantling joints, except flange mating surfaces, shall be prepared for coating in accordance with instructions of the coating manufacturer and shall then be shop coated with liquid epoxy in accordance with ANSI/AWWA C210. The flange mating surfaces shall be cleaned and shop primed with universal primer.

G. Mechanical Couplings

1. The piping layout for mechanical couplings shall provide a space of at least 1/4 inch , but not more than 1 inch , between the pipe ends.

2. All surfaces, including the interior surfaces of the middle rings, shall be prepared for coating in accordance with instructions of the coating manufacturer and shall be shop coated with 16 mils liquid epoxy in accordance with ANSI/AWWA C210.

3. A ductile iron pipe factory spacer shall be provided for the piping where indicated on the drawings. The spacer shall be shop lined and coated with 16 mils of liquid epoxy. Piping surfaces within the coupling shall be shop coated with 16 mils of liquid epoxy.

4. Tie bolts shall be provided to restrain mechanical coupling connections where indicated on the Drawings. The connecting pipe shall be furnished with welded retainer rings as recommended by pipe manufacturer. The pipe manufacturer shall also coordinate the restrained connection with the pressure rating, length, and diameter dimensions of the mechanical coupling being furnished to assure proper clearance is provided for completing the restrained coupling installation.

2.5 REDUCERS

A. Reducers shall be eccentric or concentric as indicated on the Drawings. Reducers of eccentric pattern shall be installed with the straight side on top, so that no air traps are formed.

2.6 BLOWOFFS

A. Each blowoff shall be located and arranged as indicated on the Drawings.

2.7 ACCESS OPENINGS

A. Access openings shall be installed at the locations indicated on the Drawings. Access openings shall be 36 inch diameter outlets for 36 inch and larger diameter pipe and the same size as the pipe for 24 and 30 inch diameter pipe. Access openings shall be provided with either flanged outlets with blind flange cover or mechanical joint outlets with restrained mechanical joint plugs. Unless otherwise indicated on the Drawings or acceptable to the Engineer, covers shall be designed for the same external loads and internal pressures as the adjacent pipe. Covers shall be fabricated from steel plate and shall have two handles fabricated from 1 inch diameter rod or shall be manufacturer’s standard blind flange with integrally cast lifting devices, either one in the center or two or more symmetrically located around the perimeter of the cover. At the option of the Contractor, and if acceptable to the Engineer, reinforced or dished covers of lighter weight and equal strength may be provided.

2.8 SHOP COATING AND LINING

A. The interior of all pipe and fittings, unless noted otherwise, shall be cement mortar lined.

B. The exterior surfaces of all pipe and fittings which will be exposed in both interior and exterior locations shall be shop primed. Flange faces shall be coated with a suitable rust-preventive compound. Exterior surfaces of all other pipe and fittings shall be coated with asphaltic coating.

2.9 OWNER'S SHOP INSPECTION AND TESTING

A. Tests for preliminary acceptance of materials and methods of manufacture shall be made at the expense of the Contractor. At the Owner's option, inspection and control tests during manufacture of the pipe to be provided under this Contract may be made by representatives of the Owner. The manufacturer and the Contractor shall provide facilities, space, and assistance for testing and the Owner's representative shall have free access to all parts of the plant involved in the furnishing of materials under this Contract.

B. Prior to the start of fabrication of the pipe, the Contractor shall submit the manufacturer's fabrication schedule covering each stage of the fabrication of the pipe. A fabrication schedule shall be submitted to Owner at least 30 days prior to fabrication activities. Each time the schedule is changed, the Contractor shall revise and resubmit the schedule. The Contractor shall notify the Engineer at least 3 days prior to any change in the revised and current schedule. If the Owner's representatives make an inspection and the manufacturer is not performing the work as indicated in the revised and current schedule for that date, the expense shall be the sole responsibility of the Contractor.

C. The Owner's representatives may reject any material which is not applied or fabricated in accordance with the Contract Documents, and which does not attain the prescribed test results. The expense of all subsequent tests, due to failure of original materials and fabrication to comply with the Contract Documents, shall be the sole responsibility of the Contractor.

D. Inspection and testing by the Owner's representatives are for the sole benefit of the Owner. Inspection by the Owner's representatives, or Owner’s decision not to provide inspections, shall not relieve the Contractor of his responsibility to provide materials and perform the work in accordance with the Contract Documents.

E. The Owner's expense for any reinspections due to failure of original materials and fabrication to comply with the Contract Documents or for any inspection trip that was made when work was not being performed as indicated in the current schedule, will be deducted from the Contractor's pay estimate.

F. The Owner reserves the right to sample and test any pipe after delivery and to reject all pipe represented by any sample which fails to meet with the specified requirements.

PART 3 - EXECUTION

3.1 INSPECTION

A. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation; pipe ends shall be examined with particular care. All defective pipe and fittings shall be removed from the site.

3.2 PROTECTION AND CLEANING

A. The interior of all pipe and fittings shall be thoroughly cleaned of all foreign material prior to installation and shall be kept clean until the work is completed. Before jointing, all joint contact surfaces shall be wire brushed if necessary and wiped clean.

B. Precautions shall be taken to prevent foreign material from entering the pipe during installation. Debris, tools, clothing, or other objects shall not be placed in or allowed to enter the pipe.

C. Whenever pipe laying is stopped, the open end of the pipe shall be closed to prevent entry of dirt, mud, rodents, and other material. All water in the trench shall be removed prior to removing the closure.

3.3 CUTTING PIPE

A. Cutting shall be done in a neat manner, without damage to the pipe or the lining. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the ends of the pipe shall be dressed with a file or a power grinder to remove all roughness and sharp edges and coated with a suitable repair coating. The cut ends of push-on joint pipe shall be suitably beveled.

B. All field cutting of existing gray cast iron pipe shall be done with mechanical pipe cutters, except where the use of mechanical cutters would be difficult or impracticable.

C. Ends of ductile iron pipe shall be cut with a portable guillotine saw, abrasive wheel, saw, milling cutter, or oxyacetylene torch. The use of hydraulic squeeze type cutters will not be acceptable. Field-cut holes for saddles shall be cut with mechanical cutters; oxyacetylene cutting will not be acceptable.

D. Contractor shall use factory prepared pipe ends unless a field cut is required for connections.

3.4 ALIGNMENT AND GRADE

A. Buried piping shall be laid to the lines and grades indicated on the Drawings and as specified. Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the values stipulated for full-length push-on joint pipe for full-length mechanical joint pipe of AWWA C600, unless specially designed bells and spigots are provided. Contractor shall submit his proposed methods to measure deflection of deflected joints in accordance with the Submittal section.

B. Whenever deflections would exceed the values stipulated in AWWA C600, either shorter pipe sections or fittings shall be installed where needed to conform to the alignment or grade indicated on the Drawings and as acceptable to the Engineer.

C. Unless otherwise specified or acceptable to Engineer, laser beam equipment, surveying instruments, or other suitable means shall be used to maintain alignment and grade. At least one elevation reading shall be taken on each length of pipe. If laser beam equipment is used, periodic elevation measurements shall be made with surveying instruments to verify accuracy of grades. If such measurements indicate thermal deflection of the laser beam due to differences

between the ground temperature and the air temperature within the pipe, precautions shall be taken to prevent or minimize further thermal deflections.

D. Additional requirements for alignment and grade are covered in the Project Requirements and Trenching and Backfilling sections and on the Drawings.

E. Tolerances

1. Each section of pipe shall be laid to the alignment and grade indicated on the Drawings and pipe laying schedule with pipe ends within the following tolerances;

   a. +/- 0.10 foot in grade at any point
   b. +/- 0.20 foot in alignment at any point

2. In addition, piping shall be visually straight or on a smooth curve between the points of defection or curvature indicated on the Drawings. Stricter tolerances than specified above shall be used as necessary to maintain minimum cover, to maintain required clearances, to make connections to existing pipe, to maintain the correct slope to avoid high or low points along the pipeline other than at locations indicated on the Drawings, or to meet other restrictions as required or directed by the Engineer.

3.5 LAYING PIPE

A. Buried pipe shall be protected from lateral displacement by placing the specified pipe embedment material installed as specified in the Trenching and Backfilling section. Under no circumstances shall pipe be laid in water, and no pipe shall be laid under unsuitable weather or trench conditions. Pipe embedment material and trench backfill shall be placed and compacted under and around each side of outlets and fittings to hold the pipe in proper position and alignment during the subsequent pipe jointing, embedment, and backfilling.

B. Pipe shall be laid with the bell ends facing the direction of laying, except where reverse laying is specifically acceptable to Engineer.

C. The pipe laying schedule shall be annotated during the progress of the work to show all changes made during construction for record documentation. Upon completion of the installation of the piping, the annotated pipe laying schedule shall be submitted to Engineer in accordance with the Submittals Procedures section.

3.6 JOINTS

A. Each joint, including restrained joints, shall be checked by Contractor as recommended by the pipe manufacturer to verify that the joint and the restraints are installed properly. Restrained joints shall be extended after they are assembled to minimize further take-up.

3.7 MECHANICAL JOINTS

A. Mechanical joints shall be carefully assembled in accordance with the pipe manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Bolts shall be uniformly tightened to the torque values listed in Appendix A of ANSI/AWWA C111/A21.11. Over tightening of bolts to compensate for poor installation practice will not be acceptable.

B. The holes in mechanical joints with tie rods shall be carefully aligned to permit installation of the tie rods. In flange and mechanical joint pieces, holes in the mechanical joint bells and the flanges shall straddle the top centerline for horizontal piping.

3.8 PUSH-ON JOINTS

A. The pipe manufacturer's instructions and recommendations for proper jointing procedures shall be followed. All joint surfaces shall be lubricated with a soap solution provided by the pipe manufacturer immediately before the joint is completed. Lubricant shall be suitable for use in potable water, shall be stored in closed containers, and shall be kept clean. Each spigot end shall be suitably beveled to facilitate assembly.

B. Pipe ends for restrained joint pipe shall be prepared in accordance with the pipe manufacturer's recommendations.

3.9 FLANGED JOINTS

A. When bolting flanged joints, care shall be taken to avoid restraint on the opposite end of the pipe or fitting which would prevent uniform gasket compression or would cause unnecessary stress in the flanges. One flange shall be free to move in any direction while the flange bolts are being tightened. Bolts shall be tightened gradually in a crisscross pattern and at a uniform rate, to ensure uniform compression of the gasket around the entire flange. All flange joint bolting procedures shall be in accordance with the pipe manufacturer's recommendations.

B. Special care shall be taken when connecting piping to any pumping equipment to ensure that piping stresses are not transmitted to the pump flanges. All connecting piping shall be permanently supported to obtain accurate matching of bolt holes and uniform contact over the entire surface of flanges before any bolts are installed in the flanges.

C. Pump connection piping shall be free to move parallel to its longitudinal centerline while the bolts are being tightened. Each pump shall be leveled, aligned, and wedged into position which will fit the connecting piping, but shall not be grouted until the initial fitting and alignment of the pipe, so that the pump may be shifted on its foundation if necessary to properly install the connecting piping. Each pump shall, however, be grouted before final bolting of the connecting piping.

D. After final alignment and bolting, the pump connections shall be tested for applied piping stresses by loosening the flange bolts which, if the piping is properly installed, should result in no movement of the piping relative to the pump or opening of the pump connection joints. If any movement is observed, the piping shall be loosened and re-aligned as needed and then the

flanges bolted back together. The flange bolts shall then be loosened and the process repeated until no movement is observed.

E. Insulated Flanged Joints

1. Insulated flanged joints shall be installed where indicated on the Drawings. In addition to one full-faced insulated gasket, each flange insulating assembly shall consist of one full-length sleeve, two insulating washers, and two backing washers for each flange bolt. The insulating gasket ID shall be 1/8 inch less than the ID of the flange in which it is installed. The insulated flanged joint accessories shall be installed in accordance with the instructions and recommendations of the insulating kit manufacturer.

3.10 DISMANTLING JOINTS

A. Dismantling joints shall be installed in accordance with the coupling manufacturer's recommendations.

3.11 MECHANICAL COUPLINGS

1. Mechanical couplings shall be installed in accordance with the coupling manufacturer's recommendations. A space of at least 1/4 inch , but not more than 1 inch , shall be left between the pipe ends. Pipe and coupling surfaces in contact with gaskets shall be clean and free from dirt and other foreign matter during assembly. All assembly bolts shall be uniformly tightened so that the coupling is free from leaks, and all parts of the coupling are square and symmetrical with the pipe. Following installation of the coupling, damaged areas of shop coatings on the pipe and coupling shall be repaired to the satisfaction of Engineer.

3.12 CORROSION PROTECTION

A. Polyethylene Encasement

1. All buried pipe including all straight pipe, bends, tees, adapters, closure pieces, and other fittings or specials, shall be provided with at least one wrap of polyethylene encasement. Other locations where ductile iron pipe and accessories shall be double wrapped with polyethylene encasement shall be as specified herein **,** as specified in the Galvanic Anode Type Cathodic Protection for Pipelines section, and as indicated on the Drawings.

2. All buried flanged valves, mechanical joint couplings with tie rods, mechanical couplings, restrained mechanical couplings and other pipe harness assemblies at valves or structure walls shall be provided with two wraps of polyethylene encasement in addition to other corrosion protection coatings as specified herein.

3. Polyethylene tube protection shall be installed in accordance with ANSI/AWWA C105/A21.5, Method A. Preparation of the pipe shall include, but shall not be limited to, removal of lumps of clay, mud, cinders, etc., prior to installation.

4. The terms "polyethylene tube protection" and "polyethylene encasement" are interchangeable and shall have the same meaning in these Contract Documents.

a. Inspection and Testing
1) Tests for preliminary acceptance of polyethylene encasement materials as required in the submittal paragraph shall be made at the expense of the Contractor.
2) At the Owner's expense, the Owner may obtain samples from the material supplied in the field and have test conducted of the requirements specified in ANSI/AWWA C105/A21.5 by an independent third-party laboratory.

B. Mechanical Joint Couplings with Tie Rods

1. The mechanical joint tie rods, bolt studs, pipe spacers and washers of buried mechanical joint couplings as detailed on the Drawings shall be protected by wrapping them with wax tape in accordance with ANSI/AWWA C217. A primer shall be applied prior to applying the wax tape. The application of the wax tape shall be as recommended by the wax tape manufacturer. There shall be no bare or unprotected ferrous metal surfaces.

2. Following application of the wax tape protection, the entire mechanical joint coupling assembly shall be wrapped with two layers of polyethylene encasement as specified herein. The two wraps of polyethylene encasement shall be lapped a minimum of 12 inches with the polyethylene encasement of the piping on each side of the coupling assembly.

C. Flanged Joints

1. The flange bolts and nuts on buried flanges, including valve flanges, shall be protected by wrapping them with wax tape in accordance with ANSI/AWWA C217. A primer shall be applied prior to applying the wax tape. The application of the wax tape shall be as recommended by the wax tape manufacturer. There shall be no bare or unprotected ferrous metal surfaces.

2. Following application of the wax tape protection, the entire flanged joint shall be wrapped with two layers of polyethylene encasement as specified herein. The two wraps of polyethylene encasement shall be lapped a minimum of 12 inches with the polyethylene encasement on each side of the joint.

D. Valves

1. Buried portions of the valve and the actuator to the wrench nut shall be wrapped with two layers of polyethylene encasement as specified herein. The two wraps of polyethylene encasement shall be lapped a minimum of 12 inches with the polyethylene encasement of the piping on each side of the valve.

E. Mechanical Couplings

1. The tie bolts and nuts on all buried mechanical couplings shall be coated with two coats of medium consistency coal tar.

2. After the protective coating has been applied to the tie bolts, the entire mechanical coupling shall be encapsulated with a shrink sleeve as indicated on the Drawings. The shrink sleeve shall extend a minimum of 6 inches on to the pipe on each side of the coupling. A primer shall be applied to the piping on each side of the coupling prior to installing the shrink sleeve. The application of the shrink sleeve shall be in accordance with ANSI/AWWA C216 and as recommended by the shrink sleeve manufacturer. There shall be no bare or unprotected ferrous metal surfaces. Following installation of the shrink sleeve, the entire assembly shall be encapsulated with two wraps of polyethylene encasement lapped a minimum of 12 inches with the polyethylene encasement of the piping on each side of the assembly as specified herein.

F. Restrained Mechanical Couplings

1. The corrosion protection for the mechanical coupling and its tie bolts and nuts of all buried restrained mechanical coupling assemblies shall be protected with two coats of medium consistency coal tar and shrink sleeve as specified herein for buried mechanical couplings.

2. The tie rods and bolts of the coupling assembly shall be protected by wrapping them with wax tap in accordance with ANSI/AWWA C217 and as detailed on the Drawings. A primer shall be applied prior to applying the wax tape. The application of the wax tape shall be as recommended by the wax tape manufacturer. There shall be no bare or unprotected ferrous metal surfaces.

3. Following the application of the wax tape, the entire restrained mechanical coupling assembly shall be encapsulated with two wraps of polyethylene encasement lapped a minimum of 12 inches with the polyethylene encasement of the piping on each side of the assembly as specified herein.

G. Other Assemblies

1. All ferrous metal clamps, tie rods, bolts, and other components of buried joint harnesses, tapping saddles, or pipe reaction anchorages in contact with earth or other fill material and not encased in concrete, shall be protected by wrapping them with wax tape in accordance with ANSI/AWWA C217. A primer shall be applied prior to applying the wax tape. The application of the wax tape shall be as recommended by the wax tape manufacturer. There shall be no bare or unprotected ferrous metal surfaces.

2. Following the application of the wax tape, the entire assembly shall be encapsulated with two wraps of polyethylene encasement lapped a minimum of 12 inches with the polyethylene encasement of the piping on each side of the assembly as specified herein.

H. Surfaces Exposed in Manholes and Vaults

1. Unless otherwise specified, all uncoated surfaces exposed in manholes and vaults shall be cleaned and coated with two coats of medium consistency coal tar. The first coat shall be dry and hard before the second coat is applied. There shall be no unprotected, bare, or uncoated ferrous metal surfaces.

3.13 PROVISIONS FOR CATHODIC PROTECTION SYSTEMS

A. A corrosion protection system shall be provided for buried piping as specified in the Galvanic Anode Type Cathodic Protection for Pipelines section.

B. Electrical Bond Across Rubber-Gasketed Joints

1. Two electrical bonding cables shall be provided across each mechanical coupling and each rubber-gasketed bell-and-spigot joint. Before applying the field joint coating to mechanical couplings, two small areas of the metal surface shall be exposed on each side of the coupling, on the middle ring, and on each follower ring. Each exposed area shall be thoroughly cleaned, and two cathodic protection cables shall be connected to the top of the pipe at least 12 inches apart, one end of each on either side of the joint, and to the middle ring and follower rings of mechanically coupled joints, using the thermite process. The completed connections and exposed metal surfaces shall be coated as specified for field repair of coatings.

2. Joint bond cables shall contain at least 6 inches of slack wire to compensate for pipe movement and backfill settlement.

C. Electrical Bond Across Valves and Flanges

1. Two electrical bonding cables shall be provided across valves and flanged connections other than insulating flanges in the same manner as specified for rubber-gasketed joints.

D. Bonding Cables

1. Bonding cable and test lead wires shall be at least 8 AWG, Type CP copper cathodic protection cable, with low density, high molecular weight polyethylene insulation.

3.14 CONNECTIONS WITH EXISTING PIPING

A. Connections between new work and existing piping shall be made using fittings suitable for the conditions encountered. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with service to customers, and as authorized by Owner. Facilities shall be provided for proper dewatering and for disposal of all water removed from dewatered lines and excavations without damage to adjacent property.

B. Special care shall be taken to prevent contamination when dewatering, cutting into, and making connections with existing potable water piping. Trench water, mud, or other contaminating substances shall not be permitted to enter the lines. The interior of all pipe, fittings, and valves installed in such connections shall be thoroughly cleaned and then all connections with potable water pipelines shall be cleaned and disinfected as specified in the Cleaning and Disinfection of Water Pipelines section.

3.15 REACTION ANCHORAGE AND BLOCKING

A. Concrete blocking shall be installed where indicated on the Drawings. Concrete and reinforcing steel shall be as specified in the Cast-in-Place Concrete section.

B. The blocking size shall be of the dimensions indicated on the Drawings, shall extend from the fitting to solid, undisturbed earth, and shall be installed so that all joints are accessible for repair.

C. Reaction blocking, anchorages, or other supports for fittings installed in fills or other unstable ground, installed above grade, or exposed within structures, shall be provided as indicated on the Drawings.

D. All ferrous metal clamps, rods, bolts, and other components of tapping saddles, reaction anchorages, or joint harness, subject to submergence or in contact with earth or other fill material and not encased in concrete, shall be protected from corrosion as specified in the Corrosion Protection paragraph of this section.

3.16 PRESSURE AND LEAKAGE TESTS

A. After installation, pipe and fittings shall be subjected to a pressure test and a leakage test in accordance with the Pipeline Pressure and Leakage Testing section.

3.17 CLEANING AND DISINFECTION

A. After installation, all potable water pipelines shall be cleaned and disinfected as specified in the Cleaning and Disinfection of Water Pipelines section.

End of Section

Schedule 40 05 19-S01

Ductile Iron Pipe Schedule

Size in.	Location and Service	ANSI/AWWA Class	Lining Material
36	Finished Water – Fayetteville Transmission Main	250	CM
42	Finished Water - Fayetteville Transmission Main	250	CM
48	Finished Water - Fayetteville Transmission Main	250	CM

End of Schedule

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SECTION 40 05 23 - STAINLESS STEEL PIPE AND ALLOY PIPE, TUBING, AND ACCESSORIES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the furnishing of stainless steel pipe and alloy pipe, tubing and accessories through 24” diameter for the services as indicated herein. Pipe and tubing shall be furnished complete with all fittings, flanges, unions, and other accessories specified herein.

1.2 SUBMITTALS

A. Drawings and Data

1. Complete specifications, data, and catalog cuts or drawings shall be submitted in accordance with the Submittal Procedures section. Submittals are required for all piping, fittings, gaskets, sleeves, and accessories, and shall include the following data:

    a. Name of Manufacturer
    b. Type and model
    c. Construction materials, thickness, and finishes
    d. Pressure and temperature ratings

B. Gasket Material Certifications.

1. Contractor shall obtain and submit a written statement from the gasket material manufacturer certifying that the gasket materials are compatible with the joints specified herein and are recommended for the specified field test pressures and service conditions.

C. Welding Procedures and Qualifications.

1. All welding and brazing procedures and operators shall be qualified by an independent testing laboratory in accordance with the applicable provisions of Section IX of the ASME Code. All procedure and operator qualifications shall be in written form and submitted to the Engineer for review.

D. Compliance Data.

1. Pipe for liquid chemical service shall comply with ASME B31.3. Pipe for all other services shall comply with ASME B31.1.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

All materials shall be stored in a sheltered location above the ground, separated by type, and shall be supported to prevent sagging or bending.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless steel pipe and alloy pipe materials shall be as specified herein.

B. Material Classification SS-1

SS-1 – Schedule 10S with Beveled Ends. Stainless steel vent piping for clearwell and vaults. 2-1/2 inch and larger.	Pipe Fittings	ASTM A312, Grade TP316L. Buttwelded, ASTM A403, WP316L. Fittings shall conform to ANSI/ASME B16.9, Schedule 10S with beveled ends.

C. Accessory Materials

1. Accessory materials for the stainless steel pipe systems shall be as indicated. Flanges shall be flat faced for water service and shall be raised face for air or gas service except when connecting to flat face equipment or valve flanges.

Flanges

SS-1 Pipe Backing Flanges: Stainless steel plate, AISI Type 316 to match fittings. Provide stub ends or angle face rings with material and thickness to match fittings. The angle or radius between the angle face ring or stub end and the pipe shall match the angle or radius of the backing flange for proper seating. Flanges shall conform with ANSI/ASME B16.5, Class 150 diameter and drilling; with the following thicknesses:

Nominal Pipe Size inches	Flange Thickness inches
1/2-8	1/2

Flange Bolts: ASTM A193 Class 2, AISI Type 304, ANSI B18.2.1, heavy hex head, length such that, after installation, the bolts will project 1/8 to 3/8 inch beyond outer face of the nut.

Flange Nuts: ASTM A194, AISI Type 304, ANSI/ASME B18.2.2, heavy hex pattern. Washers shall be installed under the nuts.

Flange Gaskets

All other services.	Flexitalic "Style CG," spiral wound, AISI Type 304 stainless steel, non-asbestos filler, 3/16 inch nominal thickness, with compression ring 1/8 inch thick to match required flange dimensions.
Elbows	Elbows shall be long radius type for which the laying length is 1.5 times the pipe diameter.
Insulating Fittings	
Threaded	Dielectric steel pipe nipple, ASTM A53, Schedule 40, polypropylene lined, zinc plated; Perfection Corp. "Clearflow Fittings."
Flanged	Epco "Dielectric Flange Unions" or Central Plastics "Insulating Flange Unions."

2. Branch Connections

a. Branch connections 2-1/2 inches and smaller shall be made with welding fittings. Welded outlets shall be used. Where the exact outlet size desired is in doubt, but is known to be less than 1 inch, a 1 inch outlet shall be provided and reducing bushings used as needed.

b. Branch connections sized 3 and larger shall be made with pipe nipples or with welding fittings with welded outlets. Pipe nipples and welding fittings shall be welded to the pipe shell and reinforced as needed to meet design and testing requirements. The pressure rating of branch and branch connections shall equal or exceed the pressure rating of the main pipe it is connected to.

c. Small branch connections shall be so located that they will not interfere with joints, supports, or other details, and shall be provided with caps or plugs to protect the threads during shipping and handling.

2.2 WELDING OF STAINLESS STEEL AND ALLOYS

A. Filler metal for welding austenitic stainless steel and alloys, P-number 8 base materials shall be in accordance with the following:

1. Material Type/Grade 304 shall use Type 308 filler metal.

2. Material Type/Grade 304L shall use Type 308L filler metal.

3. Material Type/Grade 316, shall use Type 316 filler metal.

4. Material Type/Grade 316L shall use Type 316L filler metal.

B. The following requirements shall apply when fabricating austenitic stainless steel and alloy components.

C. Grinding shall be by aluminum oxide, zirconium oxide, or silicon carbide grinding wheels that shall not have been used on carbon or low alloy steels. Hand or power wire brushing shall be by stainless steel brushes that shall not have been used on carbon or low alloy steels for stainless

steel pipe. Hand or power wire brushing shall be by Carpenter 20 brushes that shall not have been used on carbon or low alloy steels for Carpenter 20 pipe. Hand or power wire brushing shall be by Hastelloy C276 brushes that shall not have been used on carbon or low alloy steels for Hastelloy C276 pipe. All tools used in fabrication shall be protected to minimize contact with steel alloys or free iron. Grinding wheels and brushes shall be identified and controlled for their use on these materials only to ensure that contamination of these materials does not occur.

D. Antispatter compounds, marking fluids, marking pens, tape, temperature indicating crayons, and other tools shall have a total halogen content of less than 200 parts per million.

E. Heat input control for welding shall be specified in the applicable WPS and shall not exceed 55,000 joules per inch as determined by the following formula:

$$\text{Heat Input } \left(\text{J}/_{\text{in.}}\right) = \frac{\text{Voltage x Amperage x 60}}{\text{Travel Speed } (\text{in.}/_{\text{min.}})}$$

F. Complete penetration pressure retaining welds shall be made using the Gas Tungsten Arc Welding (GTAW) process for the root and second layer as a minimum.

G. Austenitic stainless steel instrument tubing shall be welded using only the GTAW process.

H. Socket welds or butt welds in all austenitic stainless steel instrument tubing lines shall require an inert gas backing (purge) using argon during welding to avoid oxidation.

I. The application of heat to correct weld distortion and dimensional deviation without prior written approval from the Engineer is prohibited.

J. Unless otherwise approved in writing, the GTAW process shall require the addition of filler metal.

K. The maximum preheat and interpass temperature for austenitic stainless steel shall be 350° F . The minimum preheat temperature shall be 50° F .

L. Complete joint penetration welds welded from one side without backing, weld repairs welded from one side without backing, or weld repairs in which the base metal remaining after excavation is less than 0.1875 inch from being through wall, which are fabricated from austenitic stainless steel ASME P-number 8 base metal or unassigned metals with similar chemical compositions, shall have the root side of the weld purged with an argon backing gas prior to welding. Backing gas (purge) shall only be argon. The argon backing gas shall be classified as welding grade argon or shall meet Specification SFA-5.32, AWS Classification SG-A. The backing gas (purge) shall be maintained until a minimum of two layers of weld metal have been deposited.

2.3 SHOP CLEANING AND PICKLING OF STAINLESS STEEL PIPING AND WELDS

A. All stainless steel piping shall be thoroughly cleaned and pickled at the mill in accordance with ASTM A380.

B. Pickling shall produce a modest etch and shall remove all embedded iron and heat tint. After fabrication, pickled surfaces shall be subjected to a 24 hour water test or a ferroxyl test to detect the presence of residual embedded iron. All pickled surfaces damaged during fabrication including welded areas shall either be mechanically cleaned or repickled or passivated in accordance with ASTM A380. Materials that have been contaminated with steel alloys or free iron shall not be used until all contamination is removed. When cleaning to remove steel or iron contamination is required, it shall be performed in accordance with ASTM A380, Code D requirements. Mechanical cleaning is not an acceptable cleaning method for oxygen or ozone piping. Oxygen and ozone piping shall be repickled or passivated as specified herein. All stainless steel surfaces shall be adequately protected during fabrication, shipping, handling, and installation to prevent contamination from iron or carbon steel objects or surfaces. Particulate matter shall be removed from piping and welds. Labels shall be affixed to the piping sections to indicate shop cleaning has been performed. Welds shall be either mechanically cleaned or pickled or passivated on the exterior of the pipe.

C. For buried piping, at least the exterior of all welds shall be passivated.

D. For oxygen or ozone piping, welds shall be pickled or passivated on the interior and exterior of the pipe. For small diameter piping, a solution shall be circulated. For piping large enough to enter, a passivation gel may be used. For oxygen or ozone systems, additional cleaning requirements are specified in section 13756 – Cleaning for Oxygen and Ozone service.

2.4 INSULATING FITTINGS

A. In all piping, insulating fittings shall be provided to prevent contact of dissimilar metals, including but not limited to, contact of copper, brass, or bronze pipe, tubing, fittings, valves, or appurtenances, or stainless steel pipe, tubing, fittings, valves, or appurtenances with iron or steel pipe, fittings, valves, or appurtenances. Insulating fittings shall also be provided to prevent contact of copper, brass, or bronze pipe, tubing, fittings, valves or appurtenances with stainless steel pipe, tubing, fittings, valves, or appurtenances.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Materials furnished under this section will be installed in accordance with the Miscellaneous Piping and Accessories Installation section.

End of Section

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SECTION 40 05 24 - STEEL PIPE

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the furnishing and installation of steel pipe 6 inches in diameter and larger. Steel pipe shall be furnished and installed complete with all fittings, specials, adapters, closure pieces, blowoffs, outlets, caps and plugs, temporary bulkheads, access manholes, jointing materials, pipe hangers and supports, anchors, blocking, encasements, cathodic protection, appurtenances, and accessories specified and indicated on the Drawings, and as required for proper installation and functioning of the piping.

B. Steel pipe smaller than 6 inches in diameter, light wall steel pipe, miscellaneous small piping, pipe hangers and supports, cathodic protection, pressure and leakage tests, and cleaning and disinfection are covered in other sections. Pipe trenching, embedment, and backfill are covered in the Trenching and Backfilling section.

C. The size, service, and location of steel pipelines are covered in the Steel Pipe Schedule.

D. Piping furnished hereunder shall be complete with all joint gaskets, bolts, nuts and other jointing materials required for installation of any valves and equipment, including any valves and equipment furnished by Owner or others for installation under this Contract.

1.2 GOVERNING STANDARDS

A. Except as modified or supplemented herein, all steel pipe, fittings, and specials shall conform to the applicable requirements of the following standards:

ANSI/AWWA Standards	Title
C200	Steel Water Pipe - 6 inches and Larger
C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 inches and Larger - Shop Applied
C206	Field Welding of Steel Water Pipe
C207	Steel Pipe Flanges for Waterworks Service – Sizes 4 In. through 144 In.
C208	Dimensions for Fabricated Steel Water Pipe Fittings.

C209	Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
C210	Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
C214	Tape Coating Systems for the Exterior of Steel Water Pipelines
C216	Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
C217	Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines
C602	Cement Mortar Lining of Water Pipelines in Place – 4 inches and Larger
C604	Installation of Steel Water Pipe – 4 inches and Larger
C606	Grooved and Shouldered Joints
M11	Steel Pipe – A Guide for Design and Installation

ANSI/ASME Standards	Title
B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
B16.47	Large Diameter Steel Flanges NPS 26 through NPS 60
B18.2.1	Square and Hex Bolts and Screws (Inch Series)
B18.2.2	Square and Hex Nuts (Inch Series)
B36.10	Welded and Seamless Wrought Steel Pipe

1.3 QUALIFICATIONS

A. Pipe manufacturer shall be ISO-9001 or SPFA certified with 5 years' experience in the manufacture of steel pipe, fittings, coatings, and linings specified. All pipe, fittings, specials, coatings, linings, and appurtenances shall be fabricated at one company facility for quality control purposes, unless otherwise acceptable to the Engineer.

B. Pipe Manufacturer’s Experience and Services

1. All steel pipe, fittings, specials, bolts, gaskets, other jointing materials and appurtenances shall be fabricated, lined, coated, and furnished under the direction and management of one pipe manufacturer. The pipe manufacturer's responsibilities, shall include, at a minimum; coordinating and furnishing all pipe materials, gaskets, bolts, and other jointing materials and pipe appurtenances (except for furnishing coupled joints and other similar products by a specified manufacturer) for a complete piping system that meets the specified pipe test pressure and service conditions; certifying that all pipe, fittings, specials, and other pipe materials, gaskets, and bolts specified herein are being manufactured in full accordance with the Contract Documents; preparing and submitting all submittal information and shop drawings; and making any corrections that may be required to submittal information and shop drawings.

2. The pipe manufacturer's minimum required experience qualifications shall include manufacture of interior and buried steel plant piping of similar diameters for at least two water or wastewater plants with the same type joints, linings, and coatings and suitable for the same or higher pressure rating, which has performed satisfactorily for the past 5 years.

3. All steel pipe shall be installed as specified herein and indicated on the drawings, in accordance with the pipe manufacturer's recommendations.

4. The pipe manufacturer shall provide the services of an experienced, competent, and authorized field service representative acceptable to Owner to perform all field services specified herein. The field service representative minimum required experience shall include 5 years of practical knowledge and experience installing steel pipe with joints, linings, and coatings of the pipe to be furnished. The resume of the proposed field service representative which meets the specified minimum required experience qualifications shall be submitted for review in accordance with the Submittals paragraph.

5. The field service representative shall visit the Site to advise and consult with the Contractor and check, instruct, and guide Contractor's procedures for pipe handling, laying, and jointing at the start of pipe installation for each crew and shall coordinate his services with Contractor. The field services representative shall not directly supervise the Contractor's personnel. The Contractor shall remain responsible for the piping installation work. The field service representative shall revisit the Site as often as necessary to perform an installation check.

6. Contractor shall submit a written report prepared and furnished by the field service representative certifying that Contractor's installation personnel have been properly instructed and have employed the proper pipe handling and installation procedures. Contractor shall also submit a written report prepared and furnished by the field service representative of each site visit. All reports shall be submitted in accordance with the Submittals paragraph.

7. All costs for these services shall be included in the Contract Price.

1.4 SUBMITTALS

A. General Submittals

1. Drawings, details, specifications, installation schedules, welding procedures and welder qualifications, and other data showing complete details of the fabrication, construction, weld locations, joint details and certification, and installation of pipe, fittings, specials, and connections, together with complete data covering all materials proposed for use, shall be submitted in accordance with the Submittals Procedures section. The drawings and data shall include, but shall not be limited to, the items listed in this Section.

B. Pipe Data and Certifications

1. Submittals shall indicate the ASTM designation for the material from which each class of pipe is fabricated and calculations including pipe thickness, fitting reinforcement, and field welds. The following data and certifications shall be submitted:

a. Certification by pipe manufacturer for each item furnished in accordance with ANSI/AWWA Standards.
b. Restrained joint details.
c. Certification of pipe manufacturer's field services, including a copy of the initial services, and all subsequent inspection reports.
d. Field service representative’s resume.
e. Emergency Repair Manual, including names and telephone numbers of emergency contact persons.
f. Certification of each type of gasket.
g. Certification of joint lubricant.
h. Certification of the proof-of-design tests for joints, including restrained joints.
i. Certification of pipe manufacturer or fabricator and certification of proof-of-design tests for welded-on outlets.
j. Fabrication schedule covering each stage of the fabrication of the pipe.
k. Laying schedule complete with a sequence of laying, and an explanation of all abbreviations used in the schedule. For long, straight pipe runs, the laying schedule shall list the pipeline station and centerline elevation at least every 100 feet.
l. The method that the Contractor proposes to use for measuring deflection of pipe joints.

C. Gasket Material Certifications

1. The pipe manufacturer shall obtain and submit a written statement from the gasket material manufacturer certifying that the gasket materials are compatible with the joints specified herein and are suitable for the specified field test pressures and service conditions.

D. Certifications and Affidavits of Compliance:

1. Contractor shall submit all certifications and affidavits of compliance. Performing and paying for sampling and testing as necessary shall be the Contractor's responsibility. The following certifications and affidavits of compliance are required for all pipe and other products or materials furnished, as specified in ANSI/AWWA C200 and herein.

a. Mill Certificates. Material lists and steel reinforcement schedules which describe all materials to be utilized. Metallurgical test reports for steel proposed for use on the project. Chemical and physical test reports from each heat of steel that indicate

the steel conforms to the Contract Documents. Records shall indicate heat of steel for each pipe joint listed in the pipe laying schedule.

b. List cross-referencing pipe mark numbers with pipe sequence numbers, heat numbers, and can numbers.
c. Hydrostatic test reports.
d. Results of production weld tests.
e. Sand, cement and mortar tests.
f. Rubber gasket tests and gaskets certification by pipe manufacturer, including a written statement from the gasket material manufacturer, certifying that the gasket materials are compatible with the joints specified and are recommended for the specified field test pressure and service conditions.
g. All materials in contact with treated or potable water are ANSI/NSF 61 approved.
h. Certification of the proof-of-design tests for rubber gasketed bell and spigot joints (stab joints), or field experience documentation, as specified.
i. Pipe temperature complies with Contract Documents prior to placing backfill material and prior to and during welding.
j. All welds were performed in conformance with these Contract Documents.
k. Affidavit of compliance for each ANSI/AWWA standard covering materials and work furnished for the project.

E. Shop Drawings

1. The Contractor shall submit Shop Drawings of piping in accordance with the requirements of ANSI/AWWA C200 and the following supplemental requirements:

a. Certified dimensional drawings of all pipe, fittings, specials, and appurtenances. The ASTM designation for the material from which each class of pipe is fabricated.
b. Production schedule for manufacturing/fabricating pipe for the work as part of Contractor's Progress Schedule. Steel pipe production schedule shall be included in all versions of the Contractor's Progress Schedule beginning with the first Progress Scheduled submittal.
c. Joint and pipe wall construction details which indicate the type and thickness of cylinder; the position, type, size and area of wire or other reinforcement; coatings and linings including holdbacks; manufacturing tolerances; maximum angular joint deflection limitations; and all other pertinent information required for the manufacture and installation of the product. Joint details and design criteria shall be submitted for all welded joint types, including beveled ends for alignment conformance and any deep butt strap joints required for control of temperature stresses.
d. Pipe design criteria sufficient to ascertain conformance of pipe and fittings with the Contract Documents. Pipe design criteria shall include, but shall not be limited to, minimum pipe diameter, minimum pipe wall thickness, pressures, external loads, yield strength, allowable fiber stress, longitudinal stress for restraint, temperature changes, lining and coating materials, and other factors used for pipe design.
e. Table(s) showing E', K, soil weight, deflection lag factor, external loads, and percent deflection from minimum to maximum cover depth shown in the Steel Pipe Schedule in one foot increments covering each size and class of pipe. Two tables shall be submitted for each size and class of pipe, one with live load and the

design deflection lag factor specified herein and one without live load and a deflection lag factor of 1.0.

F. Ground Elevation and Utility Locations:

1. Prior to preparation of the pipe laying schedule, Contractor shall verify the existing ground elevations and the location and depth of all underground utilities using centerline stakes set by the Contractor at no more than 100 feet intervals. Contractor shall carefully locate and excavate utility, survey, document and submit this information to the Engineer.

2. Engineer will review this information and if necessary make adjustment to the pipeline profile. Any Drawings that are modified by the Engineer shall be reissued to the Contractor.

G. Pipe Laying Schedule Information:

1. Pipe laying schedule and marking diagrams compatible with the requirements of AWWA Manual 11 (M11) which indicate the specific number of each pipe, fitting, and special and the location and direction of each pipe fitting, and special in the completed pipeline. In addition, the pipe laying schedule shall include: the station and centerline or invert elevation coordinated with the Drawings to which the bell end of each pipe will be laid; all elements of curves and bends, both in horizontal and vertical alignment; and the limits within each reach of restrained and/or welded joints or of concrete encasement. The location of all mitered pipe sections, beveled ends for alignment conformance, and any deep butt strap joints for temperature stress control shall be clearly indicated on the diagrams.

2. The pipe laying schedule shall have a sequence of laying and an explanation of all abbreviations used in the schedule. For long, straight pipe runs, the pipe laying schedule shall list the pipeline station and either the pipe centerline or invert elevation coordinated with the Drawings at least every 100 feet.

3. Drawings showing the location and details of bulkheads for hydrostatic testing of the pipeline including details for removal of test bulkheads and repair of the lining.

4. Details and locations of closures and cutoffs for length adjustment, temporary access manholes, vents and weld lead pass holes as specified or indicated on the Drawings, and as required for construction convenience.

5. The method that the Contractor proposes to use for measuring deflection of pipe joints.

6. Annotated laying schedule showing all changes made during the progress of the Work.

H. Welding Information:

1. Submit the following prior to performing any welding work:

a. Full and complete information regarding location, type, size and extent of all welds with reference called out for Welding Procedure Specifications (WPS) numbers

shall be shown on the Shop Drawings. The Shop Drawings shall distinguish between shop and field welds. Shop Drawings shall indicate welding symbols for the details of the welded joints, and the preparation of parent metal required to make them. Joints or groups of joints in which welding sequence or technique are especially important shall be carefully controlled to minimize shrinkage stresses and distortion.

b. Written welding procedures for shop and field welds (including Welding Procedure Specifications (WPS's) and Procedure Qualification Records (PQR's). All WPS used to fabricate and install pipe shall be qualified under the provisions of ANSI/AWS D1.1 – Structural Welding code – Steel or the ASME Boiler and Pressure Vessel Code (BPVC) for shop welds and ANSI/AWS D1.1 for field welds. Written WPS shall be required for all welds, both shop and field. WPS's qualified per the ASME BPVC shall include Supplementary Essential Variables for notch-tough welding. All provisions of ANSI/AWS D1.1 pertaining to notch-tough welding shall apply.

c. Written nondestructive testing (NDT) procedure specifications and NDT personnel qualifications.

d. Current welder performance qualifications (WPQ'S) shall be submitted for each welder prior to performing any work either in the shop or field. Qualification testing shall be in accordance with ASME Section IX or AWS B2.1 and as defined in Section 4 of ANSI/AWWA C206 or ANSI/AWWA C200, as applicable.

e. Credentials of the Contractor's certified welding inspectors (CWI's) and quality control specialists for review prior to starting any welding in the shop or field. The credentials shall include, but not be limited to, American Welding Society QC-1 Certification. Other NDT quality control personnel shall be certified as required by AWS D1.1 and in accordance with written practice ASNT SNT-TC-1A.

f. All NDT data for each shop-welded and field-welded joint. This data shall include all testing on each weld joint, including re-examination of repaired welds, using visual, radiographic, magnetic particle, dye penetrant examination, ultrasonic or air test examination methods specified. Test data shall be reviewed and signed by the welding inspector(s).

g. Welder logs for field and shop welding. Logs shall list all welders to be used for the work, the welding process, position, welder stamp number, certification date and certification status for each welder.

h. A welding map showing the sequence of welds for all field welds.

i. A written weld repair procedure for each type of shop and field weld proposed for use on the project.

j. A written rod control procedure for shop and field operations demonstrating how the Contractor intends to maintain rods in good condition throughout the work. The rod control procedure shall also demonstrate how the Contractor intends to ensure that the proper rods are used for each weld.

I. Control of Temperature Stresses for Welded Joints:

1. Plan and installation instructions to avoid the accumulation of expansion and contraction to minimize temperature stresses in the pipe wall during installation and when the pipeline is in service. The plan and installation instructions shall include the sequencing of events during and after installation, including backfilling and welding, use of a lengthened bell, and other methods to control temperature stresses in the pipeline.

2. Plan for monitoring pipeline temperatures.

J. Detail Drawings

1. Detail drawings indicating the type, number and other pertinent details of slings, strutting, and other methods proposed for pipe support and handling during manufacturing, transport, and installation. The recommended methods of handling and placement of the pipe shall be submitted as a record copy prior to transporting any pipe to the Site. All pipe handling equipment and methods shall be acceptable to the Engineer.

K. Loading and Shipping Drawings

1. For record copy, detailed drawings indicating loading and shipping procedures that are designed to minimize damage to coating.

L. Pipe manufacturer's written Quality Assurance/Control Program.

M. Field Service

1. Certification of pipe manufacturer's field services, including a copy of the initial services, and all subsequent inspection reports.

2. Field service representative resume.

N. Emergency Repair Manual

1. Contractor shall submit an emergency repair manual prepared and furnished by the pipe manufacturer. The manual shall include procedures for handling emergency calls and repairs; a list of stock replacement pipe sections, closures, and other parts needed for emergency repairs; names and emergency telephone numbers of pipe manufacturer’s engineering staff and factory-trained field service representatives who can be contacted day or night during an emergency; response and delivery times; and installation instructions for the materials and methods used in making repairs.

O. Pre-Submittal Meeting Plan

1. Prior to the initial pipe submittal, a pre-submittal meeting shall be held at a mutually agreed time and place. The meeting shall be attended by:

a. Representatives of Owner.
b. Contractor and Contractor’s superintendent.
c. Contractor’s pipe manufacturer’s design engineer.
d. Representatives of Engineer.

2. Contractor shall bring to the meeting a preliminary schedule for the following:

a. Pipe installation sequencing.
b. Pipe fabrication and delivery.
c. Pipe shop drawing and data submittals as set forth in the Submittals Procedures section.

3. The purpose of the meeting is to review the preliminary schedules and submittal data requirements, to discuss the fabrication and delivery schedules, to review development of the pipe manufacturer's pipe laying schedule, to establish the timing and coordination if the Owner performs inspection at the fabrication facilities, and to establish procedure and coordinate efforts associated with the pipe submittals.

1.5 SHIPPING, HANDLING, AND STORAGE

1. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section, and as specified herein.

2. Pipe, fittings, and accessories shall be handled and stored as recommended by the pipe manufacturer and shall be handled in a manner that will ensure installation in sound, undamaged condition. Equipment, tools, and methods used in handling and installing pipe and fittings shall not damage the pipe and fittings. Forks and other lifting devices shall have broad, well-padded contact surfaces.

3. Contractor-furnished pipe and fittings in which the lining has been damaged shall be replaced by and at the expense of Contractor. With the concurrence of Engineer, small and readily accessible damaged areas may be repaired as recommended by the pipe manufacturer.

4. Contractor shall repair any damage to pipe coatings and linings before the pipe is installed.

1.6 STULLING

1. Adequate stulling shall be designed and provided by the pipe manufacturer on all specials, fittings, and straight pipe so as to avoid damage to the pipe during handling, storage, hauling, and installation. The stulling shall be tight fitting to prevent pipe deflection and to maintain roundness of +/- 1.0 percent. Stulling shall not damage the lining. The stulling shall be placed as soon as practicable after the pipe lining is applied and shall remain in place while the pipe is loaded, transported, unloaded, and installed at the site.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN

A. Steel pipe, fittings, and specials shall be fabricated type for pipe 14 inches and larger, and may be either fabricated or mill type for pipe 12 inches and smaller. All items shall be the sizes, dimensions, and shapes indicated on the Drawings or specified herein.

B. The specified size of fabricated pipe, fittings, and specials shall be the nominal inside diameter, in inches , where 12 inches and smaller, and the actual inside diameter of pipe lining, where

14 inches and larger. Where stab joint pipe is permitted and two or more wall thicknesses are required for pipe of the same size, pipe size may be adjusted slightly to allow the different classes of pipe to be stabbed together.

C. The specified size of mill pipe, fittings, and specials shall be the nominal pipe size as set forth in ANSI/ASME B36.10.

D. Pipe ellipticity (out-of-roundness) shall not exceed one percent.

E. Pipe design shall be performed by the pipe manufacturer. Minimum design criteria shall be as specified.

F. Pipe Wall Thickness

1. Pipe shall be designed for all conditions indicated in the Steel Pipe Schedule and on the drawings.

2. The wall thickness for internal pressure due to hoop stress shall be determined by the following formula.

   $t = (PD)/(2s)$,

   where

   t = the pipe wall thickness in inches

   s = the allowable fiber stress in psi , shall not exceed 50 percent of the minimum yield strength of the steel plate at working pressure or 75 percent of the minimum yield strength at the larger of field test pressure or working pressure plus surge pressure. The yield strength used in the calculation for cement mortar coated pipe shall not exceed 42,000 psi. . The yield strength used in the calculation for cement mortar lined pipe shall not exceed 42,000 psi .

   P = the pipe working pressure or the larger of field test pressure or working pressure plus surge pressure in psi .

   D = the pipe outside diameter, in inches , of straight pipe sections or the larger outside diameter of tapered sections.

3. Unless otherwise indicated, the working pressure and the working pressure plus surge pressure shall be as indicated in the Steel Pipe Schedule.

4. The pipe wall thickness shall be in accordance with ANSI/AWWA M11, except that all pipe shall have a wall thickness of at least 3/16 inch , and a diameter to wall thickness ratio not to exceed 165 unless otherwise indicated in the Steel Pipe Schedule.

5. Pipe wall thickness shall be constant for the entire length of pipe for each location or service indicated in the Steel Pipe Schedule unless otherwise indicated on the drawings or specified.

6. External loads on buried pipe shall be based on the prism load and the following design conditions.

Maximum pipe deflection, percent of nominal pipe diameter	2.0
Minimum design cover depth	See Steel Pipe Schedule
Maximum design cover depth	See Steel Pipe Schedule
Total design external load on pipe	See Steel Pipe Schedule
E', Modulus of Soil Reaction	1,400 psi
K, Bedding Constant	0.090
Weight of soil	120 lbs/cu. ft.
Deflection Lag Factor	1.10
Live load	AASHTO HS-20
Impact Factor	1.5

7. The maximum pipe deflection shall be reduced if required by the jointing system furnished.

8. Cement mortar lining or coating shall not be used in the pipe deflection calculations.

9. The pipe shall be designed to withstand full internal vacuum (0 psia) under the buried conditions and for external loading under the flood conditions at ground surface or as otherwise indicated on the Drawings, when empty.

G. Fitting Dimensions

1. The dimensions of steel pipe fittings for 48-inch and smaller pipe shall be as indicated on Figures 1-40 05 24(A) and 1-40 05 24(B) and shall be designed by the pipe manufacturer. For pipe larger than 48-inches, dimensions of steel pipe fittings shall conform to ANSI/AWWA C208 except where other dimensions are required by the piping layout indicated on the drawings and shall be designed by the pipe manufacturer. All pipe and fittings shall be restrained.

H. Reinforcement of Fittings and Specials

1. Whether or not shown on the drawings, all bends, fittings, branch connections, reducers, and special sections shall be reinforced, or the pipe wall thickness shall be increased, so that the combined stresses due to internal pressure (circumferential and longitudinal) and bending will not exceed the allowable stresses specified in the Pipe Wall Thickness paragraph. Where external piping reinforcement interferes with other construction the

pipe wall thickness shall be increased and external reinforcement eliminated as necessary for acceptable clearances.

2. Where suspended, the design of reinforcement or wall thickness shall also take into consideration the weight of the piping and appurtenances full of water. Where buried, the design of reinforcement or wall thickness shall also take into consideration the external load.

3. Wall thicknesses of reducing sections shall be not less than the required thicknesses for the larger ends.

I. Joints

1. Acceptable joints of the type indicated on the Drawings and as specified herein shall be provided for all pipe installations in the locations indicated or accepted by Engineer. To facilitate installation, additional field-welded or mechanically coupled joints may be provided, but shall be kept to a minimum, and their locations shall be acceptable to Engineer. Field-welded joints shall not be used in pipe smaller than 30 inches , except in locations where the interior coating can be satisfactorily repaired and inspected.

2. Buried pipelines shall have lap-welded joints unless otherwise specified or indicated on the drawings. Restrained joints shall be lap-welded unless otherwise specified or indicated on the drawings.

3. Each joint, including restrained joints,shall be checked by Contractor as recommended by the pipe manufacturer to verify that the joint and the restraints are installed properly. The pipe manufacturer shall furnish a metal gauge or other tools as required to measure joints.

2.2 MATERIALS

Pipe, Fittings, and Specials	ANSI/AWWA C200. All steel shall be fully killed, with a maximum carbon content of 0.25 percent, made to a fine austenitic grain size practice, and manufactured from continuous cast steel. Minimum yield strength (point) for the grade of steel used shall not exceed 46,000 psi *or be less than* 42,000 psi .
Gaskets – All Joint Types	Synthetic rubber unless otherwise specified; natural rubber will not be acceptable. All gaskets shall be furnished by the pipe manufacturer, unless another manufacturer's product is specified. Pipe manufacturer shall submit certificates of gasket suitability, certifying that the gasket materials are compatible with the joints specified and are recommended for the specified field test pressure and service conditions. Gaskets for treated or potable water service shall also be certified for chlorinated and chloraminated potable water.

Joint Lubricant	Vegetable-based lubricant recommended by the pipe manufacturer. Petroleum or animal-based lubricants will not be acceptable. Lubricants that will be in contact with treated or potable water shall be certified as being in compliance with ANSI/NSF 61.
Joint Diapers	
Diapers	Non-woven polypropylene fabric, lined with polyethylene foam, minimum weight 3 oz. per square yard. “Typar” as recommended by pipe manufacturer for the joint furnished.
Liner	100 percent closed cell polyethylene foam, 1.9 to 2.1 pounds per cubic foot density, Dow Chemical Company “Ethafoam 221”, minimum thickness of ¼ inch and full width of diaper.
Steel Straps	Class 1, Type 1, hot-rolled or heat treated cold rolled, Fed Spec QQ-S-781H, 0.020” thick, waxed or painted and waxed.
Seal Clips	Push or overlap type, providing single notch-joint on ½ inch or 5/8 inch wide seals; double notch joint on ¾ inch wide seals.
Flanged Joints	
Flanges	ANSI/AWWA C207, slip-on, except where otherwise specified or indicated on the Drawings.
Dimensions and Drilling	ANSI/AWWA C207, Class D except as otherwise indicated on the Drawings or specified.
Blind Flanges	ANSI/AWWA C207, Class D except as otherwise indicated on the Drawings or specified.
Gaskets	ANSI/AWWA C207. Pipe manufacturer shall submit certification of gaskets furnished as indicated above under Gaskets – All Joint Types.
Insulated Flanges	
Flanges	As specified herein, except bolt holes shall be enlarged as needed to accept bolt insulating sleeves.
Insulation Kits	As manufactured by Advanced Products or Pipeline Seal and Insulator, Inc.

Insulating Gaskets	Type E, G10, 1/8 inch thick, with Nitrile or EPDM sealing element unless otherwise required by pipe manufacturer and acceptable by Engineer. Pipe manufacturer shall submit certification of gaskets furnished as indicated above under Gaskets – All Joint Types.
Bolt Insulating Sleeves	G-10, 1/32 inch thick.
Insulating Washers	G-10, 1/8 inch thick, two for each flange bolt.
Backing Washers	Steel, 1/8 inch thick, two for each flange bolt.
Flange Bolting	
Material	ANSI/AWWA C207, unless otherwise required by the pipe manufacturer including higher strength and accepted by the Engineer. Bolts and studs shall be ASTM F593 Type 304 and nuts shall be ASTM F594 Type 304.
Type	Bolt and nut; bolt-stud and two nuts permitted for 1 inch and larger.
Bolts and Bolt-Studs	
Length	As required for ends to project 1/4 to 1 inch beyond outer face of nut.
Ends	Chamfered or rounded.
Threading	ANSI/ASME B1.1, coarse thread series, Class 2A fit. Bolt-studs may be threaded full length.
Bolt Head Dimensions	ANSI/ASME B18.2.1; regular pattern for square, heavy pattern for hexagonal.
Nuts	Hexagonal.
Dimensions	ANSI/ASME B18.2.2, heavy, semi-finished pattern.
Threading	ANSI/ASME B1.1, coarse thread series, Class 2B fit.
Coupled Joints	
Mechanical Couplings	

Gaskets	Gaskets shall be as recommended by the coupling manufacturer. Coupling manufacturer shall submit certification of gaskets furnished as indicated above under Gaskets – All Joint Types.
Full Ring Type	
Insulating	Baker "Series 216", Dresser "Style 39", or Smith-Blair "416"; without pipe stop.
All Others	Baker "Series 200", Dresser "Style 38", or Smith-Blair "411 Steel Coupling"; without pipe stop.
Dismantling Joints	
Restrained 3 inch and larger. Unless otherwise indicated on the Drawings, dismantling joints shall be restrained.	Romac "DJ400", Dresser "Style 131 Dismantling Joint", or Viking Johnson. For use in potable water systems, coating to be in accordance with NSF-61.
Restrained Joints	
Welded	ANSI/AWWA C200 and C206.
Lugs or Collars	ASTM A283, Grade B or C; or ASTM A36.
Tie Bolts	ASTM F593 Type 304.
Threading	ANSI/ASME B1.1, Class 2A fit, coarse thread series for 7/8 inch and smaller, and 8-thread series for 1 inch and larger.
Ends	Chamfered or rounded.
Nuts	Hexagonal, ASTM F594 Type 304.
Threading	As specified for tie bolts, except Class 2B fit.
Dimensions	ANSI/ASME B18.2.2, heavy semifinished pattern.
Flat Washers	ASTM F594 Type 304
Small Branch Connections	
Pipe Nipples	Seamless black steel pipe, ASTM A53, standard weight (Schedule 40).
Welding Fittings	

Threaded Outlets	Bonney Forge "Thredolets" or Flowserve/Vogt "Weld Couplets".
Welded Outlets	Bonney Forge "Weldolets" or Flowserve/Vogt "Weld Couplets".
Coatings and Linings	All materials in contact with treated or potable water shall be certified as being in compliance with ANSI/NSF 61.
Liquid Epoxy	ANSI/AWWA C210.
Polyurethane	ANSI/AWWA C222.
Cement Mortar	ANSI/AWWA C205 and C602.
Cement	ASTM C150, Type II.
Sand	ANSI/AWWA C205, Section 4.2.3, except sand for field-applied lining shall pass a No. 16 sieve.
Epoxy Bonding Agent	ASTM C881, Type II, moisture insensitive and suitable for service conditions.
Latex Admixture	Euclid "Flex-Con" or Sika "SikaLatex".
Universal Primer	Pipe manufacturer’s standard.
Watertight/Dusttight Pipe Sleeves	“GPT Link-Seal", insulating type with modular rubber sealing elements, nonmetallic pressure plates, and stainless steel bolts and nuts.
Anti-Seize Thread Lubricant	Jet-Lube "Nikal", John Crane "Thred Gard Nickel", Bostik/Never-Seez "Pure Nickel Special" or Permatex "Nickel Anti-Seize".
Anchor Bolts	ASTM F593 Type 304.
Joint Grout and Diapers	ANSI/AWWA C205.
Corrosion Protection	
Heat–shrinkable Coating and Primer (Shrink Sleeve)	ANSI/AWWA C216, cross-linked polyethylene sheeting precoated with adhesive; minimum 80 mils; type and recovery as recommended by Shrink Sleeve manufacturer; Canusa-CPS or Berry Plastics Water Wrap. Three component system.
Underlying Sleeve	Heavy cross-linked polyethylene backing; Canusa-CPS I2/PE Backing.
Wax Tape and Primer	ANSI/AWWA C217. Cold-applied petroleum wax primer and cold-applied petroleum wax tape; Trenton Wax-Tape and Primer.

	Primer, wax tape, and outer wrap.
Medium Consistency Coal Tar	Carboline "Bitumastic 50" or Tnemec "46-465 H.B. Tnemecol".

2.3 ENDS OF SECTIONS

A. For Field Welding

1. Ends of pipe, fittings, and specials for joints butt-welded in the field shall have the ends beveled for butt welding in accordance with the governing standards.

2. Ends of pipe, fittings, and specials for field-welded lap joints, Figures 3-40 05 24(A) and 3-40 05 24(B), shall have both the bell and the spigot expanded by pressing, if necessary, (not rolling) to obtain the required shape and welding tolerances.

B. For Fitting with Flanges

1. Ends to be fitted with slip-on flanges shall be prepared to accommodate the flanges in accordance with the governing standards.

C. For Mechanical Couplings

1. Ends to be joined by mechanical couplings shall be plain end type. Pipe seam welds on ends to be joined by mechanical couplings without pipe stops shall be ground flush to permit slipping the coupling in at least one direction to clear the pipe joint. The welds on ends to be joined by split ring type couplings shall be ground flush to allow uniform contact of the shoulder and pipe wall. Outside diameter and out-of-round tolerances shall be within the limits specified by the coupling manufacturer.

D. For Connection to Dissimilar Pipe Materials

1. Steel pipe connections to buried or submerged cement mortar coated steel pipe, concrete pipe, or cast or ductile iron pipe shall be made with insulated flanges.

2.4 SEAMS

A. Except for seamless mill-type pipe, all piping shall be made from steel plates rolled into cylinders or sections thereof with the longitudinal seams butt-welded, or shall be spirally formed and butt-welded. There shall be not more than two longitudinal seams. Girth seams shall be butt-welded and shall be spaced not closer than 10 feet apart except in specials and fittings.

2.5 PIPE LENGTHS

A. Straight pipe section lengths shall be pipe manufacturer's standard lengths, unless otherwise indicated on the Drawings.

B. All pipe to be connected with mechanical couplings shall be fabricated so that the space between pipe ends within the couplings will not exceed the amount recommended by the coupling manufacturer, but shall be at least 1/2 inch.

2.6 SMALL BRANCH CONNECTIONS

A. Branch connections 2-1/2 inches and smaller shall be made with welding fittings with threaded outlets (threadolet). Where the exact outlet size desired is in doubt, but is known to be less than 1 inch , a 1 inch outlet shall be provided and reducing bushings used as needed.

B. Branch connections sized 3 through 12 inches shall be made with pipe nipples or with welding fittings with welded outlets. Pipe nipples and welding fittings shall be welded to the pipe shell and reinforced as needed to meet design and testing requirements.

C. Small branch connections shall be so located that they will not interfere with joints, supports, or other details, and shall be provided with caps or plugs to protect the threads during shipping and handling.

2.7 DRAINS AND VENTS

A. Pipe used for drain and vent piping shall be ASTM A53, standard weight, black steel pipe. Drain valves shall be ball valves. Vent valves shall be ball valves. Drain and vent valves shall comply with the requirements of the valves section.

2.8 FLANGED JOINTS

1. Flange faces of flanged joints shall be normal to the pipe axis. Angular deflection (layback) of the flange faces shall not exceed the allowable set forth in ANSI/AWWA C207. All flanges shall be refaced after welding to the pipe, if necessary to prevent distortion of connecting valve bodies from excessive flange bolt tightening and to prevent leakage at the joint.

2. Pipe lengths and dimensions and drillings of flanges shall be coordinated with the lengths and flanges for valves, pumps, and other equipment to be installed in the piping. All mating flanges shall have the same diameter and drilling and shall be suitable for the pressures to which they will be subjected.

3. Flanges shall be of the slip-on type, except that welding-neck or slip-on flanges welded to short lengths of pipe shall be used where installation of flanges in the field is permitted or required.

4. For welding neck flanges, the pipe shall be concentrically reduced as necessary for proper alignment of the pipe wall with the welding neck flange for butt welding. The interior of the weld joint and flange shall be cement lined in the shop as specified in ANSI/AWW C205.

2.9 MECHANICAL COUPLINGS

A. The middle ring of mechanical couplings shall have a thickness at least equal to the wall thickness specified herein for the size of pipe on which the coupling is to be used. If the coupling manufacturer's standard thickness is less, that thickness may be used unless allowable pressures are exceeded. The length of each middle ring shall be not less than 10 inches for 36 inches and larger pipe and not less than 7 inches for pipe smaller than 36 inches .

B. Middle rings shall be shop galvanized and the remaining components shall be cleaned and shop primed with 2 mils of a universal primer.

C. All surfaces, including the interior surfaces of the middle rings, shall be prepared for coating in accordance with the coating manufacturer's instructions and shall then be coated with liquid epoxy in accordance with ANSI/AWWA C210.

D. Factory pipe spacers shall be provided where indicated on the drawings. The spacers shall be factory coated and lined with 16 mils of liquid epoxy.

2.10 DISMANTLING JOINTS

A. Dismantling joints shall be provided for restrained couplings 6 inches and larger. Dismantling joints shall comply with AWWA C219 and shall be restrained flange by flange couplings manufactured as a single unit. Unless otherwise indicated on the Drawings, dismantling joints shall be restrained.

B. The inner and outer surfaces of dismantling joints, except flange mating surfaces, shall be prepared for coating in accordance with instructions of the coating manufacturer and shall then be coated with liquid epoxy in accordance with ANSI/AWWA C210. The flange mating surfaces shall be cleaned and shop primed with universal primer.

2.11 RESTRAINED JOINTS

A. Restrained joints shall be flanged, welded, flanged coupling adapters with anchor studs, or harnessed, as specified or as indicated on the Drawings.

B. Where indicated on the Drawings, mechanically coupled joints shall be restrained with harness bolts and lugs or collars. Joint harnesses shall conform to the details indicated on the Drawings. Lugs or collars shall be shop welded to the pipe and coated as specified for the adjacent pipe.

C. All pipe and fittings shall be restrained.

2.12 PROTECTIVE COATINGS AND LININGS

A. All steel pipe, fittings, specials, wall fittings, and accessories shall be lined, coated, or wrapped as specified herein.

B. Type of Coating and Lining

1. Surface preparation shall be in accordance with the pipe manufacturer's and coating and lining manufacturer's instructions. Types of protective coating and lining shall be as follows:

Exterior Surfaces in Interior Locations	Shop-applied universal primer. Field painting is covered in the Protective Coatings section.
Exterior Surfaces Underground, Including those Encased in Concrete – Treated Water and Clearwell TW Interconnect piping.	Polyurethane, AWWA C222. The governing standards shall be as modified herein.
Exterior Surfaces Underground, Including those Encased in Concrete – Fayetteville Transmission Main	Polyurethane, AWWA C222. The governing standards shall be as modified herein.
Interior Surfaces	Cement mortar - shop applied, ANSI/AWWA C205. The governing standards shall be as modified herein.
Pipe Joints	
Couplings	Shop coating as specified for each type of coupling. Field coating as specified for ends of sections in the Joint Holdbacks and Coatings and Linings paragraph and the Corrosion Protection paragraph for buried couplings.
Ends of Sections	As specified in the Joint Holdbacks and Coatings and Linings paragraph.
Machined Surfaces	Rust-preventive compound.
Blind Flanges	Shop coat with 20 mil dry film thickness of liquid epoxy in accordance with ANSI/AWWA C210.

C. Modifications to the Governing Standards

1. Cement Mortar Lining

a. Cement mortar lining for all pipe shall be shop applied Except as modified herein, shop-applied mortar linings shall comply with ANSI/AWWA C205.

1) Specials. Wire fabric reinforcement shall be used in the lining of fittings and specials in accordance with ANSI/AWWA C205.

2) Adjacent to Valves. If the specified nominal pipe size is the actual outside diameter, cement mortar lining installed in steel pipe adjacent to butterfly valves shall be tapered so that the lining material will not interfere with the valve disc during valve operation.

2.13 MARKING

A. In addition to the pipe markings required by ANSI/AWWA C200, each pipe section, fitting, and special shall be clearly marked to indicate the service, the wall thickness, and the minimum yield strength of the pipe material. Pipe piece identification shall be shown on both the inside and outside of each pipe section, fitting, and special.

2.14 SHOP INSPECTION AND TESTING

A. Except as otherwise indicated or acceptable to Engineer, all materials and work shall be inspected and tested by the pipe manufacturer in accordance with ANSI/AWWA C200. All costs in connection with such inspection and testing shall be borne by Contractor.

B. Copies of all test reports shall be submitted in accordance with the Submittals Procedures section.

C. Owner reserves the right to sample and test any pipe after delivery and to reject all pipe represented by any sample which fails to comply with the specified requirements.

D. Steel greater than or equal to 1/4 inch thickness used in production manufacturing of pipe and specials shall be tested for notch toughness using Charpy V-Notch tests in accordance with ASTM A370 – Test Methods and Definitions for Mechanical Testing of Steel Products. The test acceptance for full size specimens (0.394 in. by 0.394 in. size) shall be 25 foot-pounds at a test temperature of 32 degrees F; tests shall include three impact specimens and shall be conducted in the direction transverse to the final direction of rolling. When full-size specimens are not obtainable, the minimum required Charpy value is permitted to be reduced by multiplying the ratio of the (actual width along the notch / 0.394 in.) x 25 ft-lbs. For sub size specimens the test temperature shall be reduced as follows: Width along the notch > 0.296 in. (no reduction required); 0.295 in. (3/4 size bar): 5 degrees F reduction; 0.236 in.: 15 degrees F reduction. Straight line interpolation for intermediate values shall be used. Tests shall be conducted in accordance with ASTM A20 for two coils of each heat. Only welding consumables that are classified by the applicable AWS filler metal standard (e.g. A5.1, A5.17, A5.18, A5.20) with Charpy impact test requirements at a temperature 32 degrees F or lower are permitted.

E. Owner's Inspection at the Shop

1. If Owner elects to inspect any work or materials, as permitted under Section 5.1 of ANSI/AWWA C200, all costs in connection with the services of Owner's inspector will be paid for by Owner.

2. A fabrication schedule shall be submitted to Owner at least 30 days prior to fabrication activities. Each time the schedule is changed, the Contractor shall revise and resubmit the schedule. The Contractor shall notify the Engineer at least 5 days prior to any change in the revised and current schedule. If the Owner's representatives make an inspection and the manufacturer is not performing the work as indicated in the revised and current schedule for that date, the expense shall be the sole responsibility of the Contractor.

3. Additional weld test specimens shall be furnished to Owner's inspector for testing by an independent testing laboratory whenever, in the judgment of Owner's inspector, a satisfactory weld is not being made. Test specimens shall also be furnished when Owner's inspector desires. The entire cost of obtaining, inspecting, and testing of such additional specimen plates, welds, or materials will be borne by Owner. If any specimen is found not to conform to the specified requirements, the materials represented by the specimen will be rejected. The expense of all subsequent tests due to failure of original specimens to comply with the specifications shall be the responsibility of Contractor.

4. In addition to making or witnessing specified tests and submitting any required reports to Engineer and Owner, Owner's inspector will submit written reports to Contractor concerning all materials rejected, noting the reason for each rejection.

5. Inspection by Owner's inspector, or Owner’s option not to provide inspections, shall not relieve Contractor of his responsibility to provide materials and to perform the work in accordance with the Contract Documents.

6. The Owner reserves the right to sample and test any pipe after delivery and to reject all pipe represented by any sample which fails to meet with the specified requirements.

F. Welding Procedures, Welder Qualifications, and Testing

1. All welding procedures, welders, welding operators, and tackers shall be qualified in accordance with ASME Section IX or AWS B2.1 as defined in ANSI/AWWA C200. All qualifications shall be in accordance with the position in which the welding is to be accomplished.

2. All shop welds shall be visually inspected by a Certified Welding Inspector (CWI). All shop welds shall be visually inspected in accordance with the requirements of AWS D1.1, Table 6.1, Visual Inspection Acceptance Criteria table for statically loaded nontubular connections. All shop butt welds on steel pipe and fittings, except cylinders that are hydrostatically tested, shall be ultrasonically or radiographically tested by qualified and certified personnel. Shop ultrasonic weld tests and evaluation shall be in accordance with Section 9 of API 5L or ASME Section VIII, Division 1, Part UW-53. Radiographic weld tests and evaluation shall be in accordance with ASME Section VIII, Division I, Part UW-51. All other shop welds shall be either liquid penetrant examined in accordance with ASTM E 165, or magnetic particle examined in accordance with ASTM E 709. Acceptance criteria shall be in accordance with ASME Code, Section VIII, Division I, Appendix 6 for magnetic particle examination and Appendix 8 for liquid penetrant examination.

3. Personnel performing visual inspection of welds shall be qualified and currently certified as Certified Welding Inspectors (CWI) in accordance with AWS QC1, Standard for Qualification and Certification of Welding Inspectors. Personnel performing ultrasonic and radiographic tests shall be qualified and certified in accordance with written practice ASNT SNT-TC-1A.

4. Nondestructive examination procedures shall be submitted in accordance with the Submittals Procedures section at the time welding procedures are submitted. Records of

inspection, nondestructive examination, and material certification shall be submitted to Engineer.

5. The welder and welding operator qualification records shall be available at the shop facility or Site and shall be made available for review when requested.

6. All costs for inspection and testing of shop welds shall be paid by Contractor.

PART 3 - EXECUTION

3.1 INSPECTION

A. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. Pipe ends shall be examined with particular care. All defective pipe and fittings shall be removed from the Site.

B. All shop-applied exterior tape or other dielectric coatings on pipe, fittings, or specials shall be electrically inspected for holidays and other defects, and repaired if necessary. All electrical inspection shall be made in accordance with the standard to which the coating was applied.

C. Inspection and repair of linings and coatings shall be performed by and at the expense of Contractor, after receipt of the pipe, fittings, or specials on the Site and before installation. Electrical inspection of exterior tape or other dielectric coatings after installation of the pipe, fitting, or special in the trench shall be made where, in the opinion of Engineer, the coating may have been damaged by handling during installation.

D. Confined Space Entry Supervision

1. Contractor shall provide above ground confined space entry supervision whenever Engineer is required to enter the pipe to verify Contractor’s deflection measurements, inspect joints, or any other time the Engineer is required to enter the pipe.

3.2 PROTECTION AND CLEANING

A. The interior of all pipe and fittings shall be thoroughly cleaned of all foreign material prior to installation and shall be kept clean until the work has been accepted. Before jointing, all joint contact surfaces shall be wiped clean.

B. Precautions shall be taken to prevent foreign material from entering the pipe during installation and until the work has been accepted.

C. Whenever pipe laying is stopped, the open end of the pipe shall be closed to prevent entry of dirt, mud, rodents, and other material. All water in the trench shall be removed prior to removing the closure.

3.3 ALIGNMENT AND GRADE

A. Buried pipe shall be laid to the lines and grades as specified and indicated on the Drawings. Pipelines or runs intended to be straight shall be laid straight. Curves in stab joint pipe may be formed by opening the joint. Maximum joint openings and deflections shall be as recommended by the pipe manufacturer. For welded lap joints, deflections up to 4-1/2 degrees may be made by shop-mitering the bell end of one pipe. For welded butt joints, deflections up to 22-1/2 degrees may be made by shop-mitering the ends of two adjacent sections of pipe by equal amounts. Deflections greater than 22-1/2 degrees shall be made by use of fabricated bends.

B. Where deflections would exceed the pipe manufacturer's recommendations, either shorter pipe sections or fittings shall be installed where needed to conform to the alignment or grade indicated on the Drawings and as acceptable to the Engineer.

C. High points which allow air to collect in pipelines will not be permitted unless an air release valve is indicated on the Drawings at that location.

D. Unless otherwise specified or acceptable to Engineer, laser beam equipment, surveying instruments, or other suitable means shall be used to maintain alignment and grade. At least one elevation reading shall be taken on each length of pipe. If laser beam equipment is used, periodic elevation measurements shall be made with surveying instruments to verify accuracy of grades. If such measurements indicate thermal deflection of the laser beam due to differences between the ground temperature and the air temperature within the pipe, precautions shall be taken to prevent or minimize further thermal deflections.

E. Additional requirements for alignment and grade are covered in the Project Requirements and Trenching and Backfilling sections and on the Drawings.

F. Tolerances

1. Each section of pipe shall be laid to the alignment and grade indicated on the Drawings and pipe laying schedule with pipe ends within the following tolerances;

    a. +/- 0.10 foot in grade at any point
    b. +/- 0.20 foot in alignment at any point

2. In addition, piping shall be visually straight or on a smooth curve between the points of deflection or curvature indicated on the Drawings. Stricter tolerances than specified above shall be used as necessary to maintain minimum cover, to maintain required clearances, to make connections to existing pipe, to maintain the correct slope to avoid high or low points along the pipeline other than at locations indicated on the Drawings, or to meet other restrictions as required or directed by the Engineer.

G. Annotated Pipe Laying Schedule

1. The pipe laying schedule shall be annotated during the progress of the Work to show all changes made during construction for record documentation. Upon completion of the installation of the piping, the annotated pipe laying schedule shall be submitted to Engineer in accordance with the Submittals Procedures section.

3.4 INSTALLATION

A. Buried Piping

1. Field installation of buried steel water piping shall be in accordance with ANSI/AWWA C604 unless otherwise specified or indicated on the Drawings.

2. For buried piping, all trenching, embedment, and backfilling shall conform to the Trenching and Backfilling section and the details indicated on the Drawings.

3. Pipe embedment and backfilling shall closely follow the installation and jointing of steel pipe in the trench to prevent floatation of the pipe by water and minimize longitudinal movement caused by thermal expansion or contraction of the pipe. Pipe shall be protected from floatation during installation when subjected to groundwater or flood conditions.

4. Each joint, including restrained joints, shall be checked by Contractor as recommended by the pipe manufacturer to verify that the joint and the restraints are installed properly.

5. For restrained joint pipe, not more than 160 feet of pipe shall be exposed ahead of the backfilling in any section of trench. The backfill adjacent to field joints may be temporarily omitted to provide adequate space for field coating the joints. Closure welds on restrained joint pipe shall be made during the cool part of the day.

B. Pipe Deflection

1. All buried pipe larger than 30 inches in diameter shall be tested for excessive deflection.

2. Test Section

a. At the beginning of pipe laying operations, the Contractor shall install a test section to demonstrate that the means and methods to be utilized will satisfy the pipe embedment requirements and deflection criteria. The length of the test section shall be approximately 400 feet. The Contractor shall perform and document deflection measurements and also document the successful means and methods to be used as a guide for subsequent pipe installation. The Engineer will observe construction of the test section and verify deflection measurements. The Contractor shall not proceed with production pipe laying beyond the test section without the Engineer's acceptance of the test section including documentation. Deflection measurements shall be performed as specified under Deflection Measurements.

b. If embedment materials or placement methods are changed, a new test section shall be made to demonstrate that the means and methods satisfy pipe embedment requirements and deflection criteria.

3. Deflection Measurements

a. Pipe deflection for all buried pipe shall be determined by measuring initial pipe vertical and horizontal inside diameters before the backfill load is supported by the pipe and a second vertical and horizontal inside diameters at least 24 hours after the backfill load is supported by the pipe. The second pipe deflection measurement shall be taken and the results determined before 1,000 feet of pipe is laid ahead of the initial measurement. Initial and second measurements shall be made for at least two locations on each piece of pipe and approximately equally spaced along the pipe. The points of initial deflection measurements shall be marked so that final deflection measurements are at the same points. The tolerance for deflection measurements shall be 1/8 inch. The percent deflection shall be the largest difference between the initial and second measurements at each point divided by the nominal pipe diameter. Pipe embedment and backfill not exceeding one foot above the top of pipe shall be in place during initial measurements. Struts that allow access may remain in place during initial measurements but shall be removed after initial measurements. Pipe deflection will be measured and documented by Contractor and verified by Engineer for each piece of pipe. Engineer shall be notified in advance of when deflection measurements are made. The deflection documentation shall be submitted daily unless otherwise acceptable to the Engineer.

b. Allowable Deflection

1) The allowable deflection shall be the calculated design percent of nominal diameter with a deflection lag factor of 1.1 and excluding live load, for the depth of the installed pipe to the nearest foot. Pipe exceeding the allowable deflection shall be uncovered and the embedment and backfill replaced as needed to prevent excessive deflection. After replacing embedment and backfill, the pipe shall be retested. Pipe damaged by over deflection or otherwise shall be satisfactorily repaired or removed and replaced with new pipe. All pipe shall have a maximum allowable deflection of 2.0% of the pipe outside diameter.

C. Flanged Joints

1. Flange faces shall be flat and perpendicular to the pipe centerline. The rust-preventive coating on the flange faces shall be soluble and shall be removed before the joint is made.

2. Care shall be taken in bolting flanged joints to avoid restraint on the opposite end of the pipe or fitting, which would prevent uniform gasket compression or would cause unnecessary stress in the flanges. The pipe or fitting shall be free to move in any direction while the flange bolts are being tightened. Bolts shall be tightened gradually in a crisscross pattern at a uniform rate, to ensure uniform compression of the gasket around the entire flange. All flange joint bolting procedures shall be in accordance with the pipe manufacturer's recommendations.

D. Insulated Flanged Joints

1. Insulated flanged joints shall be installed where indicated on the Drawings. In addition to one full-faced insulating gasket, each flange insulating assembly shall consist of one full-length sleeve, two insulating washers, and two backing washers for each flange bolt. The insulating gasket ID shall be 1/8 inch less than the ID of the flange in which it is

installed. The insulated flanged joint accessories shall be installed in accordance with the instructions and recommendations of the insulating kit manufacturer.

E. Welded Joints

1. All welds shall be sound and free from embedded scale or slag and shall be watertight. Butt welds shall have tensile strength across the weld not less than that of the thinner of the connected sections., Butt welds shall be used for all welded joints in pipe assemblies and in the fabrication of bends and other specials. Field-welded joints, where permitted, shall be either butt-welded or lap-welded Lap-welded joints shall have full fillet welds. Any weld that undercuts the parent metal shall be cut out, filled, and ground smooth.

2. Field welding of joints shall conform to ANSI/AWWA C206 and M11. Where acceptable to the Engineer, single field-welded butt joints with outside backing rings may be used for pipe larger than 30 inches in diameter. Backing rings will not be permitted for 30 inches and smaller pipe. Butt straps shall be welded on both the inside and outside of the pipe and at each end of the pipe and strap to avoid stress multiplication.

3. Field-welded lap joints may have only a single fillet weld on the inside of the pipe joint as detailed in Figure 3-40 05 24(B), except where double-welded joints as detailed in Figure 3-40 05 24(B) are indicated on the Drawings or specified. Lap and butt welded pipe shall have the welds completed in multiple passes. Single pass weld joints will not be acceptable. For polyurethane coated pipe, the interior joint may be welded after the exterior joint has been coated with a shrinkable wrapped sleeve or other specified coating and backfilled with at least 3 feet of backfill material. The field welding shall be performed so that the interior lining, the exterior coating, and the field applied joint coating are not damaged. All lap joint field welds shall be serialized and photographically documented with at least three photos per joint showing the full circumference of the pipe to demonstrate proper shrink sleeve installation.

4. A field test for each welder performing welds onsite, including excavation of a welded joint by each welder for inspections, shall be performed to verify that the interior lining, the exterior coating, and the field applied joint coating are not damaged by the interior welding at the start of the project. The field test shall be repeated if welding procedures are modified. CWI will be present during field tests.

5. The Owner reserves the right to request Contractor expose any completed joint for inspection. If the joint fails inspection, Contractor shall be required to repair the joint at no additional cost to the Owner. If the joint passes inspection, the Owner will compensate Contractor for time and materials for exposing the joint and re-backfilling.

6. Contractor shall include in their Contract Price four (4) locations where completed joints will be excavated, inspected, and backfilled at the direction of the Owner and Engineer. If any one of the joints inspected fails inspection, the previous three (3) joints will be required to be excavated, inspected, and backfilled at no additional cost to the Owner.

7. Provisions shall be made to minimize stresses in welded steel pipe to account for temperature changes and to avoid the accumulation of expansion and contraction during installation and after the pipe is in service as recommended by the pipe manufacturer and in accordance with ANSI/AWWA M11 and C604. The allowable temperature range of

the pipe during welding shall be established by the pipe design and monitored during installation as recommended by the pipe manufacturer. The temperature of the conveyed water will range from 36°F to 86°F.

F. Standard Inspection and Testing

1. Standard shop inspection and testing shall be in accordance with the shop inspection and testing provisions specified herein.

2. Field weld test specimens shall be furnished to Engineer for testing by an independent testing laboratory whenever, in the judgment of Engineer, a satisfactory weld is not being made. Test specimens shall also be furnished when Engineer desires. All costs for this testing will be paid by Owner.

G. Special Procedure Inspection and Testing

1. Special procedure shop inspection and testing shall be in accordance with the shop inspection and testing provisions specified herein. Field welding procedures, welders, welding operators, and tackers shall be qualified in accordance with ASME Section IX or AWS B2.1 and as defined in Section 4 of ANSI/AWWA C206 or ANSI/AWWA C200, as applicable. All qualifications shall be in accordance with all-position pipe tests as defined in the applicable qualification code.

2. The welder qualification testing for field welding shall be conducted at the Site for each welder. Results of previous qualification tests will not be accepted. The Contractor is responsible for the qualification of welders or welding operators. Field welder or welding operator performance qualification testing shall be performed under the full supervision and control of the Contractor. It is permissible to subcontract the work for preparation of test specimens, performance of NDE, and mechanical tests, provided the Contractor accepts the responsibility for the work. Copies of all test data and certifications shall be submitted to Engineer. All costs of welder qualification testing shall be paid by Contractor.

3. Upon completion of each field-welded joint, the welder or welding operator shall mark his regular identification number and the last two digits of the year the work was completed, or Contractor may have a records system that traces a welder's work. Steel stamping directly on piping will not be permitted unless "low stress" die stamps, such as interrupted dot or round-nose types, are used.

4. All field welds shall be visually inspected by a CWI. All field welds shall be visually inspected in accordance with the requirements of AWS D1.1, Table 6.1, Visual Inspection Acceptance Criteria table for statically loaded nontubular connections. Owner will furnish a third party CWI. Qualifications of CWI will be made available to Contractor for information only.

5. Field welds will be randomly inspected and tested by an independent testing laboratory as directed by Engineer. Field lap welds will be inspected by magnetic particle or the liquid penetrant method. Field butt welds will be inspected by the radiographic method and in accordance with the acceptance criteria of API 1104. Contractor shall inform Engineer

before welded joints are to be backfilled so that the joint may be inspected. Contractor shall be responsible for all costs of exposing joints that were backfilled before inspection.

6. Personnel performing visual inspection of welds shall be qualified and currently certified as Certified Welding Inspectors (CWI) in accordance with AWS QC1, Standard for Qualification and Certification of Welding Inspectors. Personnel performing nondestructive tests shall be qualified and certified in accordance with written practice ASNT SNT-TC-1A.

7. Engineer may also order nondestructive testing by an independent testing laboratory in addition to any testing specified herein.

8. Except as otherwise specified herein, all costs for inspection and testing of field welds by the independent testing laboratory will be paid by Owner. If the weld is defective, the inspection costs shall be paid by Contractor. Defective welds shall be repaired and retested at Contractor's expense.

9. Test reports of all NDE examinations or laboratory tests shall be submitted as provided for in the Quality Control and Submittals Procedures sections.

H. Couplings

1. Surfaces of pipe ends and couplings in contact with the sealing gasket shall be clean and free from foreign material when the coupling is installed on the pipe. Wrenches used in bolting couplings shall be of a type and size recommended by the coupling manufacturer. All bolts shall be tightened by approximately the same amount, with all parts of the coupling square and symmetrical with the pipe. Following installation, the exterior coating of each coupling shall be touched up or re-primed.

2. Contractor shall verify that tie bolts have been stressed to assure the pipe will not creep when pressurized.

I. Dismantling Joints

1. Dismantling joints shall be installed in accordance with the coupling manufacturer’s recommendations. Unless otherwise indicated on the Drawings, dismantling joints shall be restrained.

J. Mechanical Couplings

1. Mechanical couplings shall be installed in accordance with the coupling manufacturer's recommendations. A space of at least 1/4 inch , but not more than 1 inch , shall be left between the pipe ends. Pipe and coupling surfaces in contact with gaskets shall be clean and free from dirt and other foreign matter during assembly. All assembly bolts shall be uniformly tightened so that the coupling is free from leaks, and all parts of the coupling are square and symmetrical with the pipe. Following installation of the coupling, damaged areas of shop coatings on the pipe and coupling shall be repaired to the satisfaction of Engineer.

3.5 WALL SLEEVES AND WALL PIPES

A. Wall sleeves and wall pipes shall be installed as indicated on the Drawings and shall be installed where steel pipe passes through concrete or masonry walls, unless otherwise noted.

B. Where harness lugs are attached to wall sleeves, the sleeves shall be carefully aligned to permit installation of the tie rods. In flange and mechanical joint wall sleeves and wall pipe, holes in the mechanical joint bells and flanges shall straddle the top (or side for vertical piping) center line. The top (or side) center line shall be marked on each flange and mechanical joint piece at the fabricating shop.

C. Where specified or indicated on the Drawings for sleeves detailed, one or two sets of modular casing seals shall be installed at the face of walls to seal against soil or provide a dust or water tight seal. Contractor shall coordinate the diameter of wall sleeve with the modular casing seal manufacturer. When soil may be present at wall sleeves, a set of modular casing seals shall be installed at each face of the wall. Modular casing seals shall not be used in submerged conditions unless the hydrostatic pressure is less than 20 feet and piping is less than or equal to 60 inches size.

3.6 REDUCERS

A. Reducers shall be eccentric or concentric as indicated on the Drawings. Reducers of eccentric pattern shall be installed with the straight side on top, so that no air traps are formed.

3.7 BLOWOFFS

A. Blowoffs shall be located and arranged as indicated on the Drawings.

3.8 COMBINATION AIR VALVE MANHOLES

A. Combination air valve manholes shall be the type specified and installed at the locations indicated on the Drawings.

3.9 PIPE ANCHORS, BLOCKING, CONCRETE ENCASEMENT, HANGERS, AND SUPPORTS

A. Pipe anchors, blocking, hangers, and supports shall be installed where and as specified and indicated on Drawings and shall be fabricated in accordance with the Pipe Supports section and the details indicated on the Drawings, and shall be furnished and installed complete with all concrete bases, anchor bolts and nuts, plates, rods, and other accessories required for proper support of the piping. All piping shall be rigidly supported and anchored so that there is no movement or visible sagging between supports. Where the details must be modified to fit the piping and structures, all such modifications shall be subject to acceptance by Engineer. Unless otherwise permitted, lugs for lateral or longitudinal anchorage shall be shop welded to the pipe.

B. Concrete reaction anchorage, blocking, encasements, and supports shall be installed as indicated on the Drawings or as permitted by Engineer. Concrete and reinforcing steel for anchorages,

blocking, encasements, and supports shall conform to the Cast-in-Place Concrete section. All pipe to be encased shall be suitably supported and blocked in proper position, and shall be anchored to prevent floatation. A pipe joint shall be provided within 12 inches of each end of the concrete encasement.

C. The concrete blocking size shall be of the dimensions indicated on the Drawings, shall extend from the fitting to solid undisturbed earth, and shall be installed so that all joints are accessible for repair. If adequate support against undisturbed earth cannot be obtained, restrained joints shall be installed to provide the necessary support. If the lack of suitable solid vertical excavation face is due to improper trench excavation, restrained joints shall be furnished and installed by and at the expense of Contractor.

D. Reaction blocking, anchorages, or other supports for fittings installed in fills or other unstable ground, installed above grade, or exposed within structures, shall be provided as indicated on the Drawings.

E. All ferrous metal clamps, rods, bolts, and other components of reaction anchorages or joint harness, subject to submergence or in contact with earth or other fill material and not encased in concrete, shall be protected from corrosion as specified in the Corrosion Protection paragraph of this section.

3.10 JOINT HOLDBACKS AND COATINGS AND LININGS

A. Shop Holdbacks and Coatings and Linings and Field Repair

1. Entry into the pipe or pipeline for application of interior linings to unlined ends shall be from open ends or through access manholes, except as otherwise permitted by Engineer. Pour holes , where allowed by the Engineer, shall consist of 4-inch standard weight black steel pipe welded to the pipe to be lined and covered with a bolted blind flange.

2. Holdbacks, coatings and linings for pipe ends at joints shall conform to the following:

For Field-Welded Joints	
Cement Mortar	Hold back coating and lining 4 to 6 inches from joint. Field repair in accordance with ANSI/AWWA C205 as modified herein.
Polyurethane	Hold back coating at least 4 to 6 inches from joint. Field repair in accordance with AWWA C222 and C604 using heat shrink wrap AWWA C216, 80 mil thickness. Type I for pipe and fitting joints.
For Flanged Joints	Extend lining to ends of pipe. Field coat buried exterior surfaces as specified in the Corrosion Protection paragraph for flanges.

For Mechanically Coupled Joints	
Cement Mortar	Hold back coating 16 inches (or greater if required to clear harness lugs) from joints. Shop coat exposed surfaces with liquid epoxy to end of pipe in accordance with ANSI/AWWA C210 Epoxy. Lining shall extend to end of pipe. Field coat buried exterior surfaces as specified in the Corrosion Protection paragraph for mechanical couplings.
Liquid Epoxy	Epoxy shop coating shall extend to ends of pipe; in accordance with ANSI/AWWA C210. Field coat buried exterior surfaces as specified in the Corrosion Protection paragraph for mechanical couplings.
Polyurethane	Hold back coating 16 inches (or greater if required to clear harness lugs) from joints. Shop coat exposed surfaces with liquid epoxy to end of pipe in accordance with AWWA C21 Epoxy. Field coat buried exterior surfaces as specified in the Corrosion Protection paragraph for mechanical couplings.
For Other Type of Joints and Exposed Buried Surfaces	Other types of joints and exposed buried surfaces that cannot be shop coated with the primary coating and lining system shall be shop coated and lined with 20 mil dry film thickness of liquid epoxy in accordance with ANSI/ASSA C210 Epoxy.

B. Modifications to the Governing Standards.

1. Field Repair of Cement Mortar Lining

a. Field repair of interior joint surfaces shall be done in accordance with ANSI/AWWA C205, except that an epoxy bonding agent and latex admixture shall be used in conjunction with the sand and cement mortar. The addition of lime or pozzolan will not be permitted.

b. The exposed steel shall be thoroughly cleaned and all grease shall be removed. A coat of epoxy bonding agent shall be applied over the area to be lined in accordance with the coating manufacturer's recommendations. A soupy mixture of cement and water shall be applied over the epoxy after it becomes tacky. Cement mortar to which the latex admixture has been added shall then be packed into the area to be patched and screeded off level with the adjacent cement mortar lining. The patched area shall be given an initial floating with a wood float, followed by a steel trowel finish.

c. Defective or damaged cement mortar linings shall be removed, the surfaces cleaned, and the lining repaired as specified above for joint repair. Wire fabric reinforcement shall be used in the lining of fittings and specials in conformance with ANSI/AWWA C205.

3.11 CORROSION PROTECTION

A. Flanged Joints

1. The flange bolts and nuts on buried flanged joints shall be protected by wrapping them with wax tape in accordance with ANSI/AWWA C217. A primer shall be applied prior to applying the wax tape. The application of the wax tape shall be as recommended by the wax tape manufacturer.

2. Following application of the wax tape protection, the entire flanged joint shall be encapsulated with a shrink sleeve. The shrink sleeve shall extend a minimum of 6 inches onto the shop coated pipe on each side of the flange. A primer shall be applied to the piping on each side of the flange prior to installing the shrink sleeve. The installation of the shrink sleeve shall be in accordance with ANSI/AWWA C216 and as recommended by the shrink sleeve manufacturer. There shall be no bare or unprotected ferrous metal surfaces.

3. Corrosion protection of buried insulated flanges shall be as specified herein unless otherwise shown on the drawings

B. Valves

1. Buried valve flanges shall be protected as specified herein for buried flange joints. The corrosion protection for the entire remaining buried valve and actuator to the wrench nut shall be wax tape or shrink sleeve.

C. Mechanical Couplings

1. The coupling and its tie bolts and nuts on all buried mechanical couplings shall be coated with two coats, 20 mils minimum, of medium consistency coal tar.

2. After the protective coating has been applied to the coupling and tie bolts, the entire mechanical coupling shall be encapsulated with a three part wax tape system as indicated on the Drawings. The wax tape shall extend a minimum of 6 inches onto the shop coated pipe on each side of the coupling, including covering all epoxy coated steel. A primer shall be applied to the piping on each side of the coupling prior to installing the wax tape outer wrap. There shall be no bare or unprotected ferrous metal surfaces

D. Restrained Mechanical Couplings

1. Buried mechanical couplings shall be protected with two coats of medium consistency coal tar and *three part wax tape system* as specified herein for buried mechanical couplings.

2. The tie rods and bolts of the harness rings or lugs of the restrained coupling assembly shall be protected by wrapping them with wax tape in accordance with AWWA C217. A primer shall be applied prior to applying the wax tape. The application of wax tape shall be as recommended by the wax tape manufacturer.

3. *Following the application of the wax tape, the entire restrained mechanical coupling assembly, including coupling, tie bolts and nuts, pipe, and harness rings or lugs, shall be encapsulated by wax tape and an outer tape wrap. The wax tape shall extend a minimum of 6 inches onto the pipe beyond the end of the tie rods. The wax tape outer wrap shall extend a minimum of 6 inches onto the shop coated pipe beyond each end. A primer shall be applied to the piping on each side of the harness assembly prior toinstalling the wax tape wrap. There shall be no bare or unprotected ferrous metal surfaces.*

E. Other Assemblies

1. All ferrous metal clamps, tie rods, bolts, and other components of buried joint harnesses, mechanical joints, wall fittings, or pipe reaction anchorages in contact with earth or other fill material and not encased in concrete, shall be protected by wrapping them with wax tape in accordance with ANSI/AWWA C217. A primer shall be applied prior to applying the wax tape. The application for the wax tape shall be as recommended by the wax tape manufacturer. There shall be no bare or unprotected ferrous metal surfaces.

F. Surfaces Exposed in Manholes and Vaults

1. Unless otherwise specified, all uncoated metal surfaces exposed in manholes and vaults shall be cleaned and coated with two coats of medium consistency coal tar. The first coat shall be dry and hard before the second coat is applied. There shall be no unprotected, bare, or uncoated ferrous metal surfaces.

3.12 CONNECTIONS WITH EXISTING PIPING

A. Connections between new work and existing piping shall be made using fittings suitable for the conditions encountered. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with service to customers, and as authorized by Owner.

B. Facilities shall be provided for dewatering and for disposal of the water removed from the dewatered lines and excavations without damage to adjacent property.

C. Special care shall be taken to prevent contamination when dewatering, cutting into, and making connections with treated or potable water piping. Trench water, mud, or other contaminating substances shall not be permitted to enter the lines. The interior of all pipe, fittings, and valves installed in such connections shall be thoroughly cleaned and then swabbed with or dipped in a 200 mg/L chlorine solution.

3.13 PROVISIONS FOR CATHODIC PROTECTION

A. Cathodic protection shall be provided for buried piping as specified in the Galvanic Anode Type Cathodic (Corrosion) Protection for Pipelines section.

B. Insulated Joints

1. Insulated flange type joints shall be provided where indicated on the Drawings or specified. After installation, corrosion protection shall be provided for the joint as specified in the Corrosion Protection paragraph.

2. Electrical Bond Across Rubber-Gasketed Joints

a. Two electrical bonding cables shall be bonded to and across each mechanical coupling, stab joint, or other rubber-gasketed stab joint. Before the field joint coating is applied to mechanical couplings, two small areas of metal shall be exposed on the pipe surface each side of the coupling, on the middle ring, and on each follower ring. Before the field joint coating is applied to stab joints, two small areas of metal shall be exposed on each side of the joint. Each area shall be thoroughly cleaned, and two cathodic protection cables shall be bonded to the pipe, one on either side of the joint, and to the middle ring and follower rings for mechanically coupled joints. Each cable shall be bonded by the thermite process. The completed connections and exposed metal surfaces shall be coated as specified for field repair of coatings in the Corrosion Protection paragraph.

C. Electrical Bond Across Valves and Flanges

1. Two electrical bonding cables shall be provided across valves and flanged connections other than insulated flanges. The electrical bond shall be provided as specified for bond across rubber-gasketed joints.

D. Bonding Cables and Test Lead Wires

1. Bonding cables and test lead wires shall be not less than 6 AWG , Type CP copper cathodic protection cable, with low density, high molecular weight polyethylene insulation.

E. Test Lead Stations

1. Test lead stations shall be provided where specified or indicated on the Drawings. The test lead stations shall be in accordance with the details indicated on Figure 2-40 05 24, and as specified herein and within the Anode Type Cathodic (Corrosion) Protection for Pipelines section.. The test lead wires shall be terminated on the ground surface in a standard connection box at a protected location acceptable to Engineer. Standard connection boxes for test lead stations shall be C.P. Test Services "NM-7" plastic terminal boxes, 18 inches long, with 5 inches inside diameter, a locking cast iron lid, a terminal block with seven terminals, and the inscription "CP TEST" cast into its cover.

3.14 PRESSURE AND LEAKAGE TESTS

A. After installation, pipe and fittings shall be subjected to a pressure test and a leakage test in accordance with the Pipeline Pressure and Leakage Testing section.

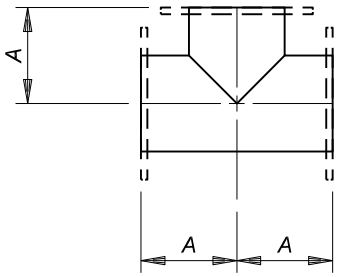
B. All pipe, fittings, valves, pipe joints, and other materials which are found to be defective shall be removed and replaced with new and acceptable materials, and the affected portion of the piping shall be retested by and at the expense of Contractor.

C. All joints shall be watertight and free from visible leaks. Any visible leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.

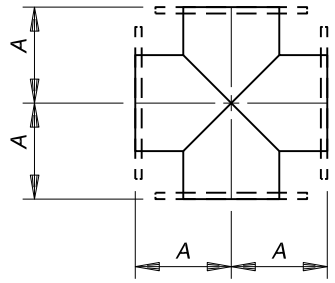
3.15 DISINFECTION

A. After installation, all potable water pipelines shall be disinfected as specified in the Cleaning and Disinfection of Water Pipelines section.

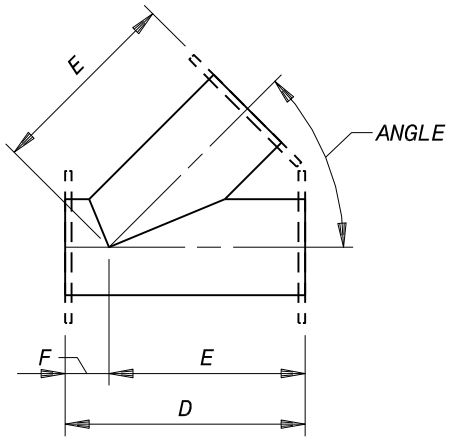
End of Section



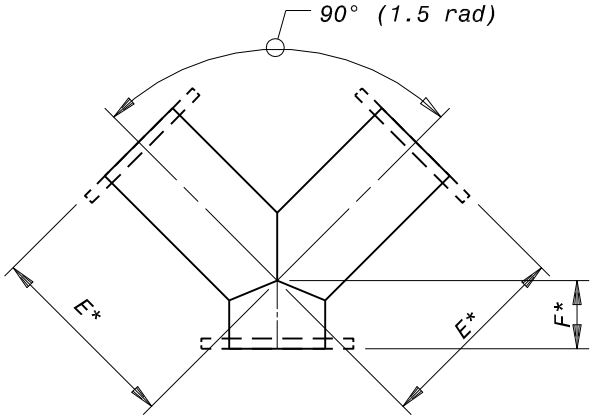
TEE



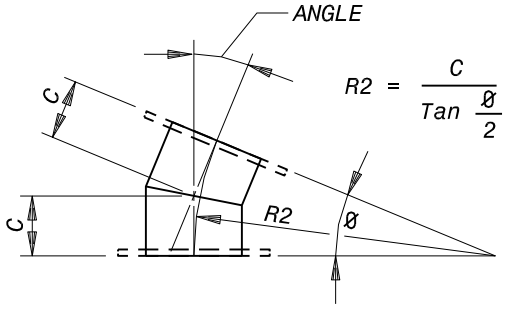
CROSS



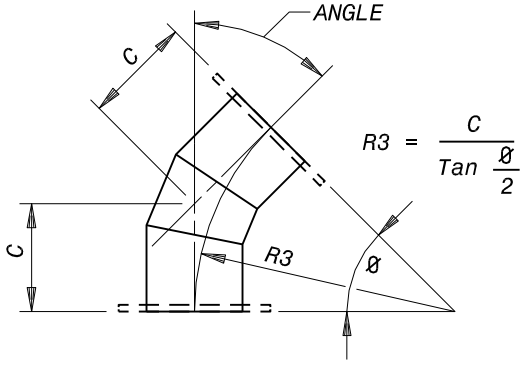
LATERAL 45° (0.7 rad) MIN; 75° (1.3 rad) MAX



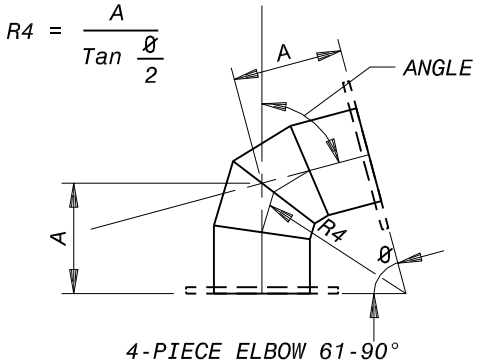
TRUE WYE-90° (1.5 rad)



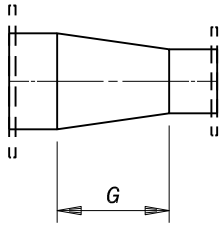
2-PIECE ELBOW
0-30° (0-0.52 rad)



3-PIECE ELBOW 31-60°
(0.54-1.0 rad)



4-PIECE ELBOW 61-90°
(1.1-1.5 rad)



REDUCER

NOTE:
SEE FIGURE 1-40 05 24(B) FOR DIMENSIONS.

STEEL PIPE FITTINGS

BLACK & VEATCH	STEEL PIPE	FIG 1-40 05 24(A)

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BLACK & VEATCH

STEEL PIPE

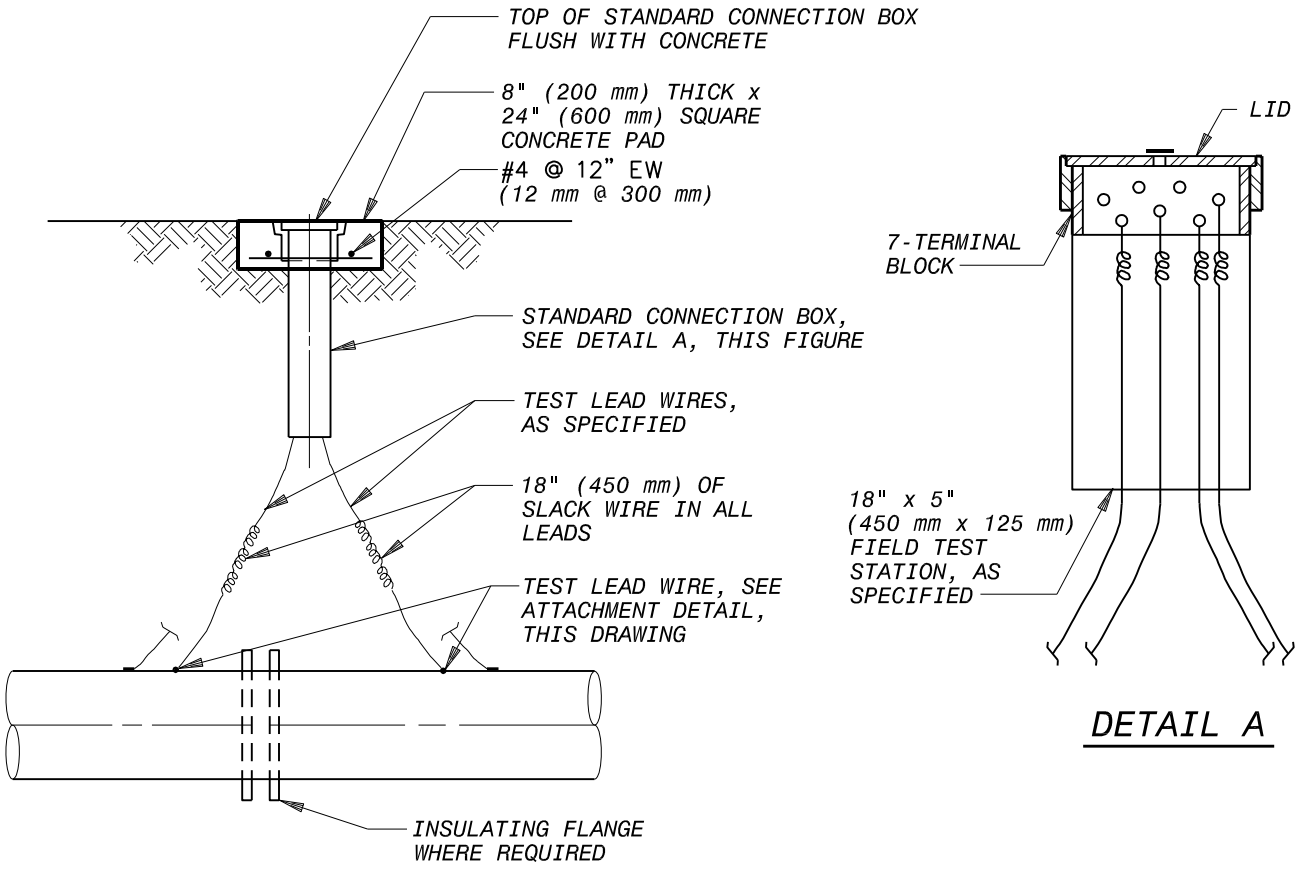
FIG 1-40 05 24(B)

DIMENSIONS FOR STEEL PIPE FITTINGS

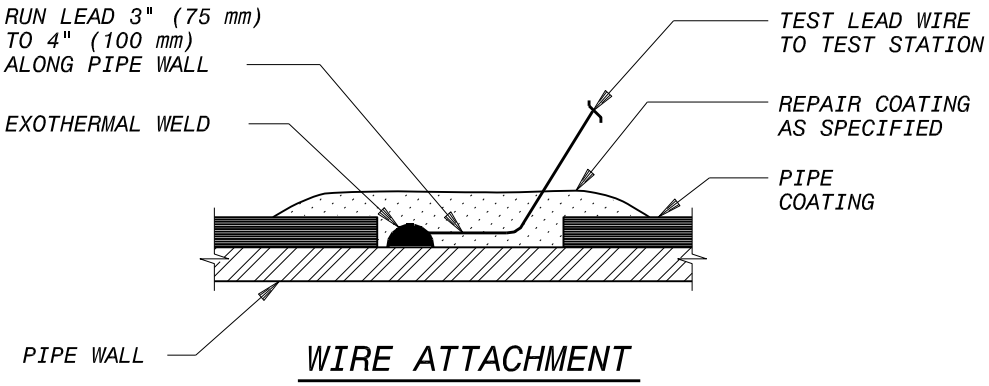
DIMENSIONS IN INCHES (MILLIMETERS)

NOMINAL DIA	TEE		CROSS A+A	LATERAL (45–75\) (0.7–1.3 rad)		TRUE WYE (90\) (1.5 rad)		ELBOWS			REDUCER CONE G
	RUN A+A	OUTLET A		RUN D	OUTLET E	E*	F*	2–PIECE (0–30\) (0.0–0.52 rad) C	3–PIECE (31–60\) (0.54–1.0 rad) C	4–PIECE (61–90\) (1.1–1.5 rad) A	
4 (100)	13 (330)	6.5 (165)	13 (330)	15 (381)	12 (305)	6.5 (330)	3 (76)	4 (102)	4 (102)	6.5 (162)	7 (178)
6 (150)	16 (406)	8 (203)	16 (406)	18 (457)	14.5 (368)	8 (203)	3.5 (89)	5 (127)	5 (127)	8 (203)	9 (229)
8 (200)	18 (457)	9 (229)	18 (457)	22 (559)	17.5 (445)	9 (229)	4.5 (114)	5.5 (140)	5.5 (140)	9 (229)	11 (279)
10 (250)	22 (559)	11 (279)	22 (559)	25.5 (648)	20.5 (521)	11 (279)	5 (127)	6.5 (165)	6.5 (165)	11 (279)	12 (305)
12 (300)	24 (610)	12 (305)	24 (610)	30 (762)	24.5 (622)	12 (305)	5.5 (140)	7.5 (191)	7.5 (191)	12 (305)	14 (356)
14 (350)	28 (711)	14 (356)	28 (711)	33 (838)	27 (686)	14 (356)	6 (152)	7.5 (191)	7.5 (191)	14 (356)	16 (406)
16 (400)	30 (762)	15 (381)	30 (762)	36.5 (927)	30 (762)	15 (381)	6.5 (165)	8 (203)	8 (203)	15 (381)	18 (457)
18 (450)	33 (838)	16.5 (419)	33 (838)	39 (991)	32 (813)	16.5 (419)	7 (178)	8.5 (216)	8.5 (216)	16.5 (419)	19 (483)
20 (500)	36 (914)	18 (457)	36 (914)	43 (1092)	35 (889)	18 (457)	8 (203)	9.5 (241)	9.5 (241)	18 (457)	20 (508)
22 (550)	40 (1016)	20 (508)	40 (1016)	46 (1168)	37.5 (953)	22 (559)	9 (229)	10 (254)	10 (254)	20 (508)	22 (559)
24 (600)	44 (1118)	22 (559)	44 (1118)	49.5 (1257)	40.5 (1029)	25 (635)	10 (254)	11 (279)	11 (279)	22 (559)	24 (610)
30 (750)	50 (1270)	25 (635)	50 (1270)	59 (1499)	49 (1245)			15 (381)	15 (381)	25 (635)	30 (762)
36 (900)	56 (1422)	28 (711)	56 (1422)	84 (2134)	60 (1524)			18 (457)	18 (457)	28 (711)	36 (914)
42 (1050)	62 (1575)	31 (787)	62 (1575)	95 (2413)	69 (1753)			21 (533)	21 (533)	31 (787)	42 (1067)
48 (1200)	68 (1727)	34 (864)	68 (1727)	104 (2642)	77 (1956)			24 (610)	24 (610)	34 (864)	48 (1219)
54 (1350)	74 (1880)	37 (940)	74 (1880)					27 (686)	27 (686)	37 (940)	54 (1372)
60 (1500)	80 (2032)	40 (1016)	80 (2032)					30 (762)	30 (762)	40 (1016)	60 (1524)

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DETAIL A



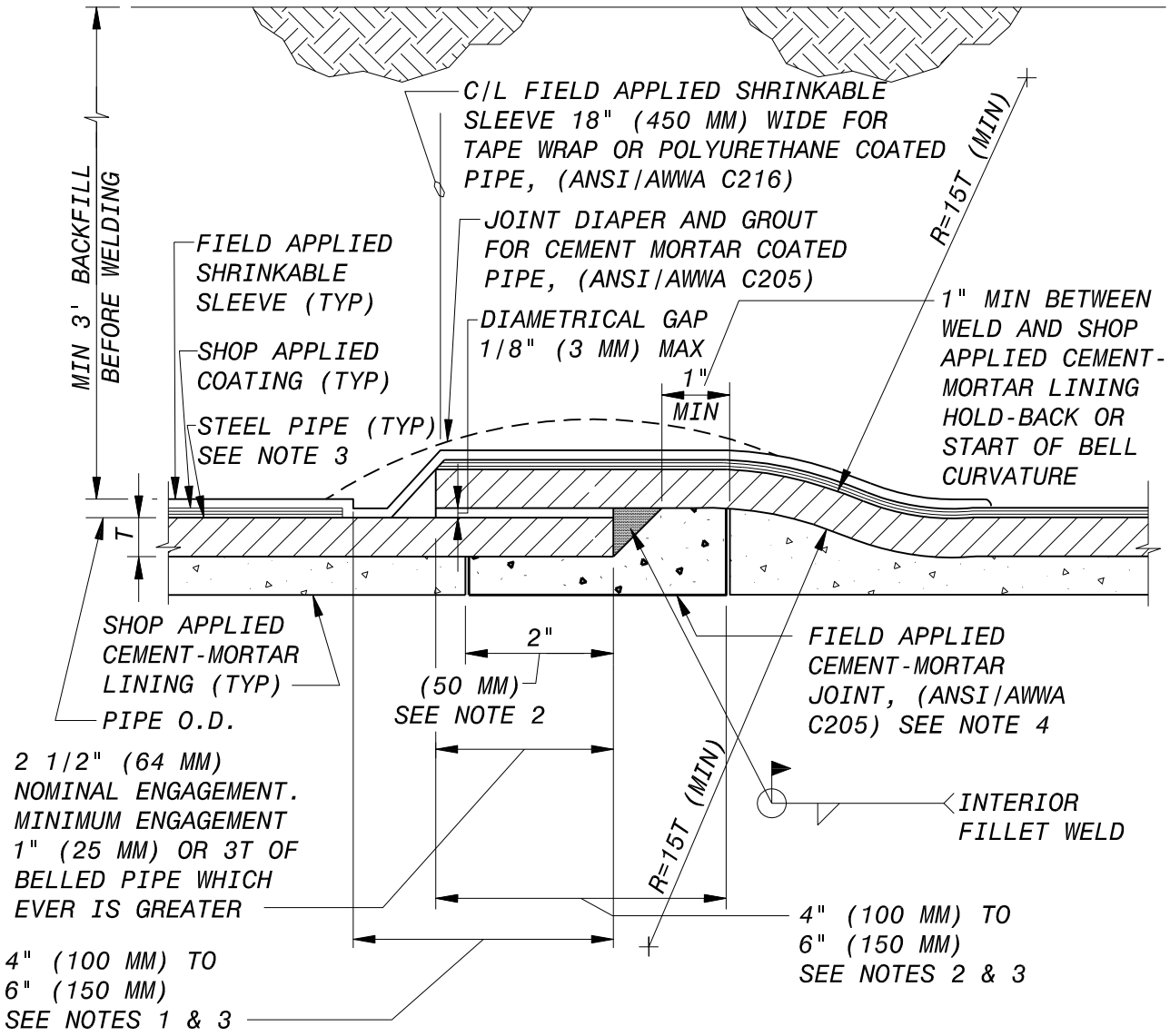
WIRE ATTACHMENT

1. ALL LEAD WIRES SHALL BE INSTALLED WITH A MINIMUM OF 18" (450 mm) OF SLACK IN EACH PLACE INDICATED TO PREVENT BREAKAGE OF WIRE BECAUSE OF BACKFILL SETTLEMENT.
2. LEAD WIRES SHALL BE ATTACHED TO THE PIPE ON THE TOP CENTER LINE, APPROXIMATELY 12" (300 mm) APART.
3. LEAD WIRES SHALL BE EXOTHERMAL (CADWELD) WELDED TO PIPES IN ACCORDANCE WITH THE INSTRUCTIONS OF THE WELDING EQUIPMENT MANUFACTURER.
4. PERMANENT, LEGIBLE IDENTIFICATION MARKERS SHALL BE ATTACHED TO EACH LEAD WIRE IN THE STANDARD CONNECTION BOX.

INSTALLATION DETAIL - POTENTIAL TEST LEAD STATION

BLACK & VEATCH	STEEL PIPE	FIG 2-15062

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SINGLE WELDED BELL/SPIGOT DETAIL (WELD AFTER BACKFILL)

NO SCALE

NOTES:

1. HOLD TAPE MATERIALS BACK 4" (100 MM) TO 6" (150 MM) ON THE SPIGOT OD. LEAVE CUT-BACK BARE STEEL.

2. HOLD CEMENT-MORTAR LINING BACK 4" (100 MM) TO 6" (150 MM) ON BELL ID AND 2" (50 MM) ON SPIGOT ID. LEAVE CUT-BACK BARE STEEL.

3. GRIND SPIRAL WELD BACK 18" (450 MM) ON BELL AND SPIGOT OD. GRIND SPIRAL WELD BACK 4" (100 MM) TO 6" (150 MM) ON BELL ID.

4. FILL JOINT GAP IN LINING BY FIELD APPLIED CEMENT-MORTAR PER ANSI/AWWA C205.

FIELD-WELDED LAP JOINT DETAIL

BLACK & VEATCH	STEEL PIPE	FIG 3-40 05 24(B)

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Schedule 40 05 24-S01

Steel Pipe Schedule

General	Pipeline Segments / Sections					
Location	Buried	Buried	Buried	Buried	Buried	Buried
Service	Treated Water	Treated Water	Treated Water	Fayetteville Transmission Main	Fayetteville Transmission Main	Fayetteville Transmission Main
Size (in)	72	60	54	48	42	36
Working Pressure (psi)	17	12	8	130	130	130
Surge Pressure (ps	-	-	-	250	250	250
Field Test Pressure (psi)	26	18	13	250	250	250
Total External Load (lb/in)	1327	1109	923	652	620	544
Maximum D/T ratio	165	165	165	165	165	165
Min. Wall Thickness (in)*	0.466	0.394	0.327	0.291	0.255	0.250

*Wall thickness shall include zero minus tolerance. Minimum wall thickness based on larger of specified maximum D/t ratio or t = (PD)/(2s) with maximum yield strength of 42,000 psi. Lower yield strength steel will result in increased thickness where yield strength controls thickness.

**In accordance with ANSI/AWWA C200 and as specified.

End of Schedule

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SECTION 40 05 32 - MISCELLANEOUS PLASTIC PIPE, TUBING, AND ACCESSORIES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the furnishing of miscellaneous plastic pipe, tubing, and accessories. Pipe and tubing shall be furnished complete with all fittings, flanges, unions, jointing materials and other necessary appurtenances.

1.2 SUBMITTALS

A. Drawings and Data

1. Complete specifications, data and catalog cuts or drawings shall be submitted in accordance with the Submittal Procedures section. Submittals are required for all piping, fittings, gaskets, sleeves, and accessories, and shall include the following data:

a. Name of Manufacturer
b. Type and model
c. Construction materials, thickness, and finishes
d. Pressure and temperature ratings

B. Gasket Material Certifications.

1. Contractor shall obtain and submit a written statement from the gasket material manufacturer certifying that the gasket materials are compatible with the joints specified herein and are recommended for the specified field test pressures and service conditions.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section. All materials shall be stored in a sheltered location above the ground, separated by type, and shall be supported to prevent sagging or bending.

B. Pipe, tubing, and fittings shall be stored between 40°F and 90°F .

PART 2 - PRODUCTS

2.1 PVC PIPE MATERIALS

A. PVC pipe materials and services shall be as specified herein.

B. Material Classification PVC-2

PVC-2 – Schedule 80 PVC Pipe with Solvent Welded Joints. Sample pump suction and discharge. Sump pump discharge .	Pipe Fittings	ASTM D1785, Cell Classification 12454, bearing NSF seal, Schedule 80. ASTM D2467, Cell Classification 12454, bearing NSF seal. Flanges or unions shall be provided where needed to facilitate disassembly of equipment or valves. Flanges or unions shall be joined to the pipe by a solvent weld. When acceptable to Engineer, threaded joints may be used instead of solvent welded joints in exposed interior locations for the purpose of facilitating assembly. The use of threaded joints in this system shall be held to a minimum.

C. Material Classification PVC-6

PVC-6 – PVC Underdrain Pipe Clearwell foundation drains	Pipe Fittings	ASTM F758, solid or perforated wall, Cell Classification 12454 or 12364, Type PS 46. ASTM D3034, Cell Classification 12454, wall thickness SDR 35, with solvent welded or elastomeric gasket joints.

D. Accessory Materials

1. Accessory materials for the PVC Pipe systems shall be as indicated.

Flanges	Diameter and drilling shall conform to ANSI/ASME B16.5, Class 150. Schedule 80 for DWV systems.
Flange Bolts and Nuts	ASTM A307, Grade B, length such that, after installation, the bolts will project 1/8 to 3/8 inch beyond outer face of the nut. Stainless steel for DWV and chemical feed systems, galvanized steel for all other systems.
Flat Washers	ANSI B18.22.1, plain. Same material as bolts and nuts.
Flange Gaskets	Full face, 1/8 inch thick, chemical-resistant elastomeric material suitable for the specified service.

2.2 PE PIPE

A. PE pipe materials and services shall be as specified herein.

B. Material Classification PE-6

PE-6 – Polyethylene Tubing. Sample Pump	Tubing and Fittings	1/8 through 3/4 inch OD, 1/16-inch wall thickness, 130°F maximum operating temperature with compression fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Materials furnished under this section will be installed in accordance with the Miscellaneous Piping and Accessories Installation section.

End of Section

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SECTION 40 05 51.13 - VALVE INSTALLATION

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the installation of new valves and actuators.

B. Cleaning, disinfection, pressure and leakage testing, insulation, and pipe supports are covered in other sections.

C. The following specification sections are applicable to valves to be installed:

	Title
1.	Miscellaneous Ball Valves
2.	Check Valves
3.	AWWA Butterfly Valves
4.	Resilient-Seated Gate Valves
5.	Air Valves

1.2 GENERAL

A. Equipment installed under this section shall be erected and placed in proper operating condition in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

B. Any valves and actuators that are identified as being provided by others will be furnished complete for installation by Contractor. Technical specifications under which the equipment will be purchased are available.

C. Coordination

1. When manufacturer's field services or installation check services are provided by the valve manufacturer, Contractor shall coordinate the services with the valve manufacturer. Contractor shall give Engineer written notice at least 30 days prior to the need for manufacturer's field services.

2. Submittals for equipment that will be furnished by others under each procurement contract will be furnished to Contractor upon completion of review by Engineer. Contractor shall review equipment submittals and coordinate with the requirements of the

Work and the Contract Documents. Contractor accepts sole responsibility for determining and verifying all quantities, dimensions, and field construction criteria.

3. Flanged and mechanical connections to valves including the bolts, nuts, and gaskets are covered in the appropriate pipe specification section. Valve ends shall match piping.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.1 INSPECTION

A. All valves and accessories shall be inspected for damage and cleanliness before being installed. Any material damaged or contaminated in handling on the job shall not be used unless it is repaired and re-cleaned to the original requirements by Contractor. Such material shall be segregated from the clean material and shall be inspected and approved by Owner or his representative before its use.

3.2 INSTALLATION

A. General

1. Valves shall be installed with sufficient clearance for proper operation of any external mechanisms, and with sufficient clearance to dismantle the valve for in-place maintenance. Installation shall be in accordance with the valve manufacturer’s recommendations.

2. Unless otherwise indicated on the Drawings or specified, all valves installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the finish floor shall be installed with their operating stems vertical. Valves installed in horizontal runs of piping having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above the finish floor shall be installed with their operating stems horizontal. If adjacent piping prohibits this, the stems and operating handwheel shall be installed above the valve horizontal centerline as close to horizontal as possible. Valves installed in vertical runs of pipe shall have their operating stems oriented to facilitate the most practicable operation, as reviewed by Engineer.

B. Installation Checks

1. When specified in the valve sections, the valve manufacturer will provide installation checks. For installation checks, the manufacturer’s field representative will inspect the valve installation immediately following installation by Contractor. The manufacturer's representatives will revisit the site as often as necessary to ensure installation satisfactory to Owner.

2. Contractor shall perform no work related to the installation or operation of materials or equipment furnished by others without direct observation and guidance of the field representative, unless Engineer and manufacturer furnishing such materials concur otherwise.

C. AWWA Butterfly Valves

1. Butterfly valves shall be installed with the shaft horizontal unless otherwise necessary for proper operation or as acceptable to Engineer.

2. Whenever an actuator must be removed to permit installation of a valve, the actuator shall be promptly reinstalled and shall be inspected and readjusted by a representative of the valve manufacturer.

D. Check Valves

1. Lift Check Valves

a. Horizontal lift checks shall be installed in a level horizontal position so that the internal parts rise and fall vertically, unless the valve is spring loaded. Angle pattern lift checks shall be installed in vertical pipe with flow upward from beneath the disc.

2. Swing Check Valves

a. Install valves oriented for the correct flow direction. Only valves designed for vertical installation shall be installed in vertical piping.

E. Resilient Seated Gate Valves

1. Resilient Seated Gate Valves

a. Valves shall be handled and installed in accordance with the recommendations set forth in the Appendices to ANSI/AWWA C509 and C515 and with the recommendations of the manufacturer.

F. Air Release and Combination Air Valves

1. The exhaust from each valve shall be piped to a suitable point acceptable to Engineer. Air release valve exhaust piping leading to a trapped floor drain shall terminate at least 6 inches above the floor.

G. Valve Boxes

1. Valve boxes shall be set plumb. Each valve box shall be placed directly over the valve it serves, with the top of the box brought flush with the finished grade. After each valve box is placed in proper position, earth fill shall be placed and thoroughly tamped around the box.

3.3 VALVE ACTUATORS

A. Valve actuators and accessories shall be factory mounted on the valve, calibrated, and tested by the valve or actuator manufacturer.

3.4 FIELD QUALITY CONTROL

A. Field Testing

1. After installation, all valves shall be tested in accordance with the Pipeline Pressure and Leakage Testing section.

2. Pressure Tests

   a. Pressure testing shall be in accordance with the Pipeline Pressure and Leakage Testing section.

3. Leakage Tests

   a. All valves shall be free from leaks. Each leak that is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor. This requirement applies whether pressure testing is required or not.

3.5 ADJUSTING

A. After installation, the opening and closing time shall be adjusted as needed for each pneumatic, hydraulic and electric actuated valve.

End of Section

SECTION 40 05 51.16 - GATE INSTALLATION

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the installation of new gates and actuators purchased by Contractor as part of this Work.

B. The following specification sections are applicable to gates to be installed under this contract:

1. Section 40 05 59.13 Metal Slide Gates

1.2 GENERAL

A. Equipment installed under this section shall be erected and placed in proper operating condition in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

B. Any gates and actuators identified as being provided by others will be furnished complete for installation by Contractor. Technical specifications under which the equipment will be purchased are available.

C. Coordination

1. When installation check services are provided by the gate manufacturer, Contractor shall coordinate the services with the gate manufacturer. Contractor shall give Engineer written notice at least 30 days prior to the need for manufacturer’s installation check services.

2. Submittals for equipment furnished by others under each procurement contract will be furnished to Contractor upon completion of review by Engineer. Contractor shall review equipment submittals and coordinate with the requirements of the Work and the Contract Documents. Contractor accepts sole responsibility for determining and verifying all quantities, dimensions, and field construction criteria.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall be as follows:

1. Grout As specified in the Grouting section.

PART 3 - EXECUTION

3.1 INSPECTION

A. All gates and accessories shall be inspected for damage and cleanliness before being installed. Any material damaged or contaminated in handling on the job shall not be used unless it is repaired and recleaned to the original requirements by Contractor. Such material shall be segregated from the clean material and shall be inspected and approved by Owner or his representative before its use.

3.2 INSTALLATION.

A. General

1. Gates and appurtenances shall be installed with sufficient clearance for proper operation of any external mechanisms, and with sufficient clearance to dismantle the gate for maintenance. Installation shall be in accordance with the manufacturer's recommendations and the requirements specified herein.

2. All bolts shall be tightened and all items requiring lubrication, including pivot pins, shall be lubricated. Anti-seize thread lubricant shall be liberally applied to the threaded portion of stainless steel anchor bolts during the installation and tightening of nuts. Excess lubricant shall be thoroughly removed following final tightening.

3. The threaded portion of each plastic stem cover shall be wrapped in at least two layers of teflon thread tape, and the threaded portion of steel pipe stem covers shall be coated with teflon thread sealer immediately prior to installation of the cover on the actuator.

4. Each gate shall be adjusted so that it does not bind or leak in excess of specified requirements. After installation, each gate shall be operated through at least two complete open-close cycles, re-adjusted and re-operated as necessary, and left in a condition acceptable to Engineer.

B. Installation Checks

1. When specified in the gate sections, the gate manufacturer will provide installation checks. For installation checks, the manufacturer’s field representative will inspect the gate installation immediately following installation by Contractor. The manufacturer's representatives will revisit the site as often as necessary to ensure installation satisfactory to Owner.

2. Contractor shall perform no Work related to the installation or operation of materials or equipment furnished by others without direct observation and guidance of the field representative, unless Engineer and manufacturer furnishing such materials concur otherwise.

C. Fabricated Stainless Steel Slide Gates

1. Each fabricated stainless steel slide gate shall be carefully installed and adjusted for proper operation. Care shall be taken to avoid warping the gate frames and to maintain tolerances between seating faces.

2. Wall thimbles, if required, shall be accurately positioned and supported to prevent shifting during placement of surrounding concrete. Square or rectangular thimbles shall be carefully braced both horizontally and vertically to prevent distortion.

3. Gates mounted directly on the vertical face of concrete walls shall be adjusted and grouted in place with non-shrinking grout in accordance with the manufacturer's recommendations.

4. Gates shall be installed so that frame members and anchor bolts do not rest upon or contact steel reinforcing bars. Anchor bolts shall be set using a template.

5. Grout fill shall be placed in the pit in front of each flush bottom closure gate after the gate has been adjusted.

6. Each actuator shall be accurately set and plumbed and shall be in proper alignment with the gate and stem before the actuator is grouted in place. Operating stems shall be installed in proper alignment and shall not bind in the lift nut or stem guides.

D. Open-Channel Metal Slide Gates and Weir Gates

1. Each open-channel slide gate or weir gate shall be carefully installed and adjusted for proper operation. Care shall be taken to avoid deformation of the gate frames and to maintain tolerances between seating faces.

2. Each embedded frame shall be carefully braced in the forms before concrete is placed, or a space shall be boxed out and the frame shall be grouted in place later. Care shall be exercised to ensure that frame members and anchor bolts do not rest upon or contact steel reinforcing bars.

3. Anchor bolts shall be carefully set using a template.

3.3 GATE ACTUATORS

A. Gate actuators and accessories shall be installed in accordance with the equipment manufacturer's recommendations.

3.4 FIELD QUALITY CONTROL

A. Field Testing

1. After installation, all gates shall be pressure tested for leakage at the hydrostatic heads specified. Leakage exceeding the specified limits which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.

B. Metal Slide Gates

1. For the maximum seating and unseating heads, the leakage shall not exceed 0.1 gpm per foot of seating perimeter.

3.5 ADJUSTING

A. After installation, the opening and closing time shall be adjusted as needed for each pneumatic, hydraulic, or electric actuated gate.

End of Section

SECTION 40 05 57 - VALVE AND GATE ACTUATORS

PART 1 - GENERAL

1.1 SCOPE

A. This section covers furnishing manual and powered valve and gate actuators and accessories as specified herein.

1.2 GENERAL

A. Equipment provided under this section shall be fabricated and assembled in full conformity with Drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

B. Actuators shall be furnished with all necessary parts and accessories indicated on the Drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of actuators.

C. General Equipment Stipulations

1. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

D. Governing Standards

1. Except as modified or supplemented herein, actuators for butterfly valves shall conform to the applicable requirements of ANSI/AWWA C504.

2. Except as modified or supplemented herein, actuators for stainless steel slide gates shall conform to the applicable requirements of ANSI/AWWA C561.

E. Marking

1. Each actuator shall be marked with the manufacturer's name, model number, and the country of origin. An identifying serial number shall be stamped on a corrosion-resistant plate attached to the actuator.

F. Temporary Number Plates

1. Each actuator shall be factory tagged or marked to identify the actuator and the applicable valve or gate by number or service as indicated in the valve or gate schedule.

1.3 SUBMITTALS

A. Drawings and Data General

1. Complete drawings, details, and specifications covering the actuators and their appurtenances shall be submitted in accordance with the Submittal Procedures section. Submittal drawings shall clearly indicate the country of origin of each actuator and its components.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN REQUIREMENTS

A. General

1. Actuators and appurtenances shall be designed for the conditions and requirements as indicated in the respective valve and gate sections.

2. Liberal factors of safety shall be used throughout the design, especially in the design of parts subject to intermittent or alternating stresses. In general, working stresses shall not exceed one-third of the yield point or one-fifth of the ultimate strength of each material.

B. Valve Actuators

1. Each actuator shall be designed to open or close the valve under all operating conditions. Actuators shall be designed for the maximum pressure differential across the valve and maximum velocities through the valve where indicated in the respective valve schedules.

2. Valve actuators shall be provided and adjusted by the valve manufacturer. Actuator mounting arrangements and positions shall facilitate operation and maintenance and shall be determined by the valve manufacturer unless indicated otherwise on the Drawings or directed by Engineer.

3. When valves are to be buried, submerged, or installed in vaults; the actuators and accessories shall be sealed to prevent the entrance of water. The design water depth shall be as indicated in the respective valve schedules but not less than 20 feet .

C. Gate Actuators

1. Actuators shall be sized to produce the torque or thrust required to operate the gate when subject to the seating and unseating operating heads as indicated in the respective gate schedules.

2. Both the design head and the operating head shall be measured from the surface of the liquid to the center line of the gate.

2.2 MATERIALS

A. Except as modified or supplemented herein, materials used in the manufacture of actuators shall conform to the requirements of the applicable governing standard(s).

2.3 VALVE MANUAL ACTUATORS

A. General

1. Manual actuators of the types listed in the valve specifications or schedules shall be provided by the valve manufacturer.

2. Unless otherwise indicated or specified, each geared manual actuator shall be equipped with an operating handwheel.

3. The direction of rotation of the wheel, wrench nut, or lever to open the valve shall be to the left (counterclockwise). Each valve body or actuator shall have cast thereon the word "Open" and an arrow indicating the direction to open.

4. The housing of traveling-nut type actuators shall be fitted with a removable cover which shall permit inspection and maintenance of the operating mechanism without removing the actuator from the valve. Travel limiting devices shall be provided inside the actuator for the open and closed positions. Travel limiting stop nuts or collars installed on the reach rod of traveling-nut type operating mechanisms shall be field adjustable and shall be locked in position by means of a removable roll pin, cotter pin, or other positive locking device. The use of stop nuts or adjustable shaft collars which rely on clamping force or setscrews to prevent rotation of the nut or collar on the reach rod will not be acceptable.

5. Each actuator shall be designed so that shaft seal leakage cannot enter the actuator housing.

6. Valves for throttling service shall be equipped with an infinitely variable locking device or a totally enclosed gear actuator.

7. Actuators shall produce the required torque with a maximum pull of 80 lbs on the lever, handwheel, or chain. Actuator components shall withstand, without damage, a pull of 200 lbs on the handwheel or chainwheel or an input of 300 foot-lbs on the operating nut.

B. Handwheels

1. Handwheel diameters shall be at least 8 inches but not more than 24 inches for 30 inch and smaller valves and not more than 30 inches for 36 inch and larger valves.

C. Wrench Nuts

1. Unless otherwise specified in the valve schedules or on the Drawings, wrench nuts shall be provided on all buried valves and on all valves that are to be operated through floor boxes. Unless otherwise directed by Owner, all wrench nuts shall comply with

Section 4.4.13 of ANSI/AWWA C500. At least two operating keys shall be furnished for operation of the wrench nut operated valves.

2.4 GATE MANUAL ACTUATORS

A. General

1. Manual actuators of the types listed in the gate schedules shall be provided by the gate manufacturer. Unless otherwise specified, actuators shall conform to ANSI/AWWA C560.

2. All bearings and gears shall be totally enclosed in a weathertight housing having a sufficient number of fittings to permit periodic lubrication of all internal moving components without partial or total disassembly of the mechanism. The pinion shaft of crank-operated mechanisms shall be supported by roller bearings or needle bearings.

3. The direction of rotation of the wheel, crank, or wrench nut to open the gate shall be to the left (counterclockwise).

B. Remote Actuators

1. Remote actuators shall be operated by a frame-mounted handwheel and chain drive. An extension shaft suitable for connection to the pinion shaft of the benchstand shall be provided complete with a roller chain, shaft couplings, support bearings, and a roller chain sprocket keyed or bolted to the end of the shaft. A handwheel with bearing housing and sprocket shall be bolted to the side frame approximately 48 inches above the operating floor. Removable aluminum or stainless steel weathertight covers shall be provided to protect the extension shaft, drive chain, and sprockets. Handwheel and sprocket diameters shall be selected to operate the gate under the maximum specified seating pressure with an effort of not more than 40 lbs applied to the rim of the handwheel. Handwheels and sprockets shall be able to withstand a 100 lb effort without damage.

C. Floorstands

1. Floorstands shall be designed to transfer operating thrusts to the supporting structure. Each floorstand shall be designed to position the crank or the handwheel approximately 36 inches above the frame yoke, supporting surface, or adjacent operating floor or platform.

D. Wall Brackets

1. Wall brackets shall be provided to support manual actuators in the locations indicated on the Drawings or indicated in the respective gate schedules. The horizontal face of the bracket shall be predrilled to accept the actuator and the stem without modification. The top of the bracket shall extend sufficiently to bear on and transfer thrust loads to the top of the supporting structure.

E. Stem Covers

1. Rising stem manual actuators shall be provided with a stem cover as indicated in the gate schedules. Stem covers shall conform to Section 4.4 of ANSI/AWWA C560.

2. Plastic Covers

   a. Covers shall be constructed of transparent plastic pipe and shall be furnished with an end cap, condensation vents, and a clear mylar position-indicating marking tape. The marking tape shall be adhesive backed and shall be permanently marked and calibrated in feet and inches . The tape shall be applied to the stem cover after the gate has been installed and shall be so positioned that the height of the slide will be indicated by reference to the top of the stem.

2.5 ACTUATOR ACCESSORIES

A. Extension Stems

1. Extension stems and stem guides shall be furnished when indicated in the respective valve schedules, indicated on the Drawings, or otherwise required for proper valve operation. Extension stems shall be of solid steel and shall be not smaller in diameter than the stem of the actuator shaft. Extension stems shall be connected to the actuator with a single Lovejoy "Type D" universal joint with grease-filled protective boot. All stem connections shall be pinned.

2. At least two stem guides shall be furnished with each extension stem, except for buried valves. Stem guides shall be of cast iron, bronze bushed, and adjustable in two directions. Stem guide spacing shall not exceed 100 times the stem diameter or 10 feet , whichever is smaller. The top stem guide shall be designed to carry the weight of the extension stem. The extension stem shall be provided with a collar pinned to the stem and bearing against the stem thrust guide.

3. Extension stems for chemical resistant butterfly valves located in drainage sumps shall be the two-piece type with stainless steel stem, PVC housing, wall support, and collar. Unless otherwise indicated on the Drawings, the length of the stem extension shall be as necessary to position the valve operator 12 inches above the maximum liquid level in the immediate area.

4. Extension stems for buried valve actuators shall extend to within 6 inches of the ground surface, shall be centered in the valve box using spacers, and shall be equipped with a wrench nut.

5. Extension stems for buried valve actuators shall be provided with position indicators as specified in the valve schedules.

B. Valve Boxes

1. Each valve buried to a depth of 4 feet or less shall be provided with a slide type valve box. Valve boxes shall be cast iron, extension sleeve type, suitable for the depth of cover indicated on the Drawings. Only one extension will be allowed with each slide type

valve box. Valve boxes shall be at least 5 inches in inside diameter, shall be at least 3/16 inch thick, and shall be provided with suitable cast iron bases and covers.

2. Each valve buried deeper than 4 feet shall be provided with a valve box consisting of a cast iron cover and a 6 inch Cast Iron Pipe section. The cover shall be Clay & Bailey "No. 2193". The pipe shaft shall extend from the valve to 5 inches inside the valve box cover.

3. All parts of valve boxes, bases, and covers shall be shop coated with manufacturer's standard coating.

4. Valve boxes which are to be provided with position indicators shall have top sections and covers designed for proper installation of the position indicator and accessories.

2.6 SHOP PAINTING

A. All ferrous metal surfaces, except bearing and finished surfaces and stainless steel components of valve actuators and accessories, shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field painting.

B. The following surfaces shall be painted:

Polished or Machined Surfaces	Rust-preventive compound.
Other Surfaces	Epoxy.
Actuators and Accessories	Universal primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Actuators will be installed on the valves in accordance with the Valve Installation section and on gates in accordance with the Gate Installation section.

End of Section

SECTION 40 05 59.13 - METAL SLIDE GATES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers furnishing slide gates and actuators as specified herein and as indicated in the Metal Slide Gate Schedule. Slide gates shall be furnished complete with frames, slides, seals, actuators, operating stems, and appurtenances as specified herein, as indicated in the schedule and as specified in the Valve and Gate Actuator section.

1.2 GENERAL

A. Equipment furnished under this section shall be fabricated and assembled in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

B. Gates and actuators shall be furnished with all necessary parts and accessories indicated on the Drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest products of a manufacturer engaged in the production of slide gates.

C. General Equipment Stipulations

1. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

D. Governing Standard

1. Except as modified or supplemented herein, all slide gates shall conform to the applicable requirements of ANSI/AWWA C561.

E. Identification

1. Slide gates specified herein shall be tagged as specified in the Equipment and Valve Identification section.

1.3 SUBMITTALS

A. Drawings and Data – General

1. Complete drawings, construction details, anchorages, and specifications covering the slide gates and appurtenances shall be submitted in accordance with the Submittals Procedures section. Each drawing shall be identified with the slide gate designation.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

A. Slide gates will be used for intra-basin submerged opening isolation within the 16-million gallon Clearwell. Slide gates TW-44-GSD-0401 and TW-44-GSD-0501 will be used to isolate flow through submerged openings between the common Influent Box and into Basin No. 4 and No.5, respectively. Slide gates TW-44-GSD-0402 and TW-44-GSD-0502 will be used to isolate flow through submerged openings between Basin No. 4 and No.5, respectively, into the common Effluent Channel. All gate materials shall be NSF certified.

B. Clearwell water will contain an estimated 3-5 mg/l chlorine residual concentration as free chlorine. Slide gates will remain in the open position for the majority of the time.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

A. Slide gates shall be designed for the conditions and requirements indicated in the Slide Gate Schedule.

B. Design

1. Liberal factors of safety shall be used throughout the design, especially in the design of parts subject to intermittent or alternating stresses. In general, working stresses shall not exceed one-third of the yield point or one-fourth of the ultimate strength of each material.

2. Gates shall be designed for the seating and unseating heads indicated in the Slide Gate Schedule.

3. Gates shall be designed to fit into the structures indicated on the Drawings.

2.3 ACCEPTABLE MANUFACTURERS

A. For slide gates acceptable manufacturers are Hydro Gate, Rodney Hunt, Coldwell-Wilcox, Golden Harvest, Waterman, Fontaine, and Whipps.

2.4 MATERIALS

Frames, Guides, Slides, Reinforcing Members, and Yoke Beams	Stainless steel, ASTM A276, 316L and ASTM A240, 316L.
Flush Bottom Closure Seal	Compressible neoprene.
Seals	UHMW polyethylene.
Seal Retainer Bar	Stainless Steel, ASTM A276, 316L.
Slide Seats and Bearing Bars	UHMW polyethylene.

Operating Stems	Stainless steel, AISI Type 316.
Assembly Fasteners	Stainless steel, AISI Type 316.
Anchor Bolts	As indicated in the Anchorage in Concrete and Masonry Section.

2.5 CONSTRUCTION

A. Frames

1. Each frame shall be an integral unit of extruded or welded structural shapes at least 1/4 inch. Frames shall be designed for embedment in concrete or installation on the face of concrete walls as indicated in the Slide Gate Schedule. Embedded frames shall be recessed so that the waterway is not obstructed.

2. Guides shall be provided on each side of each frame. Guides shall be sufficiently strong to require no further reinforcing where they extend above the operating floor, and shall support the entire height of the slide in all positions.

3. Full-length plastic slide seats or bearing bars shall be provided on the downstream side of the slide on gates subject to seating pressure from one direction. Gates subject to seating pressure from either direction shall be provided with plastic seats or bearing bars on both faces of the slide. Seats and bars shall be mechanically retained in the frame.

B. Slides

1. Slides shall be at least 1/4 inch thick and shall be provided with welded stiffeners to limit deflection to 1/360 under the maximum seating or unseating head indicated in the Slide Gate Schedule. Slides shall be adequately reinforced to withstand, without permanent distortion, the maximum thrust which can be transmitted by the operating stem. Each slide shall have a reinforced pocket or an internally threaded nut welded to the slide for connection of the stem. The pocket or nut shall be designed to withstand the maximum thrust which can be transmitted by the operating stem.

C. Closures

1. The bottom of each slide gate frame shall be recessed so that the waterway is not obstructed. A compressible seal shall be securely attached to the bottom of the slide or to the frame invert. The seal shall be of sufficient length to seal the bottom corners of each slide.

2. Where indicated in the Slide Gate Schedule, gates shall be provided with an UHMW polyethylene seat/seal.

3. An UHMW polyethylene seat/seal extruded shape shall fit into a dovetail grove in the guide section, and shall seal on both upstream and downstream sides of the slide. The seat/seal system shall act as both a bearing surface and as a seal, and the seal system shall be self-adjusting. For flush bottom application, the invert shall have a replaceable resilient neoprene seal mounted on the frame invert.

D. Operating Stems

1. Operating stems shall conform to the requirements of Section 4.3 of the governing standard. Contact surfaces of threads shall be rolled or machined to a 32 microinch finish, or smoother. Each stem shall be securely attached to the slide.

E. Stainless Steel

1. All stainless steel shall be pickled in accordance with ASTM A380 at the mill before being shipped. Pickling shall produce a modest etch and shall remove all embedded iron and heat tint. After fabrication, pickled surfaces shall be subjected to a 24 hour water test or a ferroxyl test to detect the presence of residual embedded iron. All pickled surfaces damaged during fabrication including welded areas shall be repickled or passivated in accordance with ASTM A380 as needed to remove all traces of iron contamination. All stainless steel surfaces shall be adequately protected during fabrication, shipping, handling, and installation to prevent contamination from iron or carbon steel objects or surfaces.

2.6 ACTUATORS

A. Actuators and their accessories shall be the type as indicated in the Metal Slide Gate Schedule and as specified in the Valve and Gate Actuator section.

B. Stem covers for manual actuators shall be UV resistant clear plastic, polycarbonate, or steel pipe as indicated in the Slide Gate Schedule and as specified in the Valve and Gate Actuator section.

2.7 SHOP TESTING

A. Gates shall be completely assembled in the shop to ensure that all parts fit together properly.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Slide gates and appurtenances shall be installed in accordance with the Gate Installation section.

B. Installation Check

1. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation in accordance with Startup Requirements section, and shall revisit the jobsite as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.

2. The manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.

3. All costs for these services shall be included in the contract price.

End of Section

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Slide Gates Schedule
Manual Actuators

1.010	1.020	1.040	1.050	1.060	1.070	1.080	1.090	1.010	1.110	1.130	1.140	1.150	2.010	2.030	2.031
Tag Number	**Location (1)**	**Nominal Size WxH**	**Maximum Head of Water(seating) Above Invert Gate**	**Maximum Head of Water(unseating) Above Invert Gate**	**Invert Elevation**	**Operating Floor Elevation**	**Top of Yoke Elevation**	**Type of Mounting (3)**	**Type of Closure(4)**	**Dual Stems Required**	**Special Notations(6)**	**Suitable for use with an electric portable actuator**	**Type of Manual Actuator(7)**	**Plastic Stem Cover**	**Steel Stem Cover**
1	2	4	5	6	7	8	9	10	11	12	13	14	16	18	19
		(in)	(ft)*	(ft)*	(ft)	(ft)	(ft)								
45-TW-GSD-0001	CLW	72 x 72	18.7	18.7	1346.0	1370.5	N/A	FNSC	FBUS	No	C	Yes	HGBS	Yes	No
45-TW-GSD-0401	CLW	96 x 96	18.7	18.7	1346.0	1370.5	N/A	FNSC	FBUS	No	C	Yes	HGBS	Yes	No
45-TW-GSD-0501	CLW	96 x 96	18.7	18.7	1346.0	1370.5	N/A	FNSC	FBUS	No	C	Yes	HGBS	Yes	No
45-TW-GSD-0402	CLW	96 x 96	18.7	18.7	1346.0	1370.5	N/A	FNSC	FBUS	No	C	Yes	HGBS	Yes	No
45-TW-GSD-0502	CLW	96 x 96	18.7	18.7	1346.0	1370.5	N/A	FNSC	FBUS	No	C	Yes	HGBS	Yes	No
45-TW-GSD-0003	CLW	60 x 60	18.7	18.7	1346.0	1369.5	N/A	FNSC	FBUS	No	C	Yes	HGBS	Yes	No

* Units are in feet of Head

Schedule 40 05 59.13-S01
Slide Gates Schedule
Manual Actuators

Notes:

(1) Abbreviations for locations are as indicated:

CLW	Clearwell

(2) Abbreviations for services are as indicated:

O-C	Open - Close
M	Modulating

(3) Abbreviations for types of mountings are as indicated:

ESC	Embedded, self-contained
ENSC	Embedded, non-self-contained
FSC	Face (wall) mounted, self-contained
FNSC	Face (wall) mounted, non-self-contained

(4) Abbreviations for types of closures are as indicated:

FB	Flush bottom
FBUS	Flush bottom with Ultra High Molecular Weight (UHMW) seals
WS	Weir service, downward opening, with Ultra High Molecular Weight (UHMW) seals

(5) Abbreviations for types of electric actuators are as indicated:

IE	Intelligent Electric
IEFS	Intelligent Electric with concentric floor stand
SE	Standard Electric
SEFS	Standard Electric with concentric floor stand
D-	Prefix where dual actuators are required
-WB	Suffix where wall brackets are required

(6) Special notations and requirements are as indicated:

A Design considerations restrict the maximum travel of this gate to less than gate height; at maximum design flow, the lower portion of the gate slide may extend below the water surface when the gate is open.
B Interconnected dual actuators and dual stems are required.
C This gate may be subject to the specified seating pressure applied from either direction.
D The gate shall be provided with a rectangular port in the slide for flow regulation and shall be designed so that the slide can be raised or lowered from the indicated position.

(7) Abbreviations for types of manual actuators are as indicated:

CGBS Crank-operated, geared, benchstand
CGFS Crank-operated, geared, concentric floorstand
CGOFS Crank-operated, geared, offset floorstand
HBS Handwheel-operated, non-geared, benchstand
HFS Handwheel-operated, non-geared, concentric floorstand
HGBS Handwheel-operated, geared, benchstand
HOFS Handwheel-operated, non-geared, offset floorstand
RA Remote actuator, benchstand with side handwheel and chain drive

(8) Abbreviations for limit switches on manual operated gates.

EOT End of travel (open - close)
PSS Pump start - stop (two intermediate positions)
ELSCH See electrical schematics

(9) Abbreviations for electronic or electric actuator housing.

WP Weatherproof
SUB Submersible [xx = depth of submergence](SUBxx)
EXP Explosion proof

(10) Abbreviations for control devices are as indicated.

Table 1: Control Devices

Abbreviations	Open-Close Push Button	Open-Stop-Close Push Button	Local-Off-Remote	Red and Green Indicator Lights
A	Required		Required	Required
B	Required		Required	
C		Required	Required	Required
D		Required	Required	
E		Required		
F	Required			
G	Required			Required
H		Required		Required

END OF SCHEDULE

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SECTION 40 05 61.23 - RESILIENT-SEATED GATE VALVES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers furnishing resilient-seated AWWA gate valves for clear water service. Resilient-seated gate valves shall be furnished complete with actuators and accessories as specified herein and as specified in the Valve and Gate Actuator section.

1.2 GENERAL

A. Equipment provided under this section shall be fabricated and assembled in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer unless exceptions are noted by Engineer.

B. Valves shall be furnished with all necessary parts and accessories indicated on the Drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of valves.

C. General Equipment Stipulations

1. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

D. Governing Standard

1. Except as modified or supplemented herein, all resilient-seated gate valves shall conform to the applicable requirements of ANSI/AWWA C509.

E. Temporary Number Plates

1. Each resilient-seat gate valve shall be tagged or marked in the factory with the identifying number listed in the Resilient-Seated Gate Valve Schedule.

F. Identification

1. Resilient seated gate valves shall be tagged in accordance with the Equipment and Valve Identification section.

1.3 SUBMITTALS

A. Drawings and Data

1. Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the Submittals Procedures section.

B. Test Plans and Certified Results

1. All valves shall be tested in accordance with Section 5 of the governing standard. Certified copies of the results of all tests, together with an affidavit of compliance as indicated in Section 6.3 of the governing standard, shall be submitted to Engineer before the valves are shipped.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Except as modified or supplemented herein, materials used in the manufacture of resilient-seated gate valves shall conform to the requirements of the governing standard.

B. Bronze Components

1. All bronze valve components in contact with liquid shall contain less than 16 percent zinc. All aluminum bronze components in contact with liquid shall be inhibited against dealuminization in accordance with Section 4.2.3.5.4 of ANSI/AWWA C509.

C. Gaskets

1. Gaskets shall be free of asbestos and corrosive ingredients.

D. Shop Coatings.

Epoxy

For Raw or Treated Water Service in potable water facilities (NSF certified systems)	PPG Amercoat "Amerlock 400 High-Solids Epoxy ", Carboline "Carboguard 891", Sherwin-Williams “Macropoxy 646NSF” or Tnemec "Series N140 Pota-Pox Plus".
Rust-Preventive Compound	As recommended by manufacturer.
Universal Primer	As recommended by manufacturer

2.2 VALVE CONSTRUCTION

A. Ends

1. Valve ends shall be compatible with connecting piping. Except as modified or supplemented herein, the ends shall conform to the applicable requirements of the governing standard.

2. Flanges shall be finished to true plane surfaces within a tolerance limit of 5 mils. The finished face shall be normal to the longitudinal valve axis within a maximum angular variation tolerance of 0.002 inch per inch of flange diameter.

B. Stem Seals

1. Valve stem shall be the non-rising type. Stuffing box stem seals shall be provided for all gate valves with rising stems (outside screw-and-yoke type). O-ring stem seals shall be provided for all buried gate valves, and for all gate valves with non-rising stems.

C. Rotation

1. The direction of rotation of the handwheel or the wrench nut to open the valve shall be to the left (counterclockwise).

D. Shop Coatings

1. All interior and exterior ferrous metal surfaces of valves and accessories shall be shop coated for corrosion protection. Except as specified below, the valve manufacturer's standard fusion-bonded coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field coating.

2. Surfaces shall be coated as follows:

Unfinished Surfaces

Interior Surfaces	NSF 61 Certified Epoxy.
Exterior Surfaces of Valves to be Buried or Installed in Manholes or Valve Vaults	Epoxy
Exterior Surfaces of Valves to be Submerged	Epoxy.
Exterior Surfaces of All Other Valves	Universal primer.

Polished or Machined Surfaces

Flange Faces	Rust-preventive compound.
Other Surfaces	Epoxy.

3. Alternatively, the manufacturer’s standard coating may be used and the interior surfaces of each valve shall be subjected to a nondestructive holiday test in accordance with ASTM G62, Method A, and shall be electrically void-free.

4. Interior coatings shall comply with ANSI/AWWA C550 and shall be free of holidays. The total dry film thickness of shop-applied coatings shall be not less than:

Type of Coating	Minimum Dry Film Thickness
Coal Tar Epoxy	15 mils.
Epoxy	10 mils.
Universal Primer	3 mils.

2.3 VALVE ACTUATORS

A. Requirements for valve actuators shall be as specified in the Valve and Gate Actuator section.

2.4 ACCESSORIES

A. When the Drawings indicate the need for extension stems, stem guides, position indicators, floor boxes, valve boxes, or operating stands, refer to the Valve and Gate Actuator section.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Valves shall be installed in accordance with Valve Installation section.

B. Installation Check

1. An installation check by an authorize representative of the manufacturer is not required.

End of Section

SECTION 40 05 63.53 - MISCELLANEOUS BALL VALVES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the furnishing of manually operated or remote activated two position (open-close) ball valves as specified herein.

B. Miscellaneous ball valves shall be provided where AWWA type ball valves are not required.

C. Piping, pipe supports, insulation, and accessories that are not an integral part of the valves or are not specified herein are covered in other sections.

1.2 GENERAL

A. General Equipment Stipulations

1. The General Equipment Stipulations shall apply to all equipment and materials furnished under this section. If the requirements in this section are different from those in the General Equipment Stipulations, the requirements in the section shall take precedence.

B. Identification

1. Valves specified herein shall be tagged in accordance with the Equipment and Valve Identification section.

1.3 SUBMITTALS

A. General Drawings and Data.

1. Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the Submittal Procedures section. Included in the submittal shall be drawings by the valve manufacturer to indicate the position of the valve actuator and valve shaft.

PART 2 - PRODUCTS

2.1 CONSTRUCTION

A. Ball valves shown on the drawing, but not specified herein, shall be selected to match piping material they are installed in.

B. Valves Type VB-11

VB-11 Service as specified in Miscellaneous Plastic Pipe, Tubing, and Accessories section 4 inch and smaller Flanged	Rating	150 psig nonshock cold WOG
	Type	In-line, true union, full port (Schedule 80)
	Body/Bonnet	PVC or CPVC to match piping system
	Trim	
	Seat	Teflon
	Ball	PVC or CPVC to match piping system
	Stem	PVC or CPVC to match piping system
	Thrust Washer	Teflon
	Stem Seal	Viton O-ring
	Body Seals	Viton O-rings
	End Connection	Flanged, ASME B16.5, Class 150, raised face
	Temp. Limitations	0 to 140°F
	Valve Operator	Lever
	Manufacturers	Hayward Plastic Products "True Union Ball Valve TBH Series"; Nibco "Chemtrol TU Series Tru-Bloc Ball Valve"; Spears Manufacturing Co. "True Union 2000 Standard Series 3600 Ball Valve"

C. Length Tolerance

1. Unless otherwise specified, the actual length of valves shall be within plus or minus 1/16 inch of the specified or theoretical length.

D. Shop Coatings

1. All ferrous metal surfaces of valves and accessories, both interior and exterior, shall be shop coated for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating.

Coating Materials

Coal Tar Epoxy	High-build coal tar epoxy; Ameron "Amercoat 78HB Coal Tar Epoxy", Carboline "Bitumastic 300 M", Tnemec "46H-413 Hi-Build Tneme-Tar", or Sherwin-Williams "Hi-Mil Sher-Tar Epoxy".
Epoxy Enamel (for liquid service)	Ameron "Amerlock 400 High-Solids Epoxy Coating", Carboline "Carboguard 891", or Tnemec "Series N140 Pota-Pox Plus".
Rust-Preventive Compound	As recommended by the manufacturer.

Surfaces To Be Coated

Unfinished Surfaces	
Interior Surfaces	
Liquid Service	Epoxy enamel.
Exterior Surfaces of Valves To Be Buried, Submerged, or Installed in Manholes or Valve Vaults	Coal tar epoxy.
Exterior Surfaces of all other valves	Universal primer.

2.2 VALVE ACTUATORS

A. Ball valve, except those which are equipped with power actuators or are designed for automatic operation, shall be provided with manual actuators. Unless otherwise specified or indicated on the drawings, each manual actuator shall be equipped with a lever operator. Ball valves with center lines more than 7'-6" above the floor shall be provided with chain levers.

B. Valves indicated to be electric motor operated on the drawings shall have reversible electric motor operators designed for 120 volt ac, single phase operation. Actuators shall include integral thermal overload protection and a declutchable manual override. Actuators shall be equipped with motor operation limit switches and two additional single-pole, double-throw limit switches for auxiliary open and closed indication. An internal heater and thermostat shall be provided in each actuator housing to prevent condensation. Actuators in Class I, Division 1 and Division 2, Group D hazardous areas indicated on the drawings shall have NEMA Type 7 housings. Actuators in other areas shall have NEMA Type 4X housings.

2.3 ACCESSORIES

A. If the drawings indicate the need for extension stems, stem guides; position indicator; floor boxes; valve boxes; or operating stands, refer to the Valve and Gate Actuator section.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Materials furnished under this section shall be installed in accordance with the Valve Installation section.

End of Section

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SECTION 40 05 64.11 - AWWA BUTTERFLY VALVES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers furnishing of AWWA butterfly valves for cold water service as indicated in the AWWA Butterfly Valve Schedule.

B. AWWA butterfly valves shall be furnished complete with actuators and accessories as specified herein, as indicated in the schedule, and as specified in the Valve and Gate Actuators section.

1.2 GENERAL

A. Equipment provided under this section shall be fabricated and assembled in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

B. Valves shall be furnished with all necessary parts and accessories indicated on the Drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of valves.

C. General Equipment Stipulations

1. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

D. Governing Standard

1. Except as modified or supplemented herein, all butterfly valves and manual actuators shall conform to the applicable requirements of ANSI/AWWA C504 or ANSI/AWWA C516.

E. Marking

1. Supplementing the requirements of Section 6.1 of the governing standard, the country of origin of all castings and an identifying serial number shall be stamped on a corrosion-resistant plate attached to the valve body.

F. Temporary Number Plates

1. Each butterfly valve shall be tagged or marked in the factory with the identifying number indicated on the Drawings.

G. Identification

1. AWWA butterfly valves shall be tagged in accordance with the Equipment and Valve Identification section.

1.3 SUBMITTALS

A. Drawings and Data – General

1. Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the Submittals Procedures section. Included in the submittal shall be drawings by the valve manufacturer to indicate the position of the valve actuator and valve shaft.

B. Drawings and Data – Electrical and Wiring Diagrams

1. Drawings shall include separate wiring diagrams for each electrically operated or controlled valve and the electrical control equipment. Each drawing shall be identified with the valve number or name as specified in this section.

C. Certified Test Results

1. Certified copies of test results for tests described in Section 5 of the governing standard, shall be submitted to Engineer before the valves are shipped. An affidavit of compliance with the governing standard for valves 72 inches and smaller and for valves 78 inches and larger shall be provided as indicated in Section 6.3 of ANSI/AWWA C504.

PART 2 - PRODUCTS

2.1 ACCEPTABLE PRODUCTS

A. Butterfly valves shall be by the manufacturers listed below.

1. DeZurik

2. Pratt (Mueller)

2.2 MATERIALS

A. Except as modified or supplemented herein, materials used in the manufacture of butterfly valves shall conform to the requirements of the governing standard.

B. Acceptable shop coatings are listed in the following table.

Coal Tar Epoxy	High-build coal tar epoxy; PPG Amercoat "Amercoat 78HB Coal Tar Epoxy", Carboline "Bitumastic 300 M", Tnemec "46H-413 Hi-Build Tneme-Tar", or Sherwin-Williams "Hi-Mil Sher-Tar Epoxy".

Epoxy	
For Raw or Treated Water Service in potable water facilities (NSF certified)	PPG Amercoat “Amerlock 400 High Solids Epoxy”, Carboline “Carboguard 891”, Sherwin-Williams "Macropoxy 646NSF" or Tnemec “Series N140 Pota-Pox Plus”.
Rust-Preventive Compound	As recommended by manufacturer.

2.3 VALVE CONSTRUCTION

A. Valve Bodies

1. Valves shall be short-body type unless otherwise specified in the AWWA Butterfly Valve Schedule. The use of a stop or lug cast integrally with or mechanically secured to the body for the purpose of limiting disc travel by means of direct contact or interference with the valve disc (in either the open or closed position) will not be acceptable.

B. Flanges

1. Flanges shall be finished to true plane surfaces within a tolerance limit of 0.005 inch. The finished face shall be normal to the longitudinal valve axis within a maximum angular variation tolerance of 0.002 inch per foot (0.017 percent) of flange diameter.

C. Mechanical Joint Ends

1. Mechanical joint ends shall be either mechanical joint or push-on ends conforming to ANSI/AWWA C111/A21.11.

D. Valve Shafts

1. Valve shafts shall be fabricated of AISI Type 304 or 316 stainless steel. The use of shafts having a hexagonal cross section will not be acceptable. The connection between shaft and disc shall be in accordance with the governing standard.

2. The connection between the shaft and the disc shall be mechanically secured by means of solid, smooth sided, stainless steel or monel taper pins or dowel pins. Each taper pin or dowel pin shall extend through or shall wedge against the side of the shaft and shall be mechanically secured in place. The use of set screws, knurled or fluted dowel pins, expansion pins, roll pins, tension pins, spring pins, or other devices instead of the pins specified herein will not be acceptable.

E. Valve Seats

1. Acceptable seating surfaces mating with rubber are AISI Type 304 or 316 stainless steel, monel, or plasma-applied nickel-chrome overlay for all valves; bronze for 20 inch and smaller valves; and alloy cast iron for 20 inch and smaller manually operated valves.

2. Seats shall be located on the valve body. Valve seat configurations which rely on the mating pipe flange to hold the seat in position in the valve body will not be acceptable.

F. Shaft Seals

1. Shaft seals shall be of the chevron type.

G. Thrust Bearings

1. Each valve shall be provided with one or more thrust bearings in accordance with the governing standard. Thrust bearings which are directly exposed to line liquid and which consist of a metal bearing surface in rubbing contact with an opposing metal bearing surface will not be acceptable.

2.4 VALVE ACTUATORS

A. Requirements for valve actuators shall be as specified herein, as indicated in the AWWA Butterfly Valve Schedule, and as specified in the Valve and Gate Actuators section.

B. All 8 inch and larger valves shall have geared actuators.

C. If valves with an AWWA class designation higher than specified are furnished, actuator torque capabilities shall be increased accordingly and shall be acceptable to Engineer.

D. Actuator Sizing

1. The valve manufacturer shall size the actuator in accordance with the governing standard, the operating conditions and requirements indicated in the AWWA Butterfly Valve Schedule, and the valve manufacturer's requirements.

2. Unless otherwise indicated or specified, actuator torque requirements shall be based on a maximum differential pressure across the valve equal to the maximum pressure associated with the valve class and a maximum velocity through the valve of 16 feet per second.

3. Valves with operating stands shall have actuator torques increased by 25 percent. Actuator torques determined by the above requirements shall be increased by any design factors required by paragraph 4.2.8 of ANSI/AWWA C504 for valves 72 inches and smaller, or paragraph 4.3.7 of ANSI/AWWA C516 for valves 78 inches and larger or as specified herein.

2.5 SHOP PAINTING

A. All interior and exterior ferrous metal surfaces, except finished surfaces, bearing surfaces, and stainless steel components, of valves and accessories shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field painting.

B. Surfaces shall be painted as follows:

Unfinished Surfaces

Interior Surfaces	NSF 61 Certified Epoxy.
Exterior Surfaces of Valves to be Buried or Installed in Manholes or Valve Vaults	Coal tar epoxy.
Exterior Surfaces of Valves to be Submerged	NSF 61 Certified Epoxy.
Exterior Surfaces of All Other Valves	Universal primer.
Polished or Machined Surfaces	
Flange Faces	Rust-preventive compound.
Other Surfaces	Epoxy.

1. Interior coatings shall comply with ANSI/AWWA C550 and shall be free of holidays. The total dry film thickness of shop-applied coatings shall be not less than:

Type of Coating	Minimum Dry Film Thickness
Coal Tar Epoxy	15 mils
Epoxy	10 mils
Universal Primer	3 mils

2.6 ACCESSORIES

A. Requirements for extension stems and stem guides, position indicators, floor boxes, operating stands, torque tubes, valve boxes, and extension bonnets shall be as indicated in the AWWA Butterfly Valve Schedule and as specified in the Valve and Gate Actuators section.

PART 3 - EXECUTION

A. INSTALLATION

1. Valves shall be installed in accordance with the Valve Installation section.

2. Installation Check

   a. An installation check by an authorize representative of the manufacturer is not required.
   b. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation in accordance with Commissioning section, and shall revisit the job site as often as necessary until any problems are corrected and the equipment installation and operation are satisfactory in the opinion of Engineer
   c. The manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is

free from any undue stress imposed by connecting piping and appurtenances; and has been operated under full load conditions and that it has operated satisfactorily.

d. All costs for these services shall be included in the contract price.

End of Section

Schedule 40 05 64.11
AWWA Butterfly Valves Schedule
Manual Actuators

1.010	1.020	1.031	1.040	1.060	1.070	1.080	1.090	2.010	8.010	8.020
Tag Number	Size	Application	Type of Installation(2)	AWWA Class(3)	Maximum Non-Shock Shutoff Pressure	Maximum Differential Pressure	Maximum Velocity	Type of Manual Actuator (4)	Extensions Stems	Position Indicator for Buried Valve Actuators
	(in)				(psi)	(psi)	(ft/s)			
45-TW-VBF-0001	72	Treated Water	B20	150B-F		26	8	WN	Yes	No
45-TW-VBF-0002	72	Treated Water	B20	150B-F		26	8	WN	Yes	No
45-TW-VBF-0003	54	Treated Water	SV20	150B-F		13	16	WN	No	No
45-TW-VBF-0004	4	Treated Water	SV20	150B-F		13	16	WN	No	No
45-FW-VBF-0001	42	Finished Water	B20	150B-F		130	16	WN	Yes	No
45-FW-VBF-0002	42	Finished Water	B20	150B-F		130	16	WN	Yes	No
45-FW-VBF-0003	42	Finished Water	B20	150B-F		130	16	WN	Yes	No
45-FW-VBF-0004	42	Finished Water	B20	150B-F		130	16	WN	Yes	No
45-FW-VBF-0005	36	Finished Water	B20	150B-F*		130	16	WN	Yes	No
45-FW-VBF-0006	3	Finished Water	SV20	150B-F		130	16	HW	No	No
45-FW-VBF-0007	18	Finished Water	B20	150B-MJ		130	16	WN	No	No
45-FW-VBF-0008	36	Finished Water	B21	150B-F*		130	16	WN	Yes	No

*Flanged valve assumes steel pipe material is selected for Fayetteville pipeline. If DIP is selected, valve will be MJ.

Schedule 40 05 64.11
AWWA Butterfly Valves Schedule
Manual Actuators

Notes:

(1) Actuators designated "O-C" are for "Open-Close" service. Actuators designated "M" are for "Modulating" service.

(2) Abbreviations for installation types are as follows:

B4	Buried, depth of 4 feet [1.2 m] or less
B20	Buried, depth greater than 4 feet [1.2 m] but 20 feet [6.1 m] or less
Bxx	Buried, depth greater than 20 feet [6.1 m], actual depth of xx feet
SV20	Submerged or vaulted, depth 20 feet [6.1 m] or less
SVxx	Submerged or vaulted, depth greater than 20 feet [6.1 m], actual depth of xx feet
IP	In plant

(3) Suffix letters define valve ends as follows:

F	Flanged
W	Wafer
MJ	Mechanical joint
S	Single Flange

(4) Abbreviations for actuator types are as follows:

WN	Wrench Nut
LVR	Lever
CW	ChainWheel
HW	HandWheel

(5) If a value is indicated, the leakage test shall be performed using this pressure value rather than the pressure indicated by the AWWA class.

(6) Abbreviations for limit switches on manual and cylinder operated valves.

EOT	End of travel (open - close)
PSS	Pump start - stop (two intermediate positions)
ELSCH	See electrical schematics

(7) Abbreviations for electronic or electric actuator housing.

WP	Weatherproof
SUB	Submersible [xx = depth of submergence] (SUBxx)
EXP	Explosion proof

(8) Cylinder actuators shall have torque safety factors applied in accordance with AWWA C504.

Schedule 40 05 64.11
AWWA Butterfly Valves Schedule
Manual Actuators

(9) Abbreviations for control devices are as indicated.

Table 1: Control Devices				
Abbreviations	Open-Close Push Button	Open-Stop- Close Push Button	Local-Off-Remote	Red and Green Indicator Lights
A	Required		Required	Required
B	Required		Required	
C		Required	Required	Required
D		Required	Required	
E		Required		
F	Required			
G	Required			Required
H		Required		Required

(10) Abbreviations for electric actuator types are as follows:

SE Standard Electric
IE Intelligent Electric
NE Networked Electric

END OF SCHEDULE

SECTION 40 05 68 - CHECK VALVES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the furnishing of check valves as specified herein**.**

B. Piping, pipe supports, insulation, and accessories that are not an integral part of the valves or are not specified herein are covered in other sections.

1.2 GENERAL

A. Equipment furnished under this section shall be fabricated and assembled in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer unless exceptions are noted by Engineer.

B. Valves shall be furnished with all necessary parts and accessories indicated on the Drawings, specified, otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of valves.

C. General Equipment Stipulations

1. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

D. Temporary Number Plates

1. Each check valve with an identifying number listed in the Check Valve Schedule, shall be tagged or marked in the factory with the identifying number.

E. Identification

1. Valves specified herein shall be tagged in accordance with the Equipment and Valve Identification section.

1.3 SUBMITTALS

A. Drawings and Data.

1. Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the Submittals Procedures section. Included in the submittal shall be drawings by the valve manufacturer to indicate the position of the valve actuator and valve shaft.

PART 2 - PRODUCTS

2.1 SCHEDULE

Tag Number	45-TW-CV-0001 and 45-TW-CV-0002
Size (in)	1 1/2
Type of Valve	VC-13 or 14
Service	Sump Pump Discharge and Sample Pump Discharge
Design Capacity (gpm)	20
Ends	Socket or Flange

2.2 CONSTRUCTION

A. Valves VC-13

VC-13	Rating	150 psig nonshock
	Type	Ball check, true union
Sump pump discharge	Body	PVC or CPVC, material shall match pipe material
	Trim	
Socket ends	Ball	PVC or CPVC, material shall match pipe material
3 inch and smaller PVC or CPVC pipe	Seat	Viton or EPDM
	Seals	Viton or EPDM
	End Connection	Socket
	Temp. Limitations	0 to 140°F
	Manufacturers	Hayward Plastics Products “Ball Check Valve”, Nibco “Chemtrol True Union Ball Check Valve”, Spears Manufacturing Co. “True Union 2000 Industrial Series 4500 Ball Check Valves”

B. Valves VC-14

VC-14	Rating	150 psig nonshock
	Type	Ball check, true union
Sump pump discharge	Body/Bonnet	PVC or CPVC, material shall match pipe material
	Trim	
Flanged ends	Ball	PVC or CPVC, material shall match pipe material
3 inch and smaller PVC or CPVC	Seat	Viton or EPDM
	Seals	Viton or EPDM

pipe	End Connection	Flanged, ASME B16.5, Class 150, raised face
	Temp. Limitations	0 to 140°F
	Manufacturers	Hayward Plastics Products “Ball Check Valve”, Nibco “Chemtrol True Union Ball Check Valve”, Spears Manufacturing Co. “True Union 2000 Industrial Series 4500 Ball Check Valves”

C. Shop Coatings

1. All ferrous metal surfaces of valves and accessories, both interior and exterior, shall be shop coated for corrosion protection. The valve manufacturer’s standard coating will be acceptable, provided it is functionally equivalent to the specified coating.

Coating Materials

Coal Tar Epoxy	High-build coal tar epoxy; Ameron "Amercoat 78HB Coal Tar Epoxy", Carboline "Bitumastic 300 M", Tnemec "46H-413 Hi-Build Tneme-Tar", or Sherwin-Williams "Hi-Mil Sher-Tar Epoxy".
Epoxy Enamel (for liquid service)	Ameron "Amerlock 400 High-Solids Epoxy Coating", Carboline "Carboguard°891", or Tnemec "Series N140 Pota-Pox Plus".
Rust-Preventive Compound	As recommended by the manufacturer.

Surfaces To Be Coated

Unfinished Surfaces

Interior Surfaces	
Liquid Service	Epoxy enamel.
Exterior Surfaces of Valves To Be Buried, Submerged, or Installed in Manholes or Valve Vaults	Asphalt varnish or coal tar epoxy.
Exterior Surfaces of All Other Valves	Universal primer.
Polished or Machined Surfaces	Rust-preventive compound.
Actuators and Accessories	Universal primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Materials furnished under this section shall be installed in accordance with Valve Installation section.

End of Section

SECTION 40 0586 - AIR VALVES

PART 1 - GENERAL

1.1 SCOPE

A. This section covers furnishing combination air valves as required by the Work.

1.2 GENERAL

A. Equipment provided under this section shall be fabricated and assembled in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

B. Valves shall be furnished with all necessary parts and accessories indicated on the Drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of valves.

C. General Equipment Stipulations

1. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

D. Governing Standard

1. Except as modified or supplemented herein, all valves furnished under this section shall conform to the applicable performance requirements of ANSI/AWWA C512.

E. Identification

1. Air valves shall be tagged in accordance with the Equipment and Valve Identification section.

1.3 SUBMITTALS

A. Drawings and Data

1. Complete assembly drawings, together with detailed specifications and data covering materials used and accessories forming a part of the valves furnished, shall be submitted in accordance with the Submittals Procedures section.

PART 2 - PRODUCTS

2.1 CONSTRUCTION

A. Three inch and larger combination air valves for clean water applications shall consist of an air and vacuum valve with an externally mounted air release valve. The valves shall be Apco/Valve and Primer “Single Body Combination Air Valves” for 3 inch and "Custom Combination Air Valves" for 4 inch and larger, GA Industries "Figure 950 Kinetic Custom Combination Air Valves", Multiplex "Crispin Dual Air Valves", ARI “No. D-060-HF”, or Val-Matic "Dual Body Combination Air Valves". Unless otherwise specified or indicated on the Drawings, valves shall be provided with surge check discs on the valve inlet to restrict the exhaust air flow rate.

2.2 MATERIALS

A. Except as modified or supplemented herein, materials of construction shall comply with the governing standard.

Valve Trim	Bronze or austenitic stainless steel or polymer materials.
Float	Austenitic stainless steel, polycarbonate, or foamed polypropylene.
Shop Coatings	
Epoxy (NSF-61 Certified)	PPG Amercoat “Amerlock 400 High Solids Epoxy”, Carboline “Carboguard 891”, Sherwin-Williams "Macropoxy 646NSF" or Tnemec “Series N140 Pota-Pox Plus”.
Rust-Preventive Compound	As recommended by manufacturer.

2.3 SHOP PAINTING

A. All interior and exterior ferrous metal surfaces, except stainless steel components, shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field coating. Field painting is covered in the Protective Coatings section.

B. Surfaces shall be painted as indicated:

Interior Surfaces of Valves in Clean Water Applications (Raw or Treated Water in Potable Water Facilities)	NSF-61 Certified Epoxy.

Exterior Surfaces of Valves To Be Installed in Manholes or Valve Vaults	Epoxy.
Exterior Surfaces of All Other Valves	Universal primer.
Polished or Machined Surfaces	Rust-preventive compound.

C. Interior epoxy coatings for clean water valves shall comply with ANSI/AWWA C550/NSF 61. Interior coatings for all valves shall be free of holidays. The total dry film thickness of shop-applied coatings shall be not less than:

Type of Coating	Minimum Dry Film Thickness
Epoxy	10 mils
Universal Primer	3 mils

2.4 SHUTOFF VALVES

A. A shutoff valve shall be provided in the piping leading to each air valve. Shutoff valves 3 inches and larger for clean water service shall be butterfly valves as specified in the AWWA Butterfly Valve section.

B. Each combination air valve shall be provided with a shutoff valve between the air and vacuum valve and the air release valve.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Air release and combination air valves shall be installed in accordance with the Valve Installation section.

End of Section

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SECTION 40 0593 - COMMON MOTOR REQUIREMENTS FOR PROCESS EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE

A. This section covers single and three-phase, small (fractional) and medium (integral) horsepower, alternating current motors rated 500 horsepower and less (NEMA MG1).

B. Motors shall be designated and coordinated with the driven equipment and shall be located as indicated on the Drawings.

1.2 GENERAL

A. Motors furnished under driven equipment Specification sections shall be fabricated and assembled in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer unless exceptions are noted by the Engineer.

B. Where applicable, individual motor data sheets have been developed which specify additional requirements for specific motors.

C. General Equipment Stipulations

1. The General Equipment Stipulations section shall apply to all motors, unless otherwise specified. If requirements in this section differ from those in the General Equipment Stipulations section, the requirements specified herein shall take precedence.

D. Seismic Design Requirements

1. Seismic design requirements for products specified herein shall be as indicated in the Meteorological and Seismic Design Criteria section.

E. Governing Standards

1. Motors furnished under this section shall be designed, constructed, and tested in accordance with the latest version of NEMA MG 1, NEMA MG 10, and IEEE 112, Test Method B.

F. Nameplates

1. All motor nameplate data shall conform to NEMA MG 1 requirements.

1.3 SUBMITTALS

A. Drawings and Data - General

1. Complete assembly, foundation, and installation drawings, together with complete engineering data covering the materials used, parts, devices, and accessories forming a part of the motor shall be submitted in accordance with the Submittals Procedures section. The drawings and data shall include, but shall not be limited to, the following:

B. Drawings and Data – Each Motor

1. Name of manufacturer.

2. Type and model.

3. Type of bearing and method of lubrication.

4. Rated size of motor, hp, and service factor.

5. Temperature rise and insulation rating.

6. Full load rotative speed.

7. Net weight.

8. Efficiency at full, 3/4, and 1/2 load.

9. Full load current.

10. Locked rotor current.

11. Space heater wattage, where applicable.

12. Motor temperature switch data, where applicable.

13. Motor Shaft Grounding Ring data, where applicable.

14. RTD data, where applicable.

C. Seismic Design Requirement Certifications

1. Confirmation of compliance with the requirements of the Meteorological and Seismic Design Criteria section.

1.4 OPERATION AND MAINTENANCE DATA AND MANUALS

A. Adequate operation and maintenance information shall be supplied. Operation and maintenance manuals shall be submitted in accordance with the Submittals Procedures section.

B. Operation and maintenance manuals shall include the following:

1. Assembly, installation, alignment, adjustment, and checking instructions.

2. Lubrication and maintenance instructions.

3. Guide to troubleshooting.

4. Parts lists and predicted life of parts subject to wear.

5. Outline, cross-section, and assembly drawings; engineering data; and wiring diagrams.

6. Test data and performance curves, where applicable.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

A. Service conditions for motors shall be as specified in the driven equipment Specification sections. Motors shall be designed for special conditions such as area classification, altitude, frequent starting, intermittent overload, high inertia, mounting configuration, or service environment. Where site elevation and ambient temperature is not specified in the driven equipment Specification sections, the motors shall be designed for the following.

Site elevation	Below 3,300 ft
Ambient temperature	40 °C

B. Unless specified otherwise, all motors shall be designed for full voltage starting and to operate from an electrical system that may have a maximum of 5 percent voltage distortion according to IEEE 519.

C. Motors utilizing a reduced-voltage, autotransformer starter shall be capable of reduced-voltage starting at a 65 percent tap setting.

D. Motors utilizing a reduced voltage solid state starter shall be capable of starting at 50% of the specified voltage.

E. When powered from an adjustable frequency drive (AFD), motors shall be inverter duty and specifically selected for service with an adjustable frequency type speed controller and shall be derated as required to compensate for harmonic heating effects and reduced self-cooling capability at low speed operation. Each motor shall not exceed a Class B temperature rise when operating in the installed condition at load with power received from the adjustable frequency drive. All motors driven by AFDs shall be supplied with full phase insulation on the end turns and shall meet the requirements of NEMA MG 1, Part 31. In addition to the requirements of NEMA MG 1, Part 31, motors shall be designed to be continually pulsed at the motor terminals with a voltage of 1600 volts ac.

F. The number of starts per hour for motors shall be rated for the load cycling requirements of NEMA MG 10.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

A. Unless otherwise specified in the attached motor data sheet(s), design and construction of each general-purpose motor shall be as specified herein. Motor voltage, frequency, speed, service factor, and insulation class shall be as follows.

Motor voltage.	460, 3 phase for ½ horsepower and larger, 120, single phase for smaller than ½ horsepower
Frequency.	60 Hz
Speed.	Constant speed
Service factor.	1.0 , except for AFD driven motors which shall be 1.15
Insulation class and temperature rise above 40° C design ambient (by resistance method.	Class F with 80° C rise at 1.0 SF
Enclosure.	Totally enclosed fan cooled
Main conduit box sized to include.	Main motor leads and space heater leads where space heaters are specified

B. Nameplate Horsepower

1. Motor nameplate horsepower [kW] shall be equal to or greater than the maximum load imposed by the driven equipment.

C. Enclosures

1. All motors shall be self-ventilated. All self-ventilated open type motors, including those with dripproof, splashproof, and weather protected enclosures, and the fan covers of totally enclosed fan cooled motors shall meet NEMA MG 1 requirements for a fully guarded machine.

2. Totally Enclosed Motors

   a. Totally enclosed motors shall be furnished with drain holes and rotating shaft seals. Frames, bearing brackets, external terminal housings, and fan covers for fan cooled motors shall be cast iron. External cooling fans for fan cooled motors shall be fabricated of brass, bronze, aluminum alloy containing not more than 0.2 percent copper, malleable iron, or plastic. All plastic fans shall be fabricated of a reinforced thermosetting plastic and shall be UL approved.

3. Outdoor Motors

   a. Outdoor motors shall have NEMA weather protected enclosures. All exposed metal surfaces shall be protected, where practical, with a corrosion resistant polyester coating. Exposed uncoated surfaces shall be of a corrosion resistant metal. Enclosure exterior and interior surfaces, air gap surfaces, and windings shall be protected with a corrosion resistant polyester, polyurethane or epoxy coating.

4. Encapsulated Windings

a. Where specified in the motor data sheet(s), motors shall be provided with encapsulated windings meeting the requirements of NEMA MG1-1.27.2.

D. Main Conduit Boxes

1. The main conduit box shall be in accordance with NEMA MG 1. The main conduit boxes shall be diagonally split for easy access to the motor leads, and designed for rotation in 90-degree increments. A gasket shall be furnished between the halves of the box. Conduit openings in the main conduit box shall match the size and quantity of conduits indicated on the one line Drawings.

2. The main conduit box shall be oversized at least one size larger than NEMA standard. The main conduit box shall be sized for all indicated accessory leads.

3. Motors furnished in NEMA 320 frame series and larger shall have conduit boxes designed and constructed to permit motor removal after installation without disconnecting raceways.

E. Leads

1. Motor power leads shall be wired into the main conduit box. Unless otherwise specified, space heater leads shall be wired into the main conduit box. All motor leads and their terminals shall be permanently marked in accordance with the requirements of NEMA MG 1, Part 2. Each lead marking shall be visible after taping of the terminals.

2. All motors rated 100 horsepower and larger, and all vertical motors shall have the direction of rotation marked by an arrow mounted visibly on the stator frame near the terminal housing, or on the nameplate, and the leads marked for phase sequence T1, T2, T3, to correspond to the direction of rotation and supply voltage sequence.

3. Leads for dual-voltage rated or for multispeed motors shall be easily connected or reconnected in the main conduit box for the operating voltage or for the specified speeds. Permanent instructions for making these connections shall be furnished inside the main conduit box or on the motor frame or nameplate.

F. Terminals

1. Cable type leads shall be provided with Burndy Type YA or acceptable equal compression type connectors.

G. Grounding Connections

1. All motors shall be furnished with a ground connection.

H. Bearings

1. All bearings shall be self-lubricating, shall have provisions for relubrication, and shall be designed to operate in any position or at any angle.

2. Motor bearings shall be antifriction type with L_{10} life rating of 40,000 hours in accordance with ABMA Standards.

3. All bearing mountings shall be designed to prevent the entrance of lubricant into the motor enclosure or dirt into the bearings, and shall be fitted with pipes, drain plugs, and fittings arranged for safe, easy relubrication from the outside of the motor while the motor is in service, as necessary.

I. Rotors

1. All induction motors shall have squirrel-cage rotors adequately sized to avoid overheating during acceleration of the motor and driven equipment. Rotors shall be dynamically balanced to 0.08 in./sec or less.

J. Shafts

1. Shafts shall be furnished with corrosion resistant treatment or shall be of a corrosion resistant material.

K. Torque Characteristics

1. Motors rated 200 horsepower and less shall have torques and locked-rotor current in accordance with NEMA MG 1, Part 12.

L. Motor Space Heaters

1. Unless otherwise specified in the attached motor data sheet(s), motors 1 horsepower and larger shall be provided with a space heater element sized to prevent condensation on the core and windings. The space heaters shall be isolated or so located as to prevent heat damage to adjacent painted surfaces and shall be suitable for 120 volt, 60 Hz, single phase power supply.

M. Motor Shaft Grounding Ring

1. Each motor controlled by an adjustable frequency drive shall be furnished with a maintenance free, conductive micro fiber, shaft grounding ring with circumferential micro fibers to discharge electrical shaft currents within the motor. Motor shaft grounding ring shall be installed on the drive end on the motor shaft. Shaft grounding ring shall be installed by the motor's manufacturer in accordance with grounding ring manufacturer's recommendations.

N. Assembly

1. All motors shall be completely assembled with the driven equipment, lubricated, and ready for operation.

O. Efficiency

1. Unless otherwise specified in the attached motor data sheet(s), motors shall be premium efficiency type and shall have a NEMA nominal efficiency nameplate value equal to or

greater than values indicated in the following table. Efficiency shall be determined in accordance with IEEE 112, Test Method B.

2. Vertical motors shall have efficiency values equal to or greater than those indicated in the following table minus 0.50.

Motor		Nominal Efficiency Values				Nominal Efficiency Values			
kW	hp	Open Drip Enclosure				TEFC Enclosure			
		3600 rpm	1800 rpm	1200 rpm	900 rpm	3600 rpm	1800 rpm	1200 rpm	900 rpm
0.7	1	84.0	85.5	82.5	75.0	77.0	85.5	82.5	75.5
1.1	1.5	84.0	86.5	86.5	78.0	84.0	86.5	87.5	80.0
1.5	2	85.5	86.5	87.5	86.5	85.5	86.5	88.5	85.5
2.2	3	85.5	89.5	88.5	89.5	87.0	89.5	89.5	86.5
3.7	5	86.5	89.5	89.5	89.5	88.5	89.5	89.5	85.5
5.6	7.5	88.5	91.0	90.2	88.5	90.0	91.7	91.0	86.5
7.5	10	89.5	91.7	91.7	91.0	91.0	91.7	91.0	91.0
11.2	15	90.2	93.0	91.7	91.0	91.0	92.4	92.0	91.0
14.9	20	91.7	93.0	92.4	92.0	92.0	93.0	92.0	91.0
18.7	25	92.4	93.6	93.0	92.0	92.0	93.6	93.0	91.0
22.4	30	93.0	94.1	93.6	93.0	92.4	93.6	93.0	93.0
29.8	40	93.0	94.1	94.1	93.0	92.4	94.1	94.1	93.0
37.3	50	93.0	94.5	94.1	93.0	93.0	94.5	94.1	93.0
44.8	60	93.6	95.0	94.5	94.0	93.6	95.0	94.5	93.0
56	75	94.0	95.0	95.0	94.0	93.6	95.4	95.0	94.0
74.6	100	94.5	95.4	95.0	95.0	94.1	95.4	95.0	94.0
93.2	125	95.0	95.4	95.0	95.0	95.0	95.4	95.0	94.0
112	150	95.0	95.8	95.4	95.0	95.0	95.8	95.8	94.0
149	200	95.4	95.8	95.4	95.0	95.4	96.2	95.8	94.1
186	250	95.0	95.8	95.4	95.0	95.8	96.2	95.8	94.5
224	300	95.4	95.8	95.4		95.8	96.2	95.8	
261	350	95.4	95.8	95.4		95.8	96.2	95.8	
298	400	95.8	95.8	95.8		95.8	96.2	95.8	
336	450	95.8	96.2	96.2		95.8	96.2	95.8	
373	500	95.8	96.2	96.2		95.8	96.2	95.8	

2.3 ACCESSORIES.

A. Special Tools and Accessories

1. Motors requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Each motor shall be provided with lifting eyebolts or lugs and appropriate fittings for adding bearing lubricant. Grease lubricated units shall be provided with a means of venting the casing. Oil lubricated units shall be provided with constant level oilers or with sight glasses arranged to indicate operating and static oil levels.

2.4 ANCHORS

A. Contractor shall furnish suitable anchors for each item of equipment as required for driven equipment.

2.5 BALANCE

A. All rotating parts shall be accurately machined and shall be in as nearly perfect rotational balance as practicable. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that resonance at normal operating speeds is avoided. In any case, the unfiltered vibration displacement (peak-to-peak), as measured at any point on the machine, shall not exceed the limits as required by NEMA MG 1. At any operating speed, the ratio of rotative speed to the critical speed of a unit or its components shall be less than 0.8 or more than 1.3.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Each motor shall be installed in accordance with the Equipment Installation section.

End of Section

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SECTION 40 06 20 - SCHEDULES FOR LIQUIDS PROCESS PIPING

1. SCOPE

This section consists of a schedule of 4 inch and larger pipelines indicating the type of pipe to be used. Pipe materials, installation, testing, and disinfection, when specified, are covered in other sections.

Piping smaller than 4 inch is covered in the various miscellaneous piping sections. Piping for plumbing, heating and air conditioning systems is covered in other sections. Piping to be furnished with equipment is covered in the applicable equipment section.

2. ALTERNATIVE PIPE TYPES

Where more than one type of pipe is indicated in the schedule, the type of pipe material to be installed may be selected by Contractor. The details on the drawings cover only one type of pipe for each line. If a different material is selected by Contractor, all details of connections, jointing, wall fittings, support, anchorage, and harnesses shall be modified as necessary to produce an equivalent design acceptable to Engineer.

3. WALL FITTINGS

A wall pipe or sleeve will be required for all pipe passing through concrete or masonry block walls. Wall fittings and sleeves shall be as indicated on the drawings and as specified in the applicable piping section.

4. SCHEDULE INDEX

Pipe material abbreviations and their applicable specification section number are as indicated:

Abbreviation	Pipe Material	Section No.
DIP	Ductile iron pipe	40 05 19
PVC	PVC	40 05 32
SP	Steel pipe	40 05 24
SS	Stainless steel pipe	40 05 23

5. SCHEDULE

Pipe materials shall conform to Schedule 40 06 21-S01. All pipelines indicated on the drawings and all pipelines required for proper operation of the equipment furnished shall be provided whether listed in the schedule or not.

End of Section

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Schedule 40 06 20 -S01

Pipeline Schedule

1.000	**General**
1.010	Specification Section 40 06 20
2.000	**Requirements**

Size	Service	Location	Material	Working Pressure	Test Pressure
in.				psi	psi
36	Finished Water	Buried	DIP/SP	130	250
42	Finished Water	Buried	DIP/SP	130	250
48	Finished Water	Buried	DIP/SP	130	250
54	Treated Water	Buried	SP	8	13
60	Treated Water	Buried	SP	12	18
72	Treated Water	Buried	SP	17	26
3, 6, and 30	Vent Piping	Aboveground (Clearwell) and Buried (Vault)	SS-1	-	-
8	Clearwell Underdrain	Buried	PVC-6	-	-
6	Blow-off Piping	Vault	DIP/SP	130	250
3	CAV Piping	Vault	DIP/SP	130	250
1 ½	Sump Pump Discharge	Vault	PVC-2	13	20
½	Sample Pump Discharge	Vault and Buried	PVC-2	35	53

End of Schedule

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SECTION 40 61 11 - INSTRUMENTATION AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the furnishing and installation of an instrumentation and control system designated as the Distributed Control System at Clearwell.

B. The system shall be furnished as specified, complete with all software, human machine interface (HMI) hardware, input/output hardware, instrumentation, and all devices, accessories, appurtenances, testing, and training necessary for proper operation.

C. Associated Sections

1. This section also includes the equipment and services specified in the following sections.

Section 40 71 00	FLOW INSTRUMENTS
Section 40 72 00	PRESSURE AND LEVEL INSTRUMENTS

1.2 GENERAL

A. Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

B. General Equipment Stipulations

1. The General Equipment Stipulations shall apply to all equipment and materials furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

C. Drawings

1. The Drawings indicate locations and arrangements of equipment and may include installation details and block and one-line diagrams showing connections and interfaces with other equipment. The input/output (I/O) lists are attached as an appendix to this section.

2. Principal components of the instrumentation systems shall be as indicated on the P&ID drawings and instrument device schedule attached to this section.

D. Codes, Permits and Agency Approvals

1. All work performed and all materials used shall be in accordance with the National Electrical Code, and with applicable local regulations and ordinances. Where mandated by codes, panels, assemblies, materials, and equipment shall be listed by Underwriters' Laboratories or other NRTL. Contractor shall, as part of their work, arrange for and obtain all necessary permits, inspections, and approvals by the authorities having local jurisdiction of such work. This shall include any third-party inspections and testing of panels and equipment.

E. Supplier’s Qualifications

1. Equipment and software furnished under this section and under other related sections listed in the Scope paragraph above shall be designed, coordinated, and supplied by a single manufacturer or supplier, hereinafter referred to as the System Supplier. The System Supplier shall be regularly engaged in the business of supplying computer-based monitoring, control, and data acquisition systems. The Contractor shall utilize the services of the System Supplier to coordinate all control system related items, to check-out and calibrate instruments, and to perform all testing, training, and startup activities specified to be provided.

2. The System Supplier shall have the following minimum qualifications:

a. The supplier shall maintain a design office staffed with qualified technical design personnel.
b. The supplier shall maintain competent and experienced service personnel to service the hardware and software furnished for this project.
c.
d. The supplier shall have as a minimum 5 years of experience in the design, coordination and supply of computer-based monitoring, control, and data acquisition systems.

F. Coordination

1. Systems supplied under this section shall be designed and coordinated by System Supplier for proper operation with related equipment and materials furnished by other suppliers under other sections of these specifications, under other contracts, and, where applicable, with related existing equipment. All equipment shall be designed and installed in full conformity with the Drawings, specifications, engineering data, instructions, and recommendations of the manufacturer, and the manufacturer of the related equipment.

G. Related Equipment and Materials

1. Related equipment and materials may include, but will not be limited to, instrumentation, motor controllers, valve actuators, chemical feeders, analytical measuring devices, conduit, cable, and piping as described in other sections or furnished under other contracts.

H. Device Tag Numbering System

1. All devices shall be provided with permanent identification tags. The tag numbers shall agree with System Supplier's equipment drawings and shall be as close as practical to the tag numbers used on the Drawings and device schedules. All field-mounted transmitters and devices shall have stamped stainless steel identification tags. Panel, subpanel, and rack-mounted devices shall have laminated phenolic identification tags securely fastened to the device. Hand-lettered or tape labels will not be acceptable.

1.3 GENERAL REQUIREMENTS

A. The Drawings and Specifications indicate the extent and general arrangement of the systems. If any departures from the Drawings or Specifications are deemed necessary by System Supplier, details of such departures and the reasons shall be submitted to Engineer for review with or before the first stage submittal. No departures shall be made without prior written acceptance.

B. The specifications describe the minimum requirements for hardware and software. Where System Supplier's standard configuration includes additional items of equipment or software features not specifically described herein, such equipment or features shall be furnished as a part of the system and shall be warranted as specified herein.

C. Governing Standards

1. Equipment furnished under this section shall be designed, constructed, and tested in accordance with IEEE 519, ANSI C37.90, FCC Part 15 - Class A, and NEMA ICS-1-109.60.

D. Dimensional Restrictions

1. Layout dimensions will vary between manufacturers and the layout area indicated on the Drawings is based on typical values. The System Supplier shall review the Drawings, the manufacturer's layout drawings and installation requirements, and make any modifications requisite for proper installation subject to acceptance by Engineer. At least three feet of clear access space shall be provided in front of all instrumentation and control system components.

E. Workmanship and Materials

1. System Supplier shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.

2. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except for testing.

F. Appurtenances

1. Signal converters, signal boosters, amplifiers, special power supplies, special cable, special grounding, and isolation devices shall be furnished as needed for proper performance of the equipment.

G. Programming Devices

1. A programming or system-configuring device shall be provided for systems that contain any equipment that requires such a device for routine calibration, maintenance, and troubleshooting. The programming device shall be complete, newly purchased for this project, and shall be in like-new condition when turned over to Owner at completion of startup.

1.4 SUBMITTALS

A. General

1. Complete dimensional, assembly, and installation drawings, wiring and schematic diagrams; and details, specifications, and data covering the materials used and the parts, devices and accessories forming a part of the system furnished, shall be submitted in accordance with the submittals section. Submittal data shall be grouped and submitted in three separate stages. The submittal for each stage shall be substantially complete. Individual drawings and data sheets submitted at random intervals will not be accepted for review. Equipment tag numbers or identifications used on the Drawings shall be referenced where applicable.

B. First Stage Submittal

1. The first stage submittal shall include the following items.

a. A detailed list of any exceptions, functional differences, or discrepancies between the system proposed by System Supplier and this specification.

b. Product catalog cut sheets on all hardware and software items, clearly marked to show the model number, optional features, and intended service of each device.

c. Standard field termination drawings for all process input/output equipment, showing typical terminations for each type of point available in the system.

d. Additional requirements identified in other Division 40 sections.

C. Second Stage Submittal

1. Before any equipment is released for shipment to the site and before factory testing is scheduled, the following data shall be submitted.

2. At System Supplier’s option, the first and second stage submittals may be combined.

a. Wiring and installation drawings for all interconnecting wiring between components of the system and between related equipment and the equipment furnished under this section. Wiring diagrams shall show complete circuits and indicate all connections. If

panel terminal designations, inter-device connections, device features and options, or other features are modified during the fabrication or factory testing, revised drawings shall be submitted before shipment of the equipment to the site.

b. Review of drawings submitted prior to the final determination of related equipment shall not relieve System Supplier from supplying systems in full compliance with the specific requirements of the related equipment.

c. Input/output listings showing point names, numbers, and addresses. Input/output identification numbers from the contract documents shall be cross-referenced in this submittal.

d. Proposed lesson plans or outlines for all training courses specified herein, including schedule, instructors' qualifications and experience, and recommended prerequisites.

e. Standard system engineering and user manuals describing the use of the system and application programming techniques for creating reports, graphics, database, historical records, and adding new process I/O nodes to the system.

f. Additional Requirements identified in other Division 40 sections.

D. Third Stage Submittal

1. Complete system documentation, in the form of Operation and Maintenance Manuals, shall be submitted before the commencement of field acceptance testing. Operation and Maintenance Manuals shall include complete instruction books for each item of equipment and software furnished. Where instruction booklets cover more than one specific model or range of device, product data sheets shall be included which indicate the device model number and other special features. A complete set of "as-built" wiring, fabrication, and interconnection drawings shall be included with the manuals. If field-wiring modifications are made after these drawings are submitted, the affected drawings shall be revised and resubmitted. Additional requirements are identified in other Division 40 specification sections.

1.5 PREPARATION FOR SHIPMENT

A. All electronic equipment and instruments shall be suitably packaged to facilitate handling and to protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements, shall be kept dry at all times, and shall not be exposed to adverse ambient conditions.

B. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted surfaces that are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

C. Each shipment shall include an appropriate shipping list that indicates the contents of the package, including the specific instrument tags. The shipping list shall be accessible without exposing the instruments to the atmosphere. The shipping list shall also contain any cautionary

notes regarding storage of the instruments, including requirements to protect the instrument from static discharge, desensitizing chemicals (solvents, paints, etc.), or ambient atmospheric conditions.

D. Individual instruments shall be appropriately tagged or labeled to positively identify the device. All identification shall be visible without the need to unpack the instrument from its protective packaging.

E. Instrument shipment and storage requirements shall be coordinated with Engineer or Owner prior to shipment. System Supplier shall provide adequate storage and be ready to accept the shipment before shipping any equipment to the site. Additional shipping and storage requirements shall be as detailed in the individual instrument specifications.

F. Components which are shipped loose due to transportation limitations shall be assembled and disassembled by the manufacturer prior to shipment to assure that all components fit together and are adequately supported.

1.6 DELIVERY, STORAGE, AND SHIPPING

A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All equipment furnished under each section referenced in SCOPE is a part of this section and shall be selected by System Supplier for its superior quality and intended performance. Equipment and materials used shall be subject to review.

B. Standard Products

1. The systems furnished shall be standard products. Where two or more units of the same type of equipment are supplied, they shall be the products of the same manufacturer; however, all components of the systems furnished hereunder need not be the products of one manufacturer unless specified herein.

2. To the extent possible, instruments used for similar types of functions and services shall be of the same brand and model line. Similar components of different instruments shall be the products of the same manufacturer to facilitate maintenance and stocking of repair parts. Whenever possible, identical units shall be furnished.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

A. The design of the systems furnished hereunder shall utilize concepts, techniques and features that provide maximum reliability and ease of maintenance and repair. The systems shall include

board-level devices such as light emitting diodes or other indicators to facilitate quick diagnosis and repair. Diagnostic software shall be furnished to facilitate system-level troubleshooting.

B. Where redundant hardware is provided, the system shall be capable of performing all specified functions, without reconfiguring hardware or software, with only one device of each category in service.

C. Factory Assembly

1. Equipment shall be shipped completely factory assembled, except where its physical size, arrangement, configuration, or shipping and handling limitations make the shipment of completely assembled units impracticable.

2.3 POWER SUPPLY AND INSTRUMENT SIGNAL

A. Power supply to all control system equipment will be 120 volts ac. System Supplier shall be responsible for distribution of power among enclosures, consoles, peripherals, and other components of the system from the power supply receptacles and junction boxes indicated on the Drawings. Power distribution hardware shall include cables and branch circuit overcurrent protection installed in accordance with the electrical section.

B. Unless otherwise indicated, power supply to the instrumentation will be unregulated 120 volts ac. Unless otherwise indicated, all transmitted electronic analog instrument signals shall be 4-20 mA dc and shall be linear with the measured variable.

C. Facility Distribution System

1. Equipment not indicated to be powered from an uninterruptible power source shall be suitable for being supplied from the facility distribution system and shall be capable of withstanding voltage variations of ±10 percent and harmonics up to the limits of IEEE 519 without affecting operation. System Supplier shall provide voltage conditioning or filtering equipment if necessary to meet the requirements specified.

D. Power Supplies

1. Power supplies for voltages other than those listed above shall be an integral part of the equipment furnished. Internal power supplies shall be regulated, current limiting, and self-protected.

E. Surge Withstand

1. All equipment shall meet all surge withstand capability tests as defined in ANSI C37.90 without damage to the equipment.

2.4 SERVICE CONDITIONS AND ENVIRONMENTAL REQUIREMENTS

A. The equipment provided for the instrumentation and control system shall be suitable for the service conditions specified in the attached equipment sections.

B. All equipment shall be designed and selected to operate without degradation in performance throughout the environmental extremes specified. Equipment shall be designed to prevent the generation of electromagnetic and radio frequency interference and shall be in compliance with FCC Rules and Regulations, Part 15, for Class A computing devices.

C. Ambient Temperature and Elevation

1. All system equipment located in air conditioned rooms shall be suitable for operation in ambient temperatures from 10° C to 35° C and a relative humidity of 10 to 80 percent, noncondensing. All equipment located in non air conditioned indoor areas shall be suitable for an ambient temperature range of 0° C to 50° C and a relative humidity of 10 to 95 percent, noncondensing. All equipment located outdoors shall be suitable for operation in an ambient temperature range -20° C to 60° C and a relative humidity of 5 to 100 percent. Heaters and air conditioning/cooling equipment shall be provided where essential to maintain equipment within its manufacturer-recommended operating ranges.

2. All equipment and instruments shall be designed to operate at the site elevation of 1360 ft.

D. Lightning Protection

1. In addition to other environmental protection specified herein, the entire system shall be provided with lightning protection. Lightning protection measures shall include the following.

2. Grounding

a. All major components of the system shall have a low resistance ground connection. Grounding system provisions indicated on the Drawings shall be modified as recommended by System Supplier.

3. Surge Suppressors

a. Surge and lightning suppressors shall be non-faulting, non-interrupting, and shall protect against line-to-line and line-to-ground surges. Devices shall be solid-state metal oxide varistor (MOV) type, silicon junction type, Gas Discharge Tube (GDT) type, or some combination of these types, with a response time of less than 50 nanoseconds. Surge protective devices shall be applied for the following:
   1) All 120 volts ac power connections to RTUs, PLCs, DCUs, instruments and control room equipment. Surge arresters shall be Transtector "SPD 12R Series", Phoenix Contact “PLT-SEC Series”, MCG Surge Protection “400 Series”.
   2) All analog signal circuits where any part of the circuit is outside of the building envelope. Circuits shall be protected at both the transmitter and the control system end of the circuit. Surge protection devices shall not impede or interfere with the use of smart transmitter calibration/communication.
      a) Protection devices located at the field transmitter shall be:
         - Loop Powered Transmitters – Eaton MTL “TP48”, Phoenix Contact “Surge Trab Series”, Transtector “PDS Outdoor Series”.

- Four-Wire Transmitters – Phoenix Contact “BoxTrab Series”, Schneider Electric ASCO Model 265, Emerson “SolarHD STC-SLAC Series”.

b) Protection devices in control panels shall be Transtector “12R IEP Series”, Eaton MTL “SD Modular Series”, Phoenix Contact “TTC-6P Series”.

2.5 INSTALLATION TEST EQUIPMENT

A. All necessary testing equipment for calibration and checking of system components shall be provided by System Supplier. System Supplier shall also furnish calibration and maintenance records for all testing and calibration equipment used on the site if requested by Engineer.

2.6 PROGRAMMING DEVICES

A. An instrument programming device shall be provided for the instruments specified in other sections. Quantity of programming devices shall be as specified in other sections.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. The installation of equipment furnished hereunder shall be by the Contractor or their assigned subcontractors.

B. Field Wiring

1. Field wiring materials and installation shall be in accordance with the electrical section.

C. Instrument Installation

1. Instruments shall be mounted so that they can be easily read and serviced and so that all appurtenant devices can be easily operated. Installation details for some instruments are indicated on the Drawings.

2. All outdoor instrumentation shall be protected from direct sun exposure. Instruments shall be placed in locations to limit south and west sun exposure. Sunshades shall be provided on instruments that are subject to the direct sun exposure. Sunshades shall be located so the opening faces north or east where possible. Sunshades shall be provided as shown on the Drawings.

3.2 SYSTEM SOFTWARE CONFIGURATION

A. The system software will be configured by Owner.

3.3 SYSTEMS CHECK

A. System Supplier shall provide the services of a trained and experienced field supervisor to assist the installation contractor during installation, and to calibrate, test, and advise others of the procedures for installation, adjustment, and operation.

B. Field Inspection at Delivery

1. The field supervisor shall inspect major equipment items within five working days of delivery, to assure that the equipment was not damaged during shipment and shall supervise or assist with unpacking, initial placement, and initial wiring of the system.

C. Field Calibration of Instruments

1. After each instrument has been installed, a technical representative of System Supplier shall calibrate each instrument and shall provide a written calibration report for each instrument, indicating the results and final settings. The adjustments of calibrated instruments shall be sealed or marked, insofar as possible, to discourage tampering. Instrument calibration shall be done before checkout of the system operation. A typical instrument calibration report is attached to the end of this section.

D. Training for Installation Personnel

1. The field supervisor shall train the installation personnel in reading and understanding submittal drawings, and in the correct installation and wiring procedures for the equipment. 1/2_ day shall be included for this training.

E. Field Inspection Prior to Start Up

1. After installation and wiring connections are complete, the field supervisor, with additional System Supplier's personnel shall verify that each external connection to the system is correctly wired and field process components and devices are functioning as intended. A minimum of 2_working days shall be included for this task, but System Supplier shall be responsible for completing the following scope of work.

2. Devices by Other Suppliers

a. If interrelated devices furnished by other suppliers, under other contracts, or by Owner, such as valve actuators, motor controls, chemical feeders, and instruments, do not perform properly at the time of system checkout, the field supervisor shall use suitable test equipment to introduce simulated signals to and/or measure signals from these devices to locate the sources of trouble or malfunction.

3. System Check Out Report

a. The System Supplier shall submit a written report on the results of such tests to Engineer. Additional documentation shall be furnished as requested by Engineer to establish responsibility for corrective measures. System Supplier shall verify, in writing, to Engineer or Owner that System Supplier has successfully completed the

external connection check before beginning system startup or field acceptance testing.

F. Start Up Assistance

1. After the field supervisor has completed the system check and submitted the System Check Out Report, System Supplier shall supply a factory-trained engineer and programmer to provide on-site start up assistance. During the startup period, these personnel shall thoroughly check all equipment, correct any deficiencies, and verify the proper operation of all components. Seven_working days shall be included for this task.

3.4 TESTING

A. The system shall be acceptance tested on site.

B. System Supplier shall prepare a testing procedure to be approved by Owner and Engineer that shall demonstrate that the system conforms to the specifications. The testing procedure shall be submitted at least 30 days in advance of testing. The testing shall be conducted by System Supplier and witnessed by Owner and/or Engineer.

C. System Supplier shall notify Engineer and Owner in writing at least 14 days before the proposed testing date. System Supplier shall reimburse Owner and Engineer for all expenses incurred in connection with attending repeated site testing necessitated by system failure or inadequate preparation.

D. Site Acceptance Testing

1. After installation and checkout by System Supplier’s personnel, the system shall be subjected to an acceptance test.

2. Site acceptance testing shall be scheduled after receipt of the System Check Out Report and System Supplier shall verify that all field signal changes are reflected in the proper address locations in the system database.

3. The site acceptance testing shall follow the approved procedure and shall operate without loss of basic functions. The number of working days of continuous operation for the test shall be Thirty (30). The operational demonstration shall confirm that the status, alarm, and process variable signals are valid and are being updated appropriately, and that the discrete and analog output signals from the control system are being correctly transmitted and implemented. Any errors or abnormal occurrences shall be recorded by System Supplier’s field representative. System Supplier’s field representative need not be continuously present during the site acceptance testing but shall be available to respond to the site within one hour of notification. The representative shall inspect the system for faults at least once every 24 hours and shall log or record any noted problems. The log shall include a description of the problem, its apparent cause, and any corrective action taken.

4. Completion of Test

a. Successful completion of the site acceptance test, including the operational demonstration, is prerequisite to Substantial Completion as specified in the Supplementary Conditions.

3.5 TRAINING

A. System Supplier shall conduct training courses for personnel selected by Owner. Training shall be provided in the categories listed below. Training shall be conducted by experienced instructors who are familiar with the specific system supplied.

B. General Training Requirements

1. In general, System Supplier's standard training courses may be used to meet the training objectives specified. Where standard courses do not meet these objectives, additional coursework shall be developed. Clock hour requirements for each level of training shall be as listed. A "clock hour" is defined as one hour of instruction or supervised training exercise. Training hour requirements are the number of hours of training to be provided for each student. Additional training time shall be provided if considered necessary to meet the training objectives.

2. Training Costs

a. All costs associated with the training program; excluding travel, lodging, and per diem expenses for Owner's and Engineer's personnel to attend off-site training programs; shall be the responsibility of System Supplier and shall be included in the contract price.

3. Lessons

a. Training lesson plans and other information for the second stage submittal as defined herein shall be submitted at least 30 days prior to the start of training.

4. Instrument Training

a. Training on the calibration, maintenance, troubleshooting, and repair for the instrument devices provided under this project shall be provided. Training shall also be provided for any hand-held or computer-based calibration devices and their associated software. Four (4) hours of training for 8 members of the Owner's staff shall be provided at the Owner's facility.

End of Section

INSTRUMENT NAME & SERVICE:		
BRAND & MODEL NO.:		
TAG OR LOOP NO.:		
INPUT/OUTPUT RANGE:		
INPUT	ACTUAL OUTPUT	DESIRED OUTPUT
PROPORTIONAL BAND:		
RESET:		
POSITION OF SWITCHES, JUMPERS, ETC.		
COMMENTS:		
DATE OF CALIBRATION: CALIBRATED BY:		
Black & Veatch	INSTRUMENT CALIBRATION REPORT	Figure 1-406111

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Item No. This is an arbitrary sequential number which is for reference only.
Area. Contains the Process area number assigned to each instrument/device. Area codes are found on legend sheet I-003.
System. Contains the system code assigned to each instrument/device. System code abbreviatons are found on legend sheet I-002.
Type. This is the ISA (or similar) alpha tag representing the function of the instrument.
Loop Number. This is the numeric (or alphanmeric) loop designation for the instrument.
Service Description. This is the description of the instrument service (i.e. Filter No. 1 Loss-of-Head).
Device Type and Size. This is the instrument device type and should match the description as listed in the specification. A size is given if applicable (e.g., flow meters).
Output Type. This generally will be '4-20 mA' or "Dry Contact'. It could also be a serial output for smart devices (such as HART or FIELD-BUS) but only if the serial output is the primary I/O interface.
Output Range. This is the calibrated range for analog devices or the trip point(s) for discrete devices.
Power Type. This will typically be '2-wire' for devices which are loop powered from the PLC enclosure, or '4-wire' for devices which are powered form external power supplies, unless noted otherwise.
DWG Name. This is the drawing number of the P&ID where the device is shown.
Spec. The provider for the specification section listed is responsible for supplying the device.
Remarks. This column may include a cross reference to another specification section where applicable or to a note which provides additional information.

Item no.	Area	System	Type	Loop Number	Tag	Service Description	Device Type	Size	Output Type	Output Range	Power Type	DWG Number	Specification	Remarks
1	45	TW	FE	0001	45-TW-FE-0001	14 MG TREATED WATER WETWELL INLET FLOW	ELECTRO-MAGNETIC FLOW ELEMENT	54"	mV	SEE FIT	N/A	045-I-601	40 71 00	RATED FOR SUBMERGENCE
2	45	TW	FIT	0001	45-TW-FIT-0001	14 MG TREATED WATER WETWELL INLET FLOW	ELECTRO-MAGNETIC FLOW TRANSMITTER	N/A	4-20 mA	0-42.0 MGD	4-WIRE	045-I-601	40 71 00	RATED FOR SUBMERGENCE
3	45	TW	LE	0400	45-TW-LE-0400	16 MG CLEARWELL BASIN NO. 4 LEVEL	RADAR LEVEL SENSOR	N/A	N/A	SEE LIT	N/A	045-I-601	40 72 00	--
4	45	TW	LE	0500	45-TW-LE-0500	16 MG CLEARWELL BASIN NO. 5 LEVEL	RADAR LEVEL SENSOR	N/A	N/A	SEE LIT	N/A	045-I-601	40 72 00	--
5	45	TW	LIT	0400	45-TW-LIT-0400	16 MG CLEARWELL BASIN NO. 4 LEVEL	RADAR LEVEL TRANSMITTER	N/A	4-20 mA	0-21.00 FT (EL 1345.00' - 1366.00')	2-WIRE	045-I-601	40 72 00	--
6	45	TW	LIT	0500	45-TW-LIT-0500	16 MG CLEARWELL BASIN NO. 5 LEVEL	RADAR LEVEL TRANSMITTER	N/A	4-20 mA	0-21.00 FT (EL 1345.00' - 1366.00')	2-WIRE	045-I-601	40 72 00	--
7	45	TW	LSH	0001	45-TW-LSH-0001	FLOWMETER VAULT SUMP LEVEL HIGH	FLOAT TYPE LEVEL SWITCH	N/A	DRY CONTACT	BY SUMP PUMP SUPPLIER	N/A	045-I-601	BY SUMP PUMP SUPPLIER	--
8	45	TW	LSHH	0001	45-TW-LSHH-0001	FLOWMETER VAULT LEVEL HIGH HIGH	FLOOD LEVEL SWITCH	N/A	DRY CONTACT	TRIP @ 0.25 FT (EL 1344.25') INCREASING	N/A	045-I-601	40 72 00	--
9	45	TW	LSL	0001	45-TW-LSL-0001	FLOWMETER VAULT SUMP LEVEL LOW	FLOAT TYPE LEVEL SWITCH	N/A	DRY CONTACT	BY SUMP PUMP SUPPLIER	N/A	045-I-601	BY SUMP PUMP SUPPLIER	--

END

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Item. This is an arbitrary sequential number which is for reference only.

IO Type: This is the type of I/O signal, as follows:

AI = Analog Input

AO = Analog Output

DI = Discrete Input

DO = Discrete Output

PI = Pulse Input (totalizer or accumulator type input)

Description. This is the description or the function (i.e. Filter No. 1 Loss-of-Head).

Field Device. This is the tag number of equipment identifier associated with the I/O point.

Controller ID. This is a sequential number for a given type within a specific controller (PLC or DCU).

Analog Data (Signal Type). This will typically be 4-20mA, but could also be 1-5Vdc, serial, HART, FLD-BUS, or similar to indicate the signal type of the associated input or output.

Analog Data (Calibrated Range). This will be the scaled value of the input in engineering units.

Analog Data (Power). This will typically be '2-wire' for devices which are loop powered from the PLC enclosure, or '4-wire' for devices which are powered form external power supplies, unless noted otherwise.

Discrete Data (Signal Type). This will be 120VAC, 24VDC, or similar to indicate the signal type of the associated input or output.

Discrete Data (Closed State). This will indicate the state of the input or output when it is considered to be closed or energized (normal, alarm, running, failed, etc.).

Discrete Data (Power Source). This will indicate the location of the power source for the wetting voltage on the contacts, as follows:

Field = External field power source. (May require interposing relays or isolated I/O module type.)

Local = Power originates from within the PLC or I/O enclosure.

Discrete Data (Interp Relay). This will be either 'Yes' or 'No' to indicate whether the input or output requires an interposing relay. Relays are typically required to isolate external voltage sources. See specifications for additional details.

P&ID. This column indicates associated Process & Instrumentation Diagram.

Remarks. This column may include a cross reference to another specification section where applicable, or to a note which provides additional information. Notes are appended to the end of the I/O listing.

Item	IO Type	Area	System	Type	Loop Number	IO Description	Service Description	Field Device	Controller ID	Analog Signal Type	Analog Signal Range	Analog Power Type	Digital Signal Type	Digital Close State	Digital Power Source	Digital Interp Relay	DWG Number	Remarks
1	AI	45	TW	FI	0001	FLOW	14 MG TREATED WATER WETWELL INLET FLOW	45-TW-FIT-0001	45-DCU-6	4 -20 mA	0-42.0 MGD	4-WIRE	N/A	N/A	N/A	N/A	045-I-601	--
2	AI	45	TW	LI	0400	LEVEL	16 MG CLEARWELL BASIN NO. 4 LEVEL	45-TW-LIT-0400	45-DCU-6	4 -20 mA	0-21.00 FT (EL 1345.00-1366.00)	2-WIRE	N/A	N/A	N/A	N/A	045-I-601	--
3	AI	45	TW	LI	0500	LEVEL	16 MG CLEARWELL BASIN NO. 5 LEVEL	45-TW-LIT-0500	45-DCU-6	4 -20 mA	0-21.00 FT (EL 1345.00-1366.00)	2-WIRE	N/A	N/A	N/A	N/A	045-I-601	--
4	DI	45	TW	YI	0001	IN AUTO	FLOWMETER VAULT SUMP PUMP IN AUTO	45-TW-PSP-0001	45-DCU-6	N/A	N/A	N/A	120VAC	IN AUTO	RIO	N/A	045-I-601	--
5	DI	45	TW	YIR	0001	RUNNING	FLOWMETER VAULT SUMP PUMP RUNNING	45-TW-PSP-0001	45-DCU-6	N/A	N/A	N/A	120VAC	RUNNING	RIO	N/A	045-I-601	--
6	DI	45	TW	LAHH	0001	HIGH HIGH LEVEL	FLOWMETER VAULT SUMP LEVEL HIGH HIGH	45-TW-LSHH-0001	45-DCU-6	N/A	N/A	N/A	120VAC	HIGH HIGH LEVEL	RIO	N/A	045-I-601	--
7	DI	45	EXISTING	LAH	--	HIGH LEVEL	14 MG CLEARWELL INFLUENT CHANNEL LEVEL HIGH	EXISTING	45-DCU-6	N/A	N/A	N/A	EXISTING	EXISTING	EXISTING	N/A	045-I-601	EXISTING
8	AI	45	EXISTING	LI	--	LEVEL	14 MG TREATED WATER WETWELL LEVEL	EXISTING	45-DCU-6	EXISTING	EXISTING	EXISTING	N/A	N/A	N/A	N/A	045-I-601	EXISTING
9	DI	45	EXISTING	YI	--	IN REMOTE	TREATED WATER HIGH SERVICE PUMP IN REMOTE	EXISTING	45-DCU-6	N/A	N/A	N/A	EXISTING	EXISTING	EXISTING	N/A	045-I-601	EXISTING
10	DI	45	EXISTING	YIR	--	RUNNING	TREATED WATER HIGH SERVICE RUNNING	EXISTING	45-DCU-6	N/A	N/A	N/A	EXISTING	EXISTING	EXISTING	N/A	045-I-601	EXISTING
11	DI	45	EXISTING	YA	--	E-STOP	TREATED WATER HIGH SERVICE PUMP E-STOP	EXISTING	45-DCU-6	N/A	N/A	N/A	EXISTING	EXISTING	EXISTING	N/A	045-I-601	EXISTING
12	DI	45	EXISTING	UA	--	COMMON FAIL	TREATED WATER HIGH SERVICE PUMP COMMON FAIL	EXISTING	45-DCU-6	N/A	N/A	N/A	EXISTING	EXISTING	EXISTING	N/A	045-I-601	EXISTING
13	DI	45	EXISTING	YA	--	FAIL TO START	TREATED WATER HIGH SERVICE PUMP FAIL TO START	EXISTING	45-DCU-6	N/A	N/A	N/A	EXISTING	EXISTING	EXISTING	N/A	045-I-601	EXISTING
14	DO	45	EXISTING	UCR	--	RUN CMD	TREATED WATER HIGH SERVICE RUN CMD	EXISTING	45-DCU-6	N/A	N/A	N/A	EXISTING	EXISTING	EXISTING	N/A	045-I-601	EXISTING

END

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SECTION 40 71 00 - FLOW INSTRUMENTS

PART 1 - GENERAL

1.1 SCOPE

A. The Flow Instrument Section covers the furnishing of flow instruments and accessories required for the Instrumentation and Control System as specified herein or as indicated on the Drawings.

B. Equipment and services provided under this section shall be subject to the Instrumentation and Control System section. This section shall be used and referenced only in conjunction with the Instrumentation and Control System section. Supplementing the Instrumentation and Control System section, instrument data, special requirements, and options are indicated on the Drawings or the Instrument Device Schedule.

C. When multiple instruments of a particular type are specified, and each requires different features, the required features are described on the Drawings or the Instrument Device Schedule.

1.2 DESIGN CRITERIA

A. Each device shall be a pre-assembled, packaged unit. Upon delivery to the work site, each device or system shall be ready for installation with only minor piping and electrical connections required by Contractor.

B. Primary elements shall derive any required power from the transmitter, unless otherwise indicated.

C. The instruments shall be installed to measure, monitor, or display the specified process at the ranges and service conditions indicated on the Drawings or as indicated in the Instrument Device Schedule. The instruments shall be installed at the locations indicated on the Drawings or in the Instrument Device Schedule.

D. Where possible, each instrument shall be factory wet flow calibrated to the full-scale flow range of the sensors or calibration ranges indicated on the Drawings or in the Instrument Device Schedule. Transmitters or similar measurement instruments shall be calibrated using National Institute of Standards and Technology (NIST) approved bench calibration procedures when such procedures exist for the instrument type. Calibration and configuration data shall be stored digitally in each device, including the instrument tag designation indicated on the Drawings or Instrument Device Schedule.

1.3 SUBMITTALS

A. Submittals shall be as specified in the Instrumentation and Control System section.

1.4 SHIPMENT, PROTECTION, AND STORAGE

A. Equipment provided under this section shall be shipped, protected, and stored as specified in the Instrumentation and Control System section. Identification of packaging shall be as specified in the Instrumentation and Control System section.

PART 2 - PRODUCTS

2.1 GENERAL

A. The following paragraphs provide minimum device requirements. The Drawings or Instrument Device Schedule shall be used to determine any additional instrument options, requirements, or service conditions.

B. Interconnecting Cable

1. For instruments where the primary element and transmitter are physically separated, interconnecting cable from the element to the transmitter shall be provided. The cable shall be the type approved by the instrument manufacturer for the intended purpose of interfacing the element to the transmitter. Length of cable shall be a minimum of three meters or as indicated on the Drawings or in the Instrument Device Schedule. The interconnecting cable shall be provided in the length necessary for installation. Splices shall not be allowed in the installed cable.

C. Programming Device

1. For instruments that require a dedicated programming device for calibration, maintenance, or troubleshooting, one such programming device shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). The programming device shall include appropriate operation manuals and shall be included in the training requirements. For systems that allow the programming device functions to be implemented in software, running on a laptop computer, the software shall be provided instead of the programming device.

D. Configuration Software/Serial Interface

1. Devices indicated as requiring a serial interface shall be provided with all accessories required to properly communicate over the serial link. As a minimum, an appropriate cable shall be provided to allow the transmitter serial interface to be connected to a personal computer. One licensed copy of the diagnostic/interface software shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). Software shall be capable of running under the Windows 11 operating system. If the software furnished performs the same functions as the programming device, specified elsewhere, then the programming device shall not be furnished.

2.2 FLOW INSTRUMENTATION

A. Magnetic Flow Meters, Signal Converters, and Accessories.

1. Magnetic Flow meter

a. The magnetic flow meter shall be a completely obstruction less, in-line flow meter with no constrictions in the flow of fluid through the meter. The meter shall consist of a metallic tube with flanged ends and with grounding rings or grounding electrodes as required by the application. Flange diameter and bolt drilling pattern shall comply with ANSI/ASME B16.5 for line sizes from 0.5 inches to 24 inches or AWWA C207 for line sizes larger than 24 inches. Flange class ratings and meter maximum pressure ratings shall be compatible with the adjoining piping. Flangeless wafer insert style meters may be used for pipe sizes up to 6 inches, where compatible with adjacent piping flanges. Self-cleaning electrodes shall be provided for all meters used for sludge metering. Electrode and liner materials shall be fully compatible with the process fluid as approved by the Engineer and shall comply with the requirements specified in the instrument device schedules. Each meter shall be factory wet flow calibrated to the sensors full flow capacity, at a facility, which is traceable to NIST or other standard acceptable to Engineer, and a copy of the calibration, report shall be submitted as part of the operation and maintenance manual submittal.

b. The meter shall be capable of standing empty for extended periods of time without damage to any components.

c. The meter housing shall be of a splash-proof and drip-proof design, unless indicated on the Drawings or in the Instrument Device Schedule to be submersible. Where required to be submersible, the meter housing shall withstand submergence in 30 feetof water for 48 hours without damage.

d. Meters shall be Krohne Enviromag 2300, without exception.

2. Magnetic Flow Meter Signal Converters

a. Separately mounted, microprocessor-based signal converters shall be provided for the magnetic flow meters. The signal converters shall include output damping, self-testing, built-in calibration capability, and an "empty pipe zero" contact input. The overall accuracy of the magnetic flow meter transmitter and signal converter shall be ±0.5 percent of actual flow rate for full-scale settings of 3 to 30 fps. The meter manufacturer shall furnish the signal cable between the converter and the magnetic flow meter. Signal cable shall be continuous and not spliced between the meter and the signal converter. The signal converter shall be housed in a corrosion resistant, weatherproof NEMA Type 4X housing and shall be suitable for operation over an ambient temperature range of -30 to +140°F, and relative humidity of 10 to 100 percent. The converter shall have an analog output of 4-20 mA dc. Transmitters tagged on the Drawings or specified to be of the indicating type shall contain a local indicator with a minimum four-digit LCD type display, scaled to read in engineering units of flow.

b. Magnetic flow meter systems shall provide zero flow stability by means of automatic zero adjustment of a DC excited metering circuit. Converters shall be capable of bi-directional flow measurement. Signal converters shall be of the same brand as the magnetic flow meters.

c. Where indicated on the Drawings or in the Instrument Device Schedule, the signal converter shall have a non-reset seven-digit totalizer on the face of the enclosure.

d. The signal converter shall be diagnosed and recalibrated with the use of a hand-held communicator/calibrator device. One device shall be furnished for all converters provided by a single manufacturer.

PART 3 - EXECUTION

3.1 FIELD SERVICES

A. Manufacturer's field services shall be provided for installation, field calibration, startup, and training as specified in the Instrumentation and Control System section.

B. Instruments shall not be shipped to the Work Site until two weeks prior to the scheduled installation. The System Supplier shall be responsible for coordinating the installation schedule with the Installation Contractor. Each shipment shall contain a listing of protective measures required to maintain sensor operation, including a listing of any common construction or cleaning chemicals that may affect instrument operation.

End of Section

SECTION 40 72 00 - PRESSURE AND LEVEL INSTRUMENTS

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the furnishing of pressure and level instruments and accessories required for the Instrumentation and Control System as specified herein or as indicated on the Drawings.

B. Equipment and services provided under this section shall be subject to the Instrumentation and Control System section. This section shall be used and referenced only in conjunction with the Instrumentation and Control System section. Supplementing the Instrumentation and Control System section, instrument data, special requirements, and options are indicated on the Drawings or the Instrument Device Schedule.

C. When multiple instruments of a particular type are specified, and each requires different features, the required features are described on the Drawings or the Instrument Device Schedule.

1.2 DESIGN CRITERIA

A. Each device shall be a pre-assembled, packaged unit. Upon delivery to the work site, each device or system shall be ready for installation with only minor piping and electrical connections required by Contractor.

B. Primary elements shall derive any required power from the transmitter, unless otherwise indicated.

C. No level or pressure instrumentation shall use mercury in switches or any other internal components.

D. The instruments shall be installed to measure, monitor, or display the specified process at the ranges and service conditions indicated on the Drawings or as indicated in the Instrument Device Schedule. The instruments shall be installed at the locations indicated on the Drawings or in the Instrument Device Schedule.

E. Where possible, each instrument shall be factory calibrated to the calibration ranges indicated in the Drawings or in the Instrument Device Schedule. Transmitters or similar measurement instruments shall be calibrated using National Institute of Standards and Technology (NIST) approved bench calibration procedures, when such procedures exist for the instrument type. Calibration data shall be stored digitally in each device, including the instrument tag designation indicated on the Drawings and/or Instrument Device Schedule.

1.3 SUBMITTALS

A. Submittals shall be as specified in the Instrumentation and Control System section.

1.4 SHIPMENT, PROTECTION, AND STORAGE

A. Equipment provided under this section shall be shipped, protected, and stored in accordance with the requirements of the Instrumentation and Control System section. Identification of packaging shall be as described in the Instrumentation and Control System section.

PART 2 - PRODUCTS

2.1 GENERAL

A. The following paragraphs provide minimum device stipulations. The Drawings or Instrument Device Schedule shall be used to determine any additional instrument options, requirements, or service conditions.

B. Interconnecting Cable

1. For systems where the primary element and transmitter are physically separated, interconnecting cable from the element to the transmitter shall be provided. The cable shall be the type approved by the instrument manufacturer for the intended purpose of interfacing the element to the transmitter. Length of cable shall be a minimum of three meters or as indicated in the Drawings or Instrument Device Schedule.

C. Programming Device

1. For systems that require a dedicated programming device for calibration, maintenance, or troubleshooting, one such programming device shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section.) The programming device shall include appropriate operation manuals and shall be included in the training requirements. For systems that allow the programming device functions to be implemented in software, running on a laptop computer, the software shall be provided instead of the programming device.

D. Configuration Software/Serial Interface

1. Devices indicated as requiring a serial interface shall be provided with all accessories required to properly communicate over the serial link. An appropriate cable shall be provided to allow the transmitter serial interface to be connected to a personal computer. One licensed copy of the diagnostic/interface software shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). Software shall be capable of running under Microsoft's Windows 11 operating system. If the software furnished performs the same functions as the programming device, specified elsewhere, then the programming device shall not be furnished.

2.2 LEVEL INSTRUMENTATION.

A. Flood Level Switches

1. The flood detecting level switches shall be float actuated and shall be suitable for wall bracket or sump mounting, as indicated on the Drawings or in the Instrument Device Schedule. The switch float mechanism shall actuate when the water level rises to 1 inch above the bottom of the housing. The switch contacts shall be hermetically sealed, rated for 0.1 amp [A] at 120 V ac, and shall be field changeable from normally open to normally closed. Flood switches shall be Contegra "Model FS 202".

B. Radar Level Transmitters

1. Radar level transmitters shall be microprocessor-based electronic units each consisting of a transmitter with integrally mounted antenna cone. The antenna shall be suitable for operation over a temperature range of -20° to +150°F and a relative humidity of 10 to 100 percent. The antenna shall be compatible with the process media being measured and encapsulated with a material such as PTFE and suitable for flange mounting. The transmitter shall be capable of continuous monitoring of solids or liquids.

2. The transmitter shall have a four-digit LCD display scaled to read in engineering units. Digit height shall be approximately 0.5 inches . The transmitter shall be designed to ignore momentary level spikes, false targets, or momentary loss-of-echo. The transmitter shall be loop-powered with an isolated 4-20 mA dc output signal linearly proportional to the measured level range. Accuracy of the transmitted signal shall be ±0.4 inches of the full range. Calibration parameters shall be entered through a keypad on the unit.

3. The transmitter shall be housed in a weatherproof, corrosion resistant NEMA Type 4X enclosure directly coupled to the antenna.

4. Transmitters mounted in hazardous area indicated on the drawings shall be suitable for use in a Class I, Division 1 or 2 area as indicated on the drawings.

5. The System Supplier shall provide an insulation kit (i.e., insulator-sleeved bolts and insulator washers), as required, to prevent corrosion due to dissimilar metals of the transmitter flange and the mounting pipe flange.

6. Contractor shall provide the manufacturer’s flange or adjustable transmitter mounting bracket to allow for an initial adjustment to the sensor placement with respect to the transmitter target. Bracket shall have set screws or a similar method for securing transmitter placement.

7. Radar level transmitters shall be Vega VEGAPULS Series.

PART 3 - EXECUTION

3.1 FIELD SERVICES

A. Manufacturer's field services shall be provided for installation, field calibration, startup, and training as specified in the Instrumentation and Control System section.

B. Instruments shall not be shipped to the Work Site until two weeks prior to the scheduled installation. System Supplier shall be responsible for coordinating the installation schedule with the Installation Contractor. Each shipment shall contain a listing of protective measures required to maintain sensor operation, including a listing of any common construction or cleaning chemicals that may affect instrument operation.

End of Section

APPENDIX A - Geotechnical Report

(FOR REFERENCE ONLY, NOT A CONTRACT DOCUMENT)

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September 5, 2024
Job No. 23-104

Black & Veatch Corporation
8400 Ward Parkway
Kansas City, Missouri 64114

Attn: Mr. Andrew Hansen, P.E.
Associate Vice President

RESULTS of GEOTECHNICAL INVESTIGATION
PROPOSED CLEARWELL – PHASE II
BEAVER WATER DISTRICT
LOWELL, ARKANSAS

INTRODUCTION

This report provides the results of the geotechnical investigation performed for the second phase of the clearwell part of the expansion of the Beaver Water District facility located at 301 N Primrose Rd, in Lowell, Arkansas. Our services in this report were provided in general accordance with the terms and scope of services described in Black & Veatch Service Contract 417134.70.1110, dated October 11, 2023. A preliminary report was submitted on May 2, 2024 with general site and subsurface considerations. The borings from the preliminary studies are presented in Appendix A.

We understand the project consists of a new clearwell which will be located at the existing facility in Lowell, Arkansas. The clearwell will have a capacity of 16 million gallons (MG) with approximate plan dimensions of 306 ft by 378 ft and a groundwater management system will be included. The bottom of the clearwell slab is planned at El 1343. Foundation loads of the new clearwell are expected to be moderate, with a maximum slab load of 2500 lbs per sq ft under the walls and a relatively smaller loads in the interior slab area. Site grading is expected to include cuts of about 22 to 32 ft below existing grades.

The purposes of this study were to explore subsurface conditions at the clearwell site and to develop recommendations to guide the design and construction of foundations and below-grade walls,

as well as to provide site grading and construction criteria. These purposes were accomplished by a multi-phased study, including:

- Drilling sample borings to determine the subsurface soil stratigraphy and obtain samples for laboratory testing;
- Performing laboratory tests to establish pertinent engineering properties of the foundation and subgrade strata; and
- Analyzing field and laboratory data to prepare recommendations to aid in foundation and below-grade wall designs, site grading planning and construction criteria.

The following report sections discuss the results of the field and laboratory studies. Conclusions and recommendations are presented in subsequent sections for design and construction.

SUBSURFACE EXPLORATION

Subsurface conditions at the clearwell site location were initially explored by drilling nine (9) preliminary sample borings to 40- to 53-ft depth. The site vicinity is shown on Figure 1 in Appendix A. The approximate boring locations are shown on the Plan of Borings, Figure 2. The boring logs are also included in Appendix A as Figures 3 through 11.

Subsurface conditions at the clearwell site location for the final study were explored by drilling ten (10) additional sample borings to 40- to 62-ft depth. The approximate boring locations are shown on the Plan of Borings, Figure 1 in Appendix B. The boring logs, presenting descriptions of the subsurface strata encountered and results of field and laboratory tests, are included as Figures 2 through 11. The ground elevation at each boring, as inferred from the available topographic information, is shown on boring logs. It must be recognized that the elevations shown are approximate and actual elevations may vary.

The borings were drilled with truck-mounted CME-550X and CME-750X rotary-drilling rigs using hollow stem auger drilling procedures. Soil and weathered rock samples were obtained using a 2-in.-diameter split-barrel sampler driven into the strata by blows of a 140-lb automatic hammer with 30-in. drop in accordance with Standard Penetration Test (SPT) procedures (ASTM D1586). The number of blows required to drive the standard split-barrel sampler the final 12 in. of an 18-in. total drive, or a portion thereof is defined as the N-value. Recorded N-values are shown on the boring logs in the "Blows Per Ft" column.

Representative samples of bedrock were obtained using a 5-ft-long NQ_{WL}- or NQ2-size double-tube core barrel with a diamond bit. For each core run, the percent recovery was determined

as the ratio of recovery to total length of core run. Rock Quality Designation (RQD) was also determined for the core run as the sum of intact, sound rock core greater than 4-in. length divided by the total length of the run and expressed in percent. Both these values are presented in the right-hand columns of the log forms, opposite the corresponding core run.

All samples were removed from sampling tools in the field, examined, and visually classified by the field geologist. Samples were then placed in appropriate containers to prevent moisture loss and/or change in condition during transfer to our laboratory for further examination and testing.

The borings were advanced using dry-auger drilling procedures to the extent possible to facilitate groundwater observations. The observations regarding groundwater are noted in the lower-right portion of each log and are discussed in subsequent sections of this report. The boreholes were backfilled after final observation of groundwater levels.

Groundwater levels were measured in the borings during and after completion of drilling. To obtain long-term groundwater data, a piezometer was installed at Boring BV-1. The piezometer consists of a 2-inch-diameter, Schedule 40 PVC, flush-thread well pipe placed in a 6-in.-diameter borehole. The piezometer included a 10-ft-long, 0.010-in. slotted screen section, a 30/50 filter sand pack, and a bentonite seal. The borehole annulus above the bentonite seal was backfilled to near the ground surface with bentonite. A summary of piezometer readings is provided in Appendix C.

LABORATORY TESTING

Laboratory tests consisting of natural water content determinations and classification tests were performed on selected representative soil samples to measure pertinent physical and engineering characteristics. A total of 121 natural water content determinations (ASTM D2216) were performed to develop information on *in-situ* soil water content. Water contents are plotted on the logs as a solid circle in accordance with the scale and symbols shown in the legend located in the upper-right corner of the logs.

To verify field classification and to evaluate soil plasticity, 20 liquid and plastic limit (Atterberg limits, ASTM D4318) determinations and 21 sieve analyses (ASTM D1140) were performed on selected representative samples. The Atterberg limits are plotted on the logs as pluses inter-connected with a dashed line using the water content scale. The percentage of soil passing through the No. 200 Sieve is noted in the "- No. 200 %" column on the appropriate boring log. Classification test results are provided in Appendix D.

Laboratory testing included analytical tests on the representative samples to evaluate the corrosion potential of the near-surface soils. The testing program included the following.

- Soil pH (AASHTO T289)
- Soil Resistivity (AASHTO T288 / ASTM G57)
- Chlorides (AASHTO T291)
- Sulfates (AASHTO T290)
- pH (AASHTO T289/ASTM D4972)
- Redox (ASTM G200)

The results of these tests are summarized in Appendix E.

GENERAL SITE and SUBSURFACE CONDITIONS

Site Conditions

The clearwell is inside the existing Beaver Water District complex. The terrain is generally grass-covered with a few isolated trees. Underground water lines are located near Starr Lane and run east-west. The site terrain slopes gently to the northwest, with the ground surface elevation varying from approximately El 1364 to El 1375. Surface drainage is considered fair.

Seismic Conditions

According to the Arkansas Building Authority (2005), the Benton County site is in Seismic Zone 1, i.e., the zone of least seismic potential in Arkansas. Based on the subsurface conditions encountered in the borings and the local geology, a Seismic Site Class C (very stiff soil and soft rock profile) is considered appropriate for this location with respect to the criteria of the International Building Code (IBC 2021) and AWWA D100-11. The liquefaction potential is considered negligible for the predominantly cohesive overburden soils and limestone encountered within the exploration depths of the borings.

Subsurface Conditions

The project site is located in the mapped exposure of the Boone Formation. The early and middle Mississippian Period Boone consists of fine- to coarse-grained limestone interbedded with chert. The chert content can vary widely, both horizontally and vertically, and limestone or chert may be predominant. The Boone Formation is known for dissolutional features such as sinkholes, caves, and enlarged fissures. Typically, the limestone/cherty limestone units of the Boone decompose (weather) to erratic blends of chert fragments and clay/silty clay. The residual soil mantle may extend to significant depths on higher terrain and may contain hard chert seams and/or layers.

The thickness of the Boone Formation is reported to be 300 to 350 ft in northern Arkansas. The Boone is generally disconformable to the underlying Chattanooga Shale and St. Joe Limestone member, with some areas having a conformable contact.

Based on the results of the borings, the subsurface stratigraphy may be generalized into three (3) primary strata as follows.

Stratum I: The Stratum I soils typically consist of medium stiff to stiff brown, light brown, tan, and orange silty clay (CL) extending to 2 to 4 feet. This stratum has a trace of chert fragments and organics. The silty clay exhibits low plasticity, moderate to high compressibility, and low shear strength. This stratum was not encountered in Boring BV-10.

Stratum II: Below the surficial silty soils is medium stiff to hard red, reddish orange, dark red, reddish brown, tan, and light gray clay, silty clay, and fine to coarse sandy clay (CL, CH, and GC) with variable, but generally numerous chert and limestone fragments and low hardness light gray highly weathered chert to 42 ft to in excess of the exploration depths of the borings. Loose to dense tan, gray, light gray, and brown fine to coarse gravelly sand (SP and SW) and sandy gravel (GW and GM) layers are locally present in this stratum. This stratum exhibits variable compressibility and shear strength. The plasticity in this stratum is moderate to high. The potential for shrink/swell activity with changes in moisture content is reduced due to the high percentage of granular soils. There is some potential for encountering hard chert intervals in this stratum. Auger refusal was locally encountered between 42 and 53 ft in this stratum.

Stratum III: The overburden soils are underlain by hard gray and light gray fresh limestone. The limestone is flat-bedded with healed fractures. The core sample recovery ranges from 80 to 100 percent and the core sample RQD ranges from 64 to 93 percent in this stratum. These RQD values are indicative of variable fair to good rock quality.

Groundwater was observed from 33 to 49 ft below existing grade (El 1316± to El 1336±) and encountered in all borings except BV-6 during the field investigation (March and April 2024). Piezometer readings in BV-1 were taken immediately after installation and at intervals from April through July 2024. Piezometer readings from BV-1 indicate a groundwater surface between 27 to 31 ft below existing grade (El 1334± to El 1338±). Groundwater levels will vary over time because of seasonal variation in precipitation or other factors not evident at the time of exploration. Perched groundwater may be encountered, especially during wet conditions. Down-gradient seepage through cut faces is likely in the sloping terrain.

Soil Corrosion

The analytical test results indicate soil resistivity ranges from 87,400 to 105,400 ohm-cm. The measured soil pH values ranged from 4.88 to 5.35. Based on published correlation[1] with these values and the visual soil classification, the on-site sandy clay with numerous chert and limestone fragments is considered to be moderately corrosive to unprotected steel and exposed reinforcing steel.

The soil chloride and sulfate contents were also measured for each sample. The measured sulfate content of the representative samples was 10 parts per million. Based on information published by the Portland Cement Association (PCA)[2], the measured sulfate contents indicate low sulfate exposure (0 to 150 parts per million). Given these results, we believe that the potential for sulfate attack of reinforced concrete on this site is low. The PCA indicates any type Portland cement is suitable for these conditions. For reinforced concrete elements in direct contact with soil, we recommend a concrete mix design with a maximum water-cement ratio of 0.45. Consideration could also be given to using additional concrete cover between steel reinforcing and soil for critical elements.

The measured chloride content of the representative samples ranged from 11 to 15 parts per million. These values indicate a low potential for corrosion to reinforced concrete. We believe that there is a low potential for corrosion of concrete due to chlorides.

ANALYSES and RECOMMENDATIONS

Foundation Design

Foundations for the clearwell must satisfy two (2) basic and independent design criteria. First, the maximum bearing pressure transmitted to the supporting strata must not exceed the allowable bearing pressure based on an allowable factor of safety with respect to bearing stratum shear strength. Secondly, foundation movements resulting from consolidation, shrinkage, or swelling of the supporting strata should be within tolerable limits for the structure. Construction factors such as installation of foundation units, fill placement, excavation procedures, and surface and groundwater conditions must also be considered.

Foundation loads are expected to be moderate with a maximum contact pressure of 2500 lbs per sq ft under the walls and relatively less pressure in the slab area. The required depth of excavation

1 Welded Steel Pipe – 1989, American Iron and Steel Institute, 1989
2 Design and Control of Concrete Mixtures; Thirteenth Edition; Portland Cement Association; 1994

for construction of the clearwell is expected to range from 26 to 32 ft below existing grades. The silty, sandy clay soils exhibit variable compressibility and shear strength with some localized weak zones. These soils are not considered suitable to directly support the mat foundation. In addition, these soils will likely become unstable under construction traffic. In view of these conditions, we recommend undercut of the subgrade soils and replacement with clean stone/aggregate base. This will stabilize the foundation soils, improve bearing capacity, and provide a stable platform for working during construction. Recommendations for foundations are discussed in the following report section.

Clearwell - Mat or Footing Foundations

We recommend that the foundation loads of the new clearwell be founded on footing or mat foundation systems supported in granular fill. We recommend undercutting approximately 26 inches below the plan subgrade and backfilling with clean stone and Class 7 base as further described. The Geotechnical Engineer should evaluate the subgrade to verify suitable bearing. Additional undercut may be warranted depending on the condition of the soils at the time of construction. The undercut should extend laterally a minimum of 5 ft beyond the limits of the mat.

We understand that a drainage layer is planned beneath the clearwell. Drainage will be provided by a perforated pipe in conjunction with a pump system. We recommend the drainage layer consist of 18 inches of #57 stone backfill. The stone backfill should be separated from the subgrade by a suitable filter fabric such as Mirafi 140N. A conceptual sketch of the subgrade improvement is provided in Appendix F. Above the clean stone, we recommend a minimum of 8 inches of Class 7 base compacted to a minimum of 95% of Modified Proctor maximum dry density at a moisture content close to optimum. A small roller is recommended for compaction. The mat may then be founded on the Class 7 base.

Mats or footings founded as recommended may be designed with respect to a maximum net allowable bearing pressure of 2500 lbs per sq foot. The recommended bearing value includes a minimum factor of safety of 3.0 with respect to the measured shear strength of the stiff silty clay/fine sandy clay and the expected strength of granular fill. Post-construction total and differential settlement of foundations supported as recommended should be less than 1.0 inch. Differential settlement should be less than one-half of the total value. The allowable bearing pressures may be increased by 33 percent for short-term transient loads and earthquake loads. A modulus of subgrade reaction (k) value of 100 lbs per cu inch may be used in the design of the mat.

Uplift resistance of foundations will be developed by the weight of the foundation units in conjunction with structure dead loads. Additional uplift restraint may be provided with a thickened base slab, extended exterior slab edges, or by other means.

Resistance to lateral forces will be developed by the sliding resistance at the mat bottom. Resistance to sliding may be evaluated using an ultimate friction value (tan δ) of 0.53 for concrete on the Class 7 granular fill. An appropriate factor of safety must be included in the analysis of sliding.

The Geotechnical Engineer should observe all foundation excavations and any undercuts to verify suitable bearing. Care should be exercised not to disturb the bottom of the undercut. The bottom of the undercut should not be exposed for a prolonged period of time.

Below-Grade Walls – Lateral Earth Pressures

It is understood that the below-grade walls of the new clearwell will extend approximately 26 to 32 ft below existing grade. The walls are expected to be restricted from rotation by inside corners, baffle walls, and/or top slabs. Consequently, the below-grade walls will be acted on by at-rest lateral earth pressures. Where the below-grade walls are free to rotate about the base, such as during construction, active earth pressures will be mobilized. Lateral earth pressure parameters for both at-rest and active conditions have been developed. The below-grade walls are anticipated to be supported on a footing or mat foundations as previously recommended above.

It is expected that the below-grade walls will be backfilled with either clean crushed stone, imported low-plasticity select fill, or excavation spoil. For excavation spoil, a low-plasticity silty clay or clayey gravel is considered suitable. Some segregation of the on-site materials will be required during excavation in order to utilize excavation spoil as wall backfill. The Site Grading section below provides further specifications for acceptable wall backfill material. For clean crushed stone, a gradation complying with ASTM D448 Number 57 stone is recommended. As a minimum, clean crushed stone wall backfill should be placed in a zone extending from the back of the wall to daylight on a 1-horizontal to 1-vertical (1H:1V) configuration or to at least 6 ft back of walls in stable rock.

A summary of recommended equivalent fluid pressures is tabulated below for walls backfilled with either clean, crushed stone or low-plasticity fill.

Lateral Earth Pressure for Wall Backfill

Earth Pressure Condition	Equivalent Fluid Pressure, lbs per sq ft per ft depth	
	Free-draining crushed stone backfill	Imported Low-plasticity select fill or approved excavation spoil
Active, drained	35	50
Active, undrained	80	90
At-rest (restrained), drained	50	80
At rest (restrained), undrained	85	100

Undrained conditions assume that the walls will be subject to full hydrostatic pressure. Drained conditions assume positive and continuous drainage of infiltrated water from the backfill. Drainage systems must be provided to assure a drained condition for walls designed with respect to drained lateral earth pressures. Where drainage cannot be assured, then undrained conditions should be assumed for wall design. The static groundwater level, as measured in the piezometer, ranged from approximate El 1334 to El 1338. However, groundwater levels could vary over time because of seasonal variation in precipitation or other factors. A drainage layer is planned below the mat to intercept any potential rise in the groundwater level. Consequently, a drained condition is considered appropriate in the wall design.

Lateral surcharge loads on walls backfilled with clean stone may be evaluated using an earth pressure coefficient 0.43 for the at-rest condition. For evaluation of lateral surcharge loads on walls backfilled with select fill or approved excavation spoil, an earth pressure coefficient of 0.66 for the at-rest condition should be utilized.

Clean granular backfill should be placed in nominal 10- to 12-in-thick lifts and densified by vibrating equipment, rodding or other suitable means. Granular backfill must be separated from the on-site soils by a suitable filter fabric. A geotextile such as Mirafi 140N or approved equal is recommended.

For walls backfilled with low-plasticity select fill or approved excavation spoil, wall backfill should be compacted to a minimum of 95 percent of the maximum dry density as determined by Standard Proctor (ASTM D698) procedures within 3% of the optimum. The top 12 to 18 in. of wall backfill should consist of low-permeability clayey soils compacted to the Standard Proctor value recommended above. This top layer should limit infiltration of surface water into backfill. The on-site silty, sandy clay (CL), free of debris, and approved by the Geotechnical Engineer, is suitable for

this use. On-site soils classifying as CH, GC, GM, DW, SP and SW are not considered suitable for this use. Maximum particle size in wall backfill should be limited to about 1.5 inches. Compaction within 5 ft of walls should be performed with hand compaction equipment. Care should be taken when compacting as overcompaction may cause damage to walls.

Considerations for Incidental Site Grading

Site grading for the new clearwell is expected to be minor. For incidental site grading, subgrade preparation should begin with any required clearing and grubbing and stripping all loose, soft, or organic-containing soils. Based on the observed depth of the organic zone, a stripping depth on the order of 6 in. is anticipated.

After stripping and performing any cut, all subgrade should be evaluated for the location and extent of soft soil zones by proof-rolling with a loaded tandem-wheel dump truck or similar equipment. Areas identified to be soft or that exhibit pumping should be undercut and processed and re-compacted or replaced, whichever is appropriate. All subgrade preparation should be observed by the Geotechnical Engineer.

The on-site silty clay and fine sandy clay, free of organics and debris, are suitable for use as general fill or backfill, provided high plasticity clay (CH) intervals and oversize chert fraction are segregated and discarded. The Geotechnical Engineer should oversee the segregation of unsuitable excavated materials and approve the remaining material. The approved materials may then be utilized as general fill or wall backfill. Significant moisture adjustment (wetting or drying) should be expected.

Imported borrow for general fill or wall backfill should be an approved low-plasticity sandy clay (CL), clayey sand (SC), gravelly clay (CL), or clayey gravel/cherty clay (GC) having a liquid limit less than 45 and a maximum plasticity index (PI) of 18 or an approved alternate. Locally available “hillside” clayey gravel (GC) having a liquid limit greater than 45 should be approved by the Geotechnical Engineer on a case by case basis. All fill and backfill should be free of organics and debris with a maximum particle size of 3 inches. Wall backfill should have a maximum particle size of 1.5 inches. All fill and backfill should be approved by the Geotechnical Engineer.

Fill and backfill should be placed in continuous, essentially horizontal lifts with a nominal loose thickness of 8 inches. Each lift of should be compacted to at least 95 percent of the Standard Proctor (ASTM D-698) maximum dry density at a water content within 3 percent of the optimum value for all materials used as general fill or wall backfill. All aggregate base should be compacted to

a minimum of 95 percent of the Modified Proctor (ASTM D-1557) maximum dry density at a water content near the optimum Modified value.

CONSTRUCTION CONSIDERATIONS

Groundwater Control

Positive surface drainage should be established at the start of the work, be maintained during construction and following completion of the project to prevent surface water ponding and subsequent saturation of subgrade soils. Density and water content of all earthwork should be maintained until the clearwell is completed. Subgrade soils that become saturated by ponding water or runoff should be excavated to undisturbed soils. Temporary diversion structures may be necessary to direct surface water and/or perched groundwater away from work areas.

The excavation for the clearwell will extend to approximately El 1340. Groundwater was observed between El 1316± and El 1336± in March and April 2024. Piezometer readings from April through June 2024 indicate a groundwater surface between El 1334± to El 1338±. Construction of the clearwell could require dewatering. To allow construction in the dry and to maintain a stable excavation bottom, groundwater levels within the clearwell excavation should be maintained at least 2 ft below the bottom of excavations. More significant groundwater amounts could be encountered during wet seasons, which would warrant more extensive dewatering efforts. Contractors should make their own assessment of dewatering requirements.

Temporary Excavations

Temporary excavations will be required for the construction of the clearwell. All excavations must comply with Local, State and Federal requirements for worker safety. Stability of short-term excavations must be evaluated in the field by qualified persons based on specific site observations. Temporary slopes should be monitored on a continuing basis and flattened as warranted by site conditions.

As an alternative to open cuts, excavations may be cut with near-vertical side walls. Temporary support for vertical cut excavations may utilize cross-lot braced sheeting, steel sheeting with helical or deadman tie-back systems, or other suitable systems. Depending on the system and design criteria selected, support systems are subject to lateral movements and potential loss of ground at the top of excavations. Ground movement and settlement related to the selected support system must be evaluated based on the proximity of adjacent foundations and structures.

Stability of short-term excavations and dewatering requirements must be evaluated in the field based on specific site observations. Braced excavations should utilize a bracing design that complies with Local, State, and Federal requirements for worker safety. Temporary slopes should be monitored on a continuing basis and flattened as warranted by site conditions.

Rock Excavation

We anticipate that the overburden soils may generally be excavated using conventional medium- to heavy-duty excavating equipment and techniques. However, Stratum II sandy clay may include fractured chert seams and layers. Discontinuous hard chert intervals may also be present within this stratum. Rock excavation techniques may be warranted to advance the excavation through these resistant chert units. Potential for rock excavation in narrow trenches is expected to be higher. Excavations extending into Stratum III limestone bedrock will require rock excavation techniques. Rock excavation may include techniques such as blasting, hoe ram, jack hammering, or other means.

In light of the above discussion, we recommend that the Contract Documents include a unit price for removal and disposal of materials and obstructions that can not be excavated with conventional heavy-duty excavating equipment. The conventional heavy-duty excavating equipment may be defined as a Caterpillar D-8R bulldozer with single tooth ripper, a Caterpillar 330B track excavator equipped with a 36-inch bucket and rock teeth, or equipment of similar power and capability. Rock excavation volumes should be determined based on in-place measurements obtained via cross sectioning.

Foundation Excavations

All foundation excavations should be observed by the Geotechnical Engineer to verify suitable bearing. Concrete should be placed in foundation excavations expeditiously following final clean up and approval to limit changes in foundation conditions. Foundation excavations should be clean and dry at the time of concrete placement.

Grubbs, Hoskyn, Barton & Wyatt, LLC. should be retained to review final design plans to insure the intent of this report was properly implemented. The conclusions and recommendations of this report should then be reviewed in light of the new information. Additionally, Grubbs, Hoskyn, Barton & Wyatt, LLC. should be retained to provide testing and observation during excavation, grading, and construction phases of the project based upon our familiarity with the project, the subsurface conditions, and the intent of the recommendations and design.

CLOSING

The Owner or a designated representative should monitor site grading, subgrade preparation, and foundation construction. Subsurface conditions significantly at variance with those encountered in the borings should be brought to the attention of the Geotechnical Engineer and work delayed pending evaluation and/or preparation of additional recommendations, if warranted.

The following attachments are included and complete this report.

Appendix A	Boring Logs from Preliminary Study
Appendix B	Boring Logs from Current Study
Appendix C	Piezometer Groundwater Measurements
Appendix D	Classification Test Results
Appendix E	Analytical Test Results
Appendix F	Subgrade Improvement Concept

* * * *

We appreciate the opportunity to be of service to you during this phase of the project. Should you have any questions regarding this report, or if we may be of additional assistance during final design or construction, please call on us.

Sincerely,

GRUBBS, HOSKYN,
BARTON & WYATT, LLC dba UES

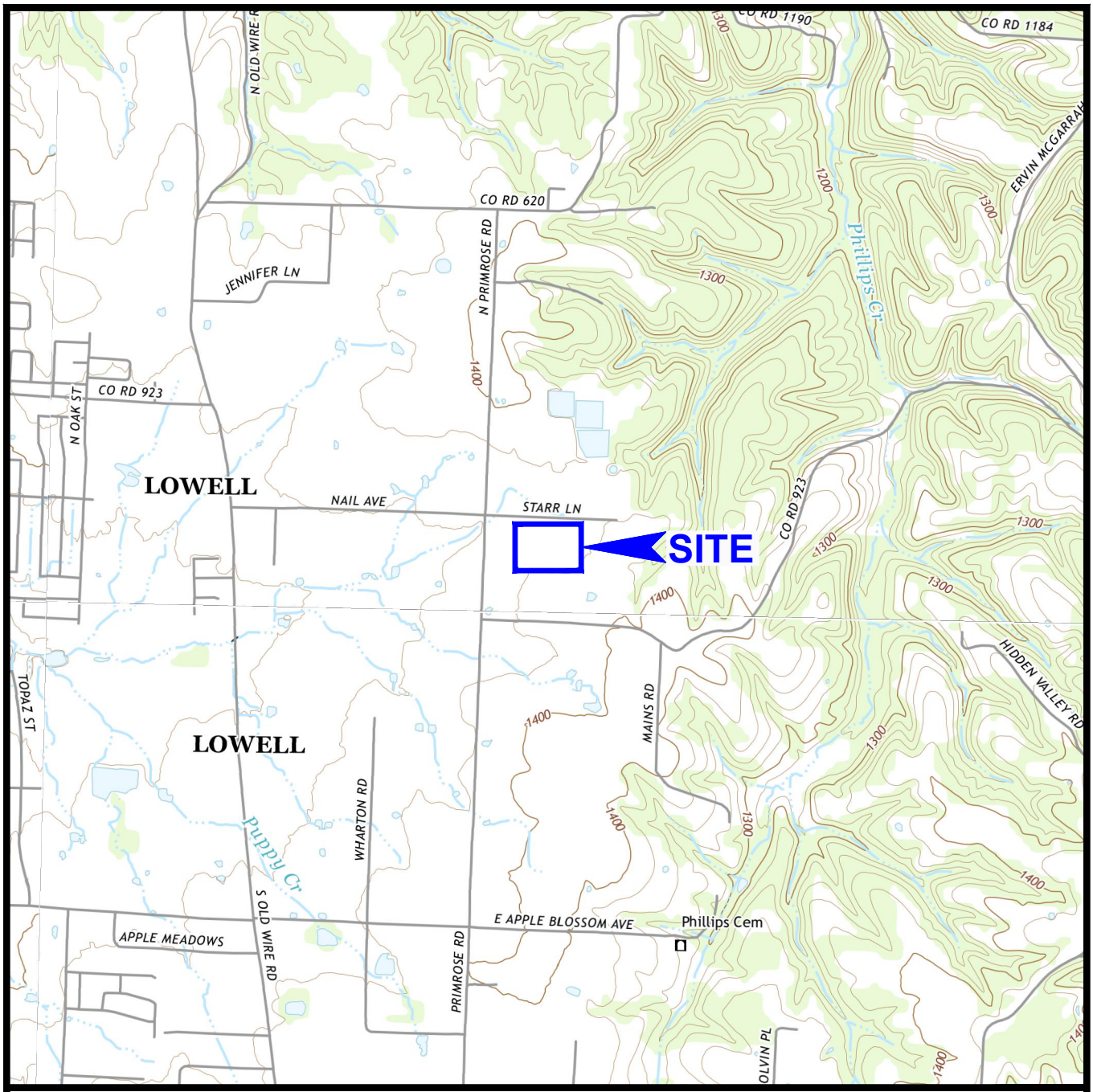
Velleta M. Scott, P.E.
Sr. Project Engineer

Subra T. Bhat, Ph.D., P.E.
Vice President/Branch Manager of Springdale Office

VMS/STB:jw

Copies submitted: Black & Veatch Corporation
Attn: Mr. Andrew Hansen, P.E. (email)
Attn: Mr. Matt Richart, P.E. (email)
Attn: Mr. Tim Malcolm, P.E. (email)

APPENDIX A



NOTES

1. Plan adapted from 7.5 minute U.S.G.S. maps for Rogers, Springdale, Sonoma, and Bentonville South, Arkansas quadrangles, last revised in 2020.

0 2,000 4,000

SCALE IN FEET

N

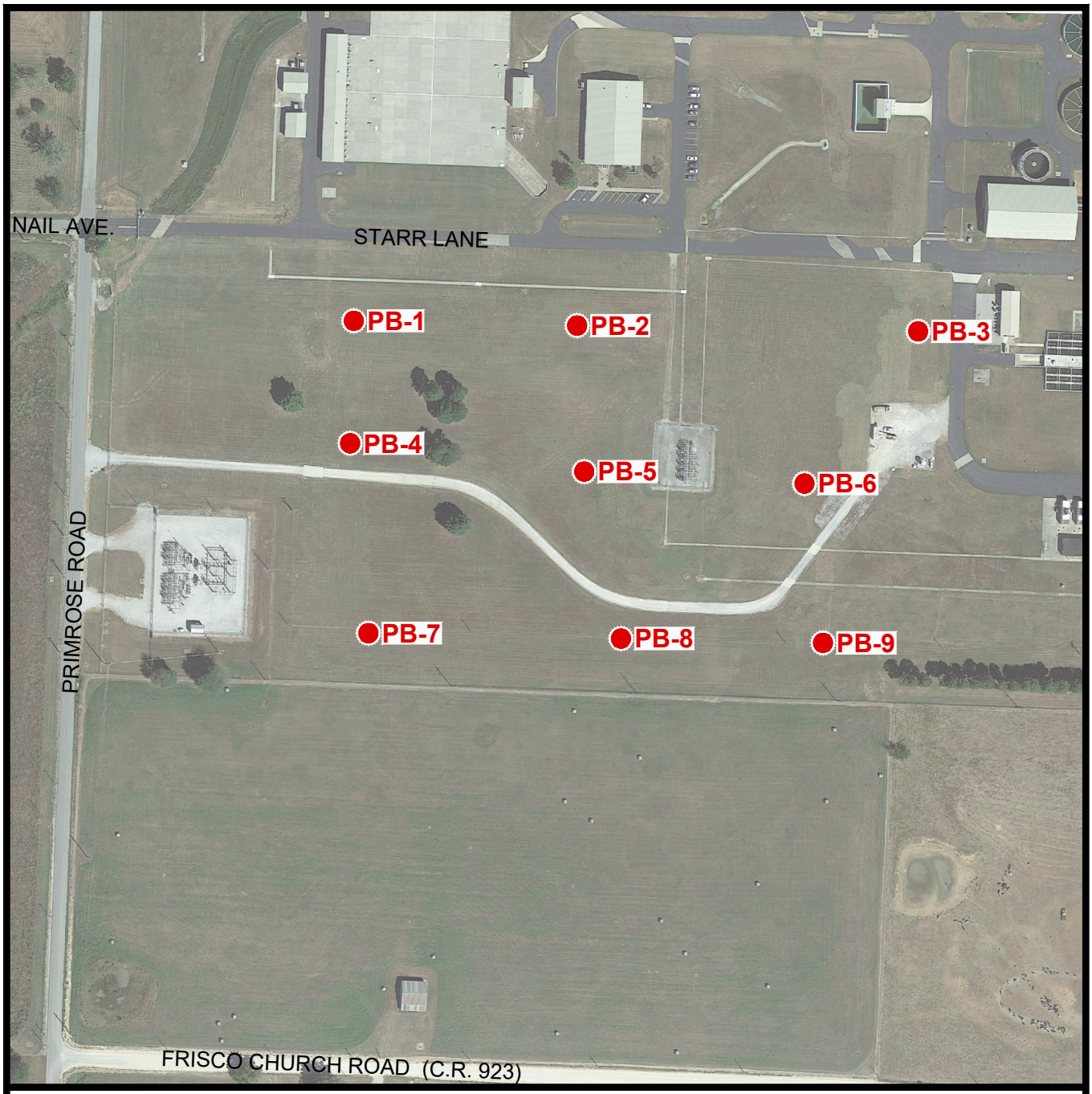
Grubbs, Hoskyn, Barton & Wyatt, LLC
CONSULTING ENGINEERS
A UES Company

BWD Plant Expansion
Lowell, Arkansas

SITE LOCATION AND TOPOGRAPHY

Project Number
23-0104

FIGURE 1



NOTES

1. Plan adapted from a September 7, 2021 aerial photograph courtesy of Google Earth.

2. Borings were located in the field with reference to site features and are shown approximate only.

LEGEND

● Boring Location

0 250 500

SCALE IN FEET

N

Grubbs, Hoskyn, Barton & Wyatt, LLC
CONSULTING ENGINEERS
A UES Company

BWD Plant Expansion
Lowell, Arkansas

AERIAL PHOTOGRAPH OF SITE AND BORING LOCATIONS

Project Number
23-0104

FIGURE 2

Surface Elevation: **1364.8** Datum **N/A**

Completion Date: **11/21/23**

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Topsoil: ~ 6 inches	1-4-9	SS1
		Stiff, brown, clayey SILT (CL-ML), some chert	3-3-6	SS2
5	1360	Very stiff to hard, sandy, LEAN CLAY (CL)	3-6-10	SS3
		Hard, red-brown, sandy CLAY (CL), with numerous chert fragments	50/5	SS4
10	1355	Very stiff to hard, red-brown, sandy CLAY (CL), with numerous chert fragments	5-12-15	SS5
15	1350		8-26-50/5	SS6
20	1345	Stiff, red-brown, sandy CLAY (CL), some chert	9-7-7	SS7
25	1340	Very stiff to hard, red-tan, sandy CLAY (GC), with numerous, highly weathered chert fragments.	3-21-8	SS8
30	1335		8-21-17	SS9
35	1330	Very stiff, red-tan, sandy CLAY (CL), with numerous, slightly weathered chert fragments.	11-10-14	SS10
40	1325	Soft to medium stiff, red-tan, sandy CLAY (GC), with numerous, highly weathered chert fragments.	1-3-1	SS11
45	1320		2-3-1	SS12
50	1315	Hard, red-tan, sandy CLAY (CL), with numerous, highly weathered chert fragments.	10-13 -50/5	SS13
			50/5	SS14
		Auger refusal at 53 feet.		

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

S-5"

76

5274"

80

51316"

101

S-5"

GROUNDWATER DATA

ENCOUNTERED AT 33.5 FEET ▽

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM

WASHBORING FROM 40 FEET

BMF DRILLER BWF LOGGER

CME550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: TRS	Checked by:	App'vd. by:
Date: 11/22/23	Date:	Date:

UES™

BWD Plant Expansion
Lowell, AR

LOG OF BORING: PB-1

Project No. 23-0104

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020.JDM - ELEVATIONS BWD EXPANSION 23-0104 (1).GPJ GTINC 063023.GDT 6/30/23

Figure 3

Surface Elevation: **1368.2** Datum **N/A**

Completion Date: **11/13/23**

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Topsoil: ~ 6 inches	1-3-3	SS1
		Medium stiff, brown, clayey SILT (CL-ML)		
		Very stiff to hard, red-brown, sandy CLAY (CL), with numerous chert fragments	2-10-15	SS2
5	1363		7-15-18	SS3
			19-23-15	SS4
		Hard, red-brown, sandy CLAY (GC), with numerous, slightly weathered chert fragments	12-19-33	SS5
10	1358			
			11-30 -50/4	SS6
15	1353			
		Very stiff. red-tan, sandy CLAY (GC), with numerous, highly weathered chert fragments	7-16-19	SS7
20	1348			
			3-9-13	SS8
25	1343			
			3-5-11	SS9
30	1338			
		Hard,tan-brown, sandy CLAY (GC), with numerous, highly weathered chert fragments	9-13-28	SS10
35	1333			
		Hard,brown-tan, sandy CLAY (GC), with numerous, slightly weathered chert fragments	12-26 -50/5	SS11
40	1328	Boring terminated at 40 feet.		
45	1323			
50	1318			

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

101

77 >>

80

43017"

60

76

52618"

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020.JDM - ELEVATIONS BWD EXPANSION 23-0104 (1).GPJ GTINC 063023.GDT 12/4/23

GROUNDWATER DATA

ENCOUNTERED AT 30 FEET ▽

AT 30 FEET AFTER 24 HOURS ▼

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

BMF DRILLER BWF LOGGER

CME550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: TRS	Checked by:	App'vd. by:
Date: 11/10/23	Date:	Date:

UES™

BWD Plant Expansion
Lowell, AR

LOG OF BORING: PB-2

Project No. 23-0104

Figure 4

Surface Elevation: 1377.3 Datum N/A

Completion Date: 11/13/23

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Topsoil: ~ 6 inches	2-7-9	SS1
		Very stiff, clayey SILT (CL-ML), some chert		
		Medium stiff to stiff, red-brown, sandy CLAY (CL), some chert	3-4-4	SS2
5	1372		3-5-7	SS3
		Soft, brown-red, sandy, FAT CLAY (GC), with numerous chert fragments	1-2-2	SS4
			2-2-2	SS5
10	1367			
		Stiff, red-brown, sandy CLAY (GC), with numerous chert fragments	1-3-10	SS6
15	1362			
		Hard, red-brown, sandy CLAY (GC), with numerous, slightly weathered chert fragments	6-11-20	SS7
20	1357			
		Very stiff,red-tan, sandy CLAY (GC), with numerous, highly weathered chert fragments	3-13-12	SS8
25	1352			
		Stiff, red-tan, sandy, FAT CLAY (GC), with numerous, slightly weathered chert fragments ▽	7-5-4	SS9
30	1347			
		Stiff, red-tan, sandy CLAY (GC), with numerous, highly weathered chert	5-4-11	SS10
35	1342			
			8-5-2	SS11
40	1337	Boring terminated at 40 feet.		
45	1332			
50	1327			

SHEAR STRENGTH, tsf
△ - UU/2 ○ - QU/2 □ - SV
0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE
(ASTM D 1586)
▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %
PL 10 20 30 40 50 LL
95 >>

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020.JDM - ELEVATIONS BWD EXPANSION 23-0104 (1).GPJ GTINC 063003.GDT 12/4/23

GROUNDWATER DATA

ENCOUNTERED AT 30 FEET ▽

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM
WASHBORING FROM ___ FEET
BMF DRILLER BWF LOGGER
CME550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: TRS	Checked by:	App'vd. by:
Date: 11/13/23	Date:	Date:

UES™

BWD Plant Expansion
Lowell, AR

LOG OF BORING: PB-3

Project No. 23-0104

Figure 5

Surface Elevation: **1370.6** Datum **N/A**

Completion Date: **11/9/23**

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Topsoil: ~ 6 inches	2-2-4	SS1
		Medium stiff, brown, clayey SILT (CL-ML) some chert		
		Hard, red-brown, sandy CLAY (GC), with numerous chert fragments	8-24-32	SS2
5	1366	Hard, red-brown, sandy CLAY (GC), with numerous, slighty weathered, chert fragments	50/5	SS3
		Hard, red-brown, sandy CLAY (GC), with numerous chert fragments	13-15-19	SS4
			13-20 -50/3	SS5
10	1361			
		Stiff to very stiff, red-tan-brown, sandy, ELASTIC SILT (GC), with numerous, slighty weathered chert fragments	3-4-9	SS6
15	1356			
			3-4-9	SS7
20	1351			
			3-4-10	SS8
25	1346			
			9-10-14	SS9
30	1341			
		Stiff, red brown, sandy CLAY (GC), with numerous, slighty weathered chert fragments	4-4-10	SS10
35	1336			
		Hard, tan-brown, sandy CLAY (GC), with numerous, highly weathered chert fragments	10-12-33	SS11
40	1331	Boring terminated at 40 feet.		
45	1326			
50	1321			

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

S-5"

70

32019"

79 >>

GROUNDWATER DATA

ENCOUNTERED AT 38.5 FEET ▽

AT 38.5 FEET AFTER 24 HOURS ▼

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

BMF DRILLER BWF LOGGER

CME550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: TRS	Checked by:	App'vd. by:
Date: 11/10/23	Date:	Date:

UES™

BWD Plant Expansion
Lowell, AR

LOG OF BORING: PB-4

Project No. 23-0104

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020.JDM - ELEVATIONS BWD EXPANSION 23-0104 (1).GPJ GTINC 063023.GDT 12/4/23

Figure 6

Surface Elevation: 1372.1 Datum N/A

Completion Date: 11/21/23

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Topsoil: ~ 6 inches	4-4-2	SS1
		Medium stiff, brown, clayey SILT (CL-ML)		
		Medium stiff, red-brown, sandy CLAY (GC), with numerous chert fragments	3-4-5	SS2
5	1367	Stiff, red-brown, silty, LEAN CLAY (CL)	6-17-25	SS3
		Hard, red-brown, sandy CLAY (GC), with numerous chert fragments	50/5	SS4
			12-16-37	SS5
10	1362			
			50/5	SS6
15	1357			
		Very stiff, red-brown, sandy CLAY (GC), with numerous chert fragments	7-12-13	SS7
20	1352			
		Stiff to very stiff, red-brown-tan, sandy CLAY (GC), with numerous, highly weathered chert fragments	3-5-4	SS8
25	1347			
			6-10-12	SS9
30	1342			
		Hard, red-tan, sandy CLAY (GC), with numerous, slightly to highly weathered chert fragments	8-11-50/5	SS10
35	1337			
			8-6-50/1	SS11
40	1332			
			2-2-2	SS12
45	1327			
			1-3-2	SS13
50	1322			
		Auger refusal at 51.5 feet.		

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

S-5"

S-5"

63 >>

81

61 5124"

174"

GROUNDWATER DATA

ENCOUNTERED AT 30.5 FEET ▽

AT 30.5 FEET AFTER 24 HOURS ▽

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM

WASHBORING FROM 40 FEET

BMF DRILLER BWF LOGGER

CME550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: TRS	Checked by:	App'vd. by:
Date: 11/22/23	Date:	Date:

UES™

BWD Plant Expansion
Lowell, AR

LOG OF BORING: PB-5

Project No. 23-0104

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020.JDM - ELEVATIONS BWD EXPANSION 23-0104 (1).GPJ GTINC 063A03.GDT 3/4/24

Figure 7

Surface Elevation: 1376.3 Datum N/A

Completion Date: 11/10/23

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Topsoil: ~ 6 inches	3-6-6	SS1
		Stiff, brown, clayey SILT (CL-ML), some chert		
		Stiff to very stiff, red-brown, silty, LEAN CLAY (CL)	3-5-8	SS2
5	1371		3-6-11	SS3
		Hard, red-brown, sandy CLAY (GC), with numerous, slightly chert fragments	13-50/5	SS4
			9-50/5	SS5
10	1366			
			13-50/5	SS6
15	1361			
		Very stiff to hard, red-tan, sandy CLAY (GC), with numerous, highly weathered chert fragments	6-11-15	SS7
20	1356			
			9-50/5	SS8
25	1351			
		Medium stiff, red-brown, ELASTIC SILT (MH)	1-3-2	SS9
30	1346			
		Very stiff,red-brown, silty CLAY (CL), some chert	21-10-6	SS10
35	1341	Very stiff, tan-brown, sandy CLAY (GC), with numerous, highly weathered chert fragments		
		Medium stiff, tan-brown, sandy CLAY (GC), with numerous, highly weathered chert fragments	2-3-3	SS11
40	1336	Boring terminated at 40 feet.		
45	1331			
50	1326			

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

513"

59"

513"

59"

178 >>

77

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020.JDM - ELEVATIONS BWD EXPANSION 23-0104 (1).GPJ GTINC 063023.GDT 12/4/23

GROUNDWATER DATA

ENCOUNTERED AT 38.5 FEET ▽

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

BMF DRILLER BWF LOGGER

CME550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: TRS	Checked by:	App'vd. by:
Date: 11/10/23	Date:	Date:

UES™

BWD Plant Expansion
Lowell, AR

LOG OF BORING: PB-6

Project No. 23-0104

Figure 8

Surface Elevation: **1376.8** Datum **N/A**

Completion Date: **11/9/23**

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Topsoil: ~ 6 inches	3-3-4	SS1
		Medium stiff, brown, clayey SILT (CL-ML)		
		Hard to very stiff , red-brown, sandy CLAY (GC), with numerous chert fragments	4-33-50/4	SS2
5	1372		13-15-34	SS3
			30-15-12	SS4
		Hard, red-brown, sandy CLAY (GC), with numerous, slightly weathered chert fragments	6-15-12	SS5
10	1367			
		Stiff to very stiff, red-brown, sandy, FAT CLAY (GC), with numerous, slightly weathered chert fragments	3-8-7	SS6
15	1362			
			6-10-13	SS7
20	1357			
		Stiff to very stiff to hard, brown-red,tan, sandy SILT (GM), with numerous, highly weathered chert fragments	3-4-7	SS8
25	1352			
			3-4-11	SS9
30	1347			
			10-21-7	SS10
35	1342			
			10-11 -50/3	SS11
40	1337	Boring terminated at 40 feet.		
45	1332			
50	1327			

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

83

4340"

73

>>

80

61

31116"

GROUNDWATER DATA

ENCOUNTERED AT 38.5 FEET ▽

AT 38.5 FEET AFTER 24 HOURS ▽

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

BMF DRILLER BWF LOGGER

CME550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: TRS	Checked by:	App'vd. by:
Date: 11/10/23	Date:	Date:

UES™

BWD Plant Expansion
Lowell, AR

LOG OF BORING: PB-7

Project No. 23-0104

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020.JDM - ELEVATIONS. BWD EXPANSION 23-0104 (1).GPJ GTINC 063023.GDT 12/4/23

Figure 9

Surface Elevation: **1377.0** Datum **N/A**

Completion Date: **11/10/23**

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD	SAMPLES
		Topsoil: ~ 6 inches	3-4-5	SS1
		Stiff, brown, clayey SILT (CL-ML)		
		Very stiff, red-brown, silty CLAY (CL)	3-7-11	SS2
5	1372	Hard, red-brown, silty CLAY (CL), with some chert	8-33-50/3	SS3
		Very stiff to hard, red-brown, sandy, FAT CLAY (GC), with numerous chert fragments	4-11-17	SS4
10	1367		12-50/5	SS5
15	1362	Very stiff, red-brown, sandy CLAY (GC), with numerous, slightly weathered chert fragments	14-17-10	SS6
20	1357	Very stiff to hard, red-brown, sandy CLAY (GC), with numerous chert fragments.	4-8-13	SS7
25	1352		5-6-29	SS8
30	1347	Very stiff, red-tan, sandy CLAY (CL), some chert	4-8-8	SS9
35	1342	Stiff to medium stiff, brown-tan, sandy CLAY (GC), with numerous, highly weathered chert fragments	8-7-7	SS10
40	1337		4-3-3	SS11
45	1332		3-4-3	SS12
50	1327	Boring terminated at 50 feet.	5-6-1	SS13

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

83

334 77 >>

512"

80

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 38.5 FEET ▽

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

BMF DRILLER BWF LOGGER

CME550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: TRS	Checked by:	App'vd. by:
Date: 11/10/23	Date:	Date:

UES™

BWD Plant Expansion
Lowell, AR

LOG OF BORING: PB-8

Project No. 23-0104

LOG OF BORING 2020.JDM - ELEVATIONS BWD EXPANSION 23-0104 (1).GPJ GTINC 063023.GDT 7/6/23

Figure 10

Surface Elevation: **1379.5** Datum **N/A**

Completion Date: **11/21/23**

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Topsoil: ~ 6 inches	2-4-5	SS1
		Stiff, brown, clayey SILT (CL-ML)		
		Hard,red-brown, sandy CLAY (GC), numerous chert fragments	6-21-21	SS2
5	1375		3-6-10	SS3
			14-50/5	SS4
		Very stiff to hard, red-brown, sandy CLAY (GC), numerous chert fragments	3-8-9	SS5
10	1370			
			50/5	SS6
15	1365			
			50/5	SS7
20	1360			
			7-23-19	SS8
25	1355			
			50/5	SS9
30	1350			
			8-23-50/4	SS10
35	1345			
		Very stiff, red-brown, sandy CLAY (GC), numerous chert fragments	3-9-13	SS11
40	1340	Boring terminated at 40 feet.		
45	1335			
50	1330			

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

514"

S-5"

S-5"

S-5"

73

4244"

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020.JDM - ELEVATIONS BWD EXPANSION 23-0104 (1).GPJ GTINC 063003.GDT 12/4/23

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

BMF DRILLER BWF LOGGER

CME550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: TRS	Checked by:	App'vd. by:
Date: 11/22/23	Date:	Date:

UES™

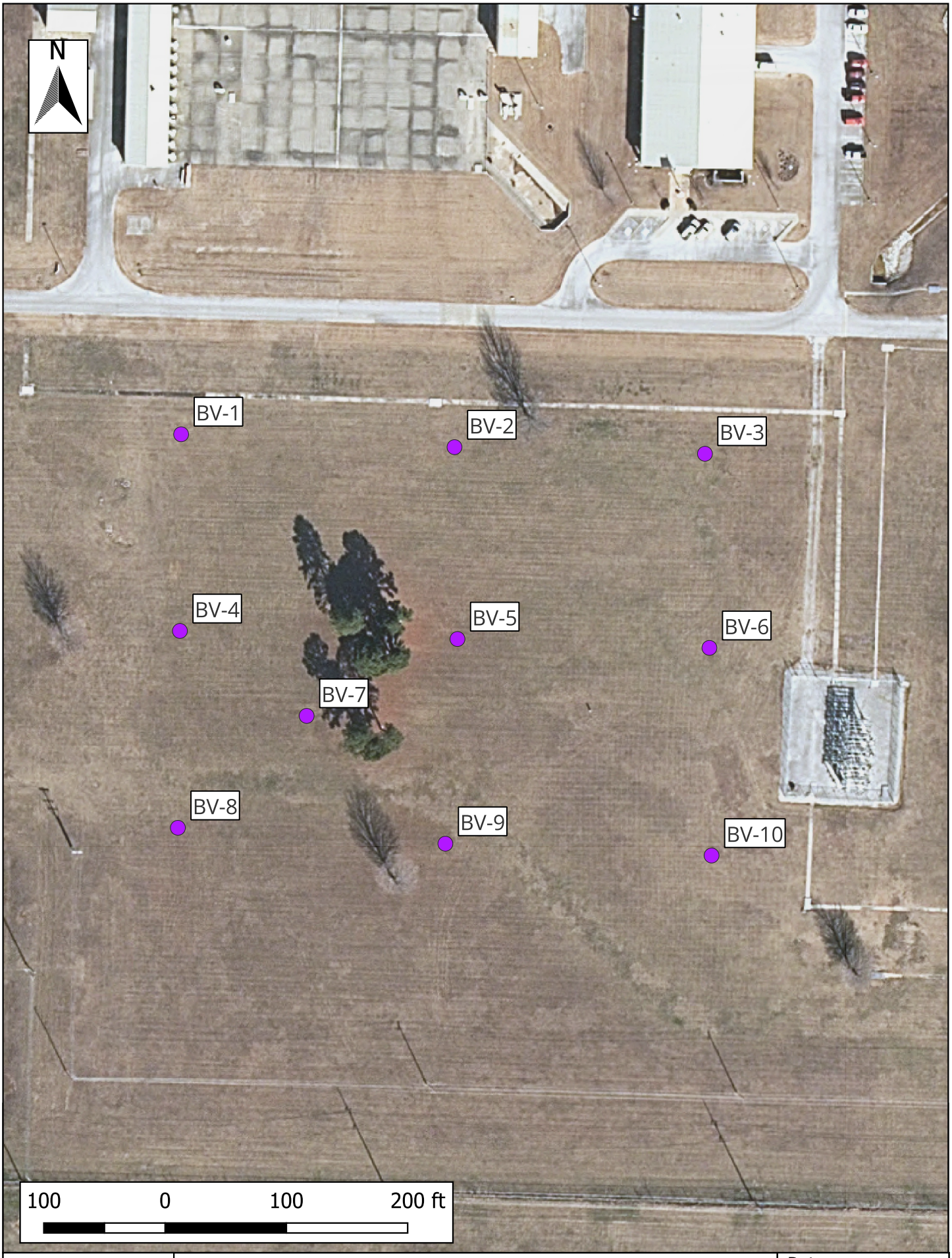
BWD Plant Expansion
Lowell, AR

LOG OF BORING: PB-9

Project No. 23-0104

Figure 11

APPENDIX B



UES™

Clearwell Boring Map

Beaver Water District
Benton County, Arkansas

Date:
04-12-24

Job No:
23-0104

Figure 1

Surface Elevation: 1364.6
Datum N/A
Completion Date: 4/4/24
Lat: 36.253132
Long: -94.104305

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Stiff, tan, silty CLAY (CL), trace chert gravel	1-5-9	SS1
		Medium stiff to very stiff, red and gray, silty CLAY (CL)	3-2-3	SS2
5	1360		3-5-14	SS3
		Very stiff to hard, red, CLAY (CH), with chert gravel	17-15-13	SS4
10	1355		18-17-15	SS5
		Stiff, red, silty CLAY (CL), with chert gravel 51.6% passed 200 sieve	2-5-8	SS6
15	1350			
		Very stiff, dark red, CLAY (CH), little chert gravel	2-12-6	SS7
20	1345			
		Stiff to very stiff, red-orange and white, sandy CLAY (CL), little chert gravel 48.4% passed 200 sieve	2-4-8	SS8
25	1340			
			8-6-16	SS9
30	1335			
		Very stiff, orange and white, clayey GRAVEL (GC) 14.1% passed 200 sieve	7-13-7	SS10
35	1330			
		Medium stiff, red-orange to dark red, sandy CLAY (CL), with limestone and chert gravel	2-1-7	SS11
40	1325			
			2-2-3	SS12
45	1320			
		Medium stiff, red-brown, sandy CLAY (CL), with chert gravel	2-2-6	SS13
50	1315			
		Auger refusal at 53 feet.		
55	1310			
60	1305			

SHEAR STRENGTH, tsf
Δ - UU/2 ○ - QU/2 □ - SV
0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE
(ASTM D 1586)
▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %
PL 10 20 30 40 50 LL

76
62

GROUNDWATER DATA

ENCOUNTERED AT 48.5 FEET ▽

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM
WASHBORING FROM ___ FEET
BF DRILLER MSE LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 4/8/24	Date:	Date:

UES™

Beaver Water District Clearwell
Lowell, AR

LOG OF BORING: BV-1

Project No. 23-0104

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020 JDM - ELEVATIONS CLEARWELL.GPJ GTINC 0638301.GPJ 5/16/24

Figure 2

Surface Elevation: 1366.6
Datum N/A
Completion Date: 3/28/24
Lat: 36.25311
Long: -94.10354

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Very stiff, brown, silty CLAY(CL), 8 inches of topsoil	1-9-9	SS1
		Stiff, red and gray, silty CLAY (CL)	3-5-4	SS2
5	1362	Hard, red-orange, silty CLAY (CL), with chert gravel	10-31 -50/4	SS3
		Hard, red, silty CLAY (CL), some chert gravel	8-22-17	SS4
10	1357		5-50/2	SS5
15	1352		50/4	SS6
20	1347	Hard, red-orange, sandy CLAY (CH), with chert gravel	11-24-7	SS7
25	1342	Stiff, red-orange, CLAY (CH), trace chert gravel 75.5% passed 200 sieve	7-6-3	SS8
30	1337	Stiff, orange-tan, clayey SAND (SC), some limestone and chert gravel 44.8% passed 200 sieve	6-9-4	SS9
35	1332	Medium stiff, tan, gravelly SAND (SW) 30.7% passed 200 sieve ▽	3-4-4	SS10
40	1327	Hard, dark red, fat CLAY (CH), trace limestone and chert gravel	4-3-50/6	SS11
		Boring terminated at 40 feet.		
45	1322			
50	1317			
55	1312			
60	1307			

SHEAR STRENGTH, tsf
Δ - UU/2 ○ - QU/2 □ - SV
0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE
(ASTM D 1586)
▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %
PL 10 20 30 40 50 LL

81
43116"
25"
S-4"
60
640"

GROUNDWATER DATA

ENCOUNTERED AT 34.5 FEET ▽

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM
WASHBORING FROM ___ FEET
BF DRILLER MSE LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 4/2/24	Date:	Date:

UES™

Beaver Water District Clearwell
Lowell, AR

LOG OF BORING: BV-2

Project No. 23-0104

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020.JDM - ELEVATIONS CLEARWELL.GPJ GTINC.0638301.GPJ 5/16/24

Figure 3

Surface Elevation: 1368.7
Datum N/A
Completion Date: 4/3/24
Lat: 36.253102
Long: -94.102839

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Very stiff, light brown to tan, silty CLAY (CL), trace chert gravel	2-8-8	SS1
		Very stiff, light brown, gray, and orange, silty CLAY, (CL) trace chert gravel	3-6-13	SS2
5	1364	Hard, red, silty CLAY (CL), with chert gravel	5-21-38	SS3
			9-18-50/5	SS4
10	1359		10-50/3	SS5
15	1354		6-19 -50/4.5	SS6
20	1349	Stiff, red and orange, sandy CLAY (CL), little chert gravel	8-7-6	SS7
25	1344	Stiff, red and orange, clayey SAND (SC), some chert gravel	4-6-7	SS8
30	1339	Very stiff, red and orange, sandy GRAVEL (GC)	4-6-10	SS9
35	1334	Stiff, tan to light brown, sandy CLAY (CH), with limestone and chert gravel 43.1% passed 200 sieve	8-4-7	SS10
40	1329		7-7-7	SS11
45	1324	Medium stiff, tan, lean to fat CLAY (CH)	1-2-3	SS12
		Auger refusal at 46.5 feet		
50	1319	Moderately fractured, thinly laminated, hard, unweathered, gray to white, LIMESTONE PSI: 18,500 Unit Weight: 149.6	100% 79%	NQ1
55	1314	PSI: 7940 lb Unit Weight: 157 lb	100% 64%	NQ2
60	1309	Boring terminated at 56.5 feet.		

SHEAR STRENGTH, tsf
Δ - UU/2 ○ - QU/2 □ - SV
0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE
(ASTM D 1586)
▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %
PL 10 20 30 40 50 LL

68
5195"
310"
69
10.5196"
157
>>

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020.JDM - ELEVATIONS CLEARWELL.GPJ GTINC.0638301.GPJ 5/16/24

GROUNDWATER DATA

ENCOUNTERED AT 33 FEET ▽

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM
WASHBORING FROM ___ FEET
BF DRILLER MSE LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 4/3/24	Date:	Date:

UES™

Beaver Water District Clearwell
Lowell, AR

LOG OF BORING: BV-3

Project No. 23-0104

Figure 4

Surface Elevation: 1369.3

Datum N/A

Completion Date: 4/2/24

Lat: 36.252687

Long: -94.104302

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Stiff, light brown-orange, silty CLAY (CL), trace chert gravel 4 inches of topsoil	1-3-6	SS1
			4-6-14	SS2
5	1364	Very stiff, light brown-tan, sandy CLAY (CL), little chert gravel	12-14-23	SS3
		Hard, white and red, silty CLAY (CL), with chert gravel	8-18-14	SS4
10	1359	Hard to very stiff, red to red-orange, sandy CLAY (CH), with chert gravel	6-22-50/3	SS5
15	1354		6-13-19	SS6
20	1349	Very stiff, orange to white, sandy CLAY (CL), with limestone and chert gravel	9-5-20	SS7
25	1344		4-12-7	SS8
30	1339		13-15-15	SS9
35	1334	Very stiff, tan to white, sandy GRAVEL (GM)	9-7-10	SS10
40	1329	Very stiff, tan to white, clayey SAND (SC), with limestone and chert gravel 36.4% passed 200 sieve	5-5-16	SS11
45	1324	Hard, tan to white, sandy GRAVEL (GM) Auger refusal at 44 feet.	50/2	SS12
50	1319			
55	1314			
60	1309			

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

72

3232"

S-2"

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020 JDM - ELEVATIONS CLEARWELL.GPJ GTINC 0638301.GPJ 5/16/24

GROUNDWATER DATA

ENCOUNTERED AT 34 FEET ▽

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

BF DRILLER MSE LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 4/2/24	Date:	Date:

UES™

Beaver Water District Clearwell
Lowell, AR

LOG OF BORING: BV-4

Project No. 23-0104

Figure 5

Surface Elevation: 1369.6
Datum N/A
Completion Date: 4/3/24
Lat: 36.252676
Long: -94.103526

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Medium stiff, light brown, silty CLAY (CL)	1-1-2	SS1
		Stiff to hard, red, brown, and gray, lean to fat CLAY (CL and CH), little chert gravel	1-4-5	SS2
5	1365		3-6-8	SS3
			6-50/5	SS4
10	1360		50/5	SS5
15	1355	Hard, red-orange, sandy CLAY (CL), with chert gravel 33.6% passed 200 sieve	9-17-50/5	SS6
20	1350	Stiff, dark red, CLAY (CH), trace chert gravel	4-4-7	SS7
25	1345	Very stiff, orange to red, sandy CLAY (CL), little chert gravel	9-11-10	SS8
30	1340		4-5-14	SS9
35	1335	Stiff, dark red to white CLAY (CH), trace chert gravel 56.5% passed 200 sieve	6-5-8	SS10
40	1330	Very stiff, red and gray, sandy CLAY (CH), some limestone and chert gravel	8-5-11	SS11
45	1325	Medium stiff, red to tan, lean to fat CLAY (CL and CH), little limestone and chert gravel	1-2-3	SS12
50	1320	Auger refusal at 52 feet 54.6% passed 200 sieve	4-5-2	SS13
55	1315	Moderately fractured, thinly laminated, hard, unweathered, white to gray, bioclastic LIMESTONE PSI: 6380 lb Unit Weight: 162.7	99% 75%	NQ1
60	1310	PSI: 16,990 lb Unit Weight: 149.3	100% 81%	NQ2
			100%/75%	NQ3
		Boring terminated at 62 feet.		

SHEAR STRENGTH, tsf
Δ - UU/2 ○ - QU/2 □ - SV
0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE
(ASTM D 1586)
▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %
PL 10 20 30 40 50 LL

56"
S-5"
67
5185"
60
>>
77
66
>>

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020.JDM - ELEVATIONS CLEARWELL.GPJ GTINC.0638301.GPJ 5/16/24

GROUNDWATER DATA

ENCOUNTERED AT 39 FEET ▽

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM
WASHBORING FROM ___ FEET
BF DRILLER MSE LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 4/3/24	Date:	Date:

UES™

Beaver Water District Clearwell
Lowell, AR

LOG OF BORING: BV-5

Project No. 23-0104

Figure 6

Surface Elevation: 1371.1

Datum N/A

Completion Date: 4/4/24

Lat: 36.252662

Long: -94.102821

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Medium stiff, brown, silty CLAY (CL)	1-2-3	SS1
		Medium stiff, tan, lean CLAY (CL)	1-2-2	SS2
5	1366	Hard, orange-white and red, sandy CLAY (CL), some chert gravel	8-34-38	SS3
		Hard, red, CLAY (GC)), with chert	7-25 -50/5.5	SS4
		gravel 44.7% passed 200 sieve	6-23-50/4	SS5
10	1361			
			5-16-50/5	SS6
15	1356			
		Hard, red-orange, sandy CLAY (CL), with chert gravel	5-16 -50/5.5	SS7
20	1351			
		Medium stiff, red, silty CLAY (CL), some chert gravel	2-2-3	SS8
25	1346			
		Stiff, white to red, silty CLAY (CL), with limestone and chert gravel	4-4-6	SS9
30	1341			
		Stiff to very stiff, tan, sandy CLAY (GC), with limestone and chert gravel 17.7% passed 200 sieve	6-10-8	SS10
35	1336			
			3-7-7	SS11
40	1331	Boring terminated at 40 feet.		
45	1326			
50	1321			
55	1316			
60	1311			

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

72

75

11.5257"

81

>>

4242

66

5171"

66

11.5165"

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

BF DRILLER MSE LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 4/8/24	Date:	Date:

UES™

Beaver Water District Clearwell
Lowell, AR

LOG OF BORING: BV-6

Project No. 23-0104

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020 JDM - ELEVATIONS CLEARWELL.GPJ GTINC 0638301.GPJ 5/16/24

Figure 7

Surface Elevation: 1370.6

Datum N/A

Completion Date: 3/26/24

Lat: 36.252498

Long: -94.103945

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Medium stiff, brown-tan, silty CLAY (CL)	2-2-2	SS1
		Hard, red-tan, sandy CLAY (CH), some chert gravel	2-29-27	SS2
5	1366	Hard to very stiff, red, silty CLAY (GC), some chert gravel	2-17-17	SS3
			3-21-21	SS4
10	1361		8-17-21	SS5
15	1356	36.5% passed 200 sieve	7-11-21	SS6
20	1351		4-8-11	SS7
25	1346	Very stiff to stiff, red, sandy CLAY (CL), some chert gravel 54.7% passed 200 sieve	10-7-6	SS8
30	1341		7-11-7	SS9
35	1336	Very stiff, red, CLAY (CH), little limestone gravel	6-7-11	SS10
40	1331	Medium stiff, tan, gravelly SAND (SW) ▽	2-2-3	SS11
45	1326	Hard, tan, SAND (SP)	50/3	SS12
		Boring terminated at 45 feet.		
50	1321			
55	1316			
60	1311			

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

76 >>

85 >>

72 >>

73

62

S-3"

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020.JDM - ELEVATIONS CLEARWELL.GPJ GTINC.0638301.GPJ 5/16/24

GROUNDWATER DATA

ENCOUNTERED AT 40 FEET ▽

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

William DRILLER Floyd LOGGER

CME 750 DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 3/27/24	Date:	Date:

UES™

Beaver Water District Clearwell
Lowell, AR

LOG OF BORING: BV-7

Project No. 23-0104

Figure 8

Surface Elevation: 1372.9
Datum N/A
Completion Date: 4/2/24
Lat: 36.252241
Long: -94.104301

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Stiff, brown to orange, silty CLAY (CL), trace chert gravel 5 inches of topsoil	2-3-6	SS1
		Hard, red to white, gravelly SAND (SW)	5-22-26	SS2
5	1368	Hard, red-orange, silty CLAY (CL), with chert gravel	5-50/5.5	SS3
		Hard, dark red, CLAY (CH), some chert gravel	21-17-28	SS4
10	1363	Hard, red to orange, sandy CLAY (CH), little chert gravel 48% passed 200 sieve	13-21-26	SS5
15	1358	Hard, white to tan, silty CLAY (CL), with chert gravel	50/4	SS6
20	1353	Very stiff to stiff, red to orange, sandy CLAY (CL), some to trace limestone and chert gravel 41.7% passed 200 sieve	3-14-9	SS7
25	1348		4-5-8	SS8
30	1343		11-11-9	SS9
35	1338	Stiff, dark red to orange, fat CLAY (CH), some limestone and chert gravel	9-6-6	SS10
40	1333	Medium stiff, brown, sandy GRAVEL (GC)	6-5-3	SS11
		Auger refusal at 42 feet		
45	1328	Moderately to slightly fractured, thinly laminated, hard, unweathered, white to gray, LIMESTONE PSI: 9320 lb Unit Weight: 164.5	80% 73%	NQ1
50	1323		100% 93%	NQ2
		Boring terminated at 52 feet.		
55	1318			
60	1313			

SHEAR STRENGTH, tsf
Δ - UU/2 ○ - QU/2 □ - SV
0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE
(ASTM D 1586)
▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %
PL 10 20 30 40 50 LL

5.55"
S-4"
65 >>

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020.JDM - ELEVATIONS CLEARWELL.GPJ GTINC.0638301.GPJ 5/16/24

GROUNDWATER DATA

ENCOUNTERED AT 39 FEET ▽

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM
WASHBORING FROM ___ FEET
BF DRILLER MSE LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 4/2/24	Date:	Date:

UES™

Beaver Water District Clearwell
Lowell, AR

LOG OF BORING: BV-8

Project No. 23-0104

Figure 9

Surface Elevation: 1373.5

Datum N/A

Completion Date: 3/26/24

Lat: 36.252212

Long: -94.103553

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Medium stiff, brown-tan, silty CLAY (CL)	3-3-4	SS1
		Hard, orange, clayey SAND (SC), little chert gravel 44.8% passed 200 sieve	7-22-27	SS2
5	1369	Hard, red, gravelly SAND (SW)	11-50/3	SS3
		Hard to stiff, red, CLAY (CH), some chert gravel	9-9-11	SS4
10	1364		8-19-12	SS5
15	1359		5-6-8	SS6
		55.5% passed 200 sieve	5-5-6	SS7
20	1354			
		Very stiff to stiff, white-orange, sandy CLAY (CL), some limestone gravel	6-8-8	SS8
25	1349			
30	1344		5-5-7	SS9
		Very stiff, red, silty CLAY(CL), some chert gravel	4-10-9	SS10
35	1339			
		Stiff to hard, tan, gravelly SAND (GW) 23.3% passed 200 sieve ▽	1-1-2	SS11
40	1334			
45	1329		5-8-6	SS12
			1-50/2	SS13
50	1324	Boring terminated at 50 feet.		
55	1319			
60	1314			

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

311"

60

21"

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020.JDM - ELEVATIONS CLEARWELL.GPJ GTINC.0638301.GPJ 5/16/24

GROUNDWATER DATA

ENCOUNTERED AT 40 FEET ▽

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

William DRILLER Floyd LOGGER

CME 750 DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 3/27/24	Date:	Date:

UES™

Beaver Water District Clearwell
Lowell, AR

LOG OF BORING: BV-9

Project No. 23-0104

Figure 10

Surface Elevation: 1374.7

Datum N/A

Completion Date: 3/28/24

Lat: 36.252192

Long: -94.102808

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Medium stiff, red, silty CLAY (CL), little chert gravel No topsoil present	3-4-4	SS1
			2-3-3	SS2
5	1370	Medium stiff to stiff, brown-tan and red, silty CLAY (CL), some to trace chert gravel	2-3-7	SS3
		Hard, red-orange, sandy CLAY, with chert gravel 48.7% passed 200 sieve	5-17-23	SS4
10	1365	Hard, red to white, silty CLAY (CL), with chert gravel	6-21-18	SS5
15	1360		10-33 -50/2	SS6
20	1355	Hard to stiff, red-orange, sandy CLAY (CH), with chert gravel	8-16-23	SS7
25	1350	41.6% passed 200 sieve	4-6-7	SS8
30	1345		7-14-16	SS9
35	1340	Hard, orange-white, gravelly SAND (SW)	8-20-14	SS10
40	1335	38.8% passed 200 sieve	5-17-23	SS11
45	1330	Very stiff to stiff, white-tan, sandy CLAY (CL), with limestone and chert gravel	10-9-8	SS12
50	1325	Boring terminated at 50 feet.	4-4-5	SS13
55	1320			
60	1315			

GRAPHIC LOG

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

83

23316"

61

>>

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2020.JDM - ELEVATIONS CLEARWELL.GPJ GTINC.0638301.GPJ 5/16/24

GROUNDWATER DATA

ENCOUNTERED AT 49 FEET ▽

DRILLING DATA

3 3/4 AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

BF DRILLER MSE LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 4/2/24	Date:	Date:

UES™

Beaver Water District Clearwell
Lowell, AR

LOG OF BORING: BV-10

Project No. 23-0104

Figure 11

APPENDIX C

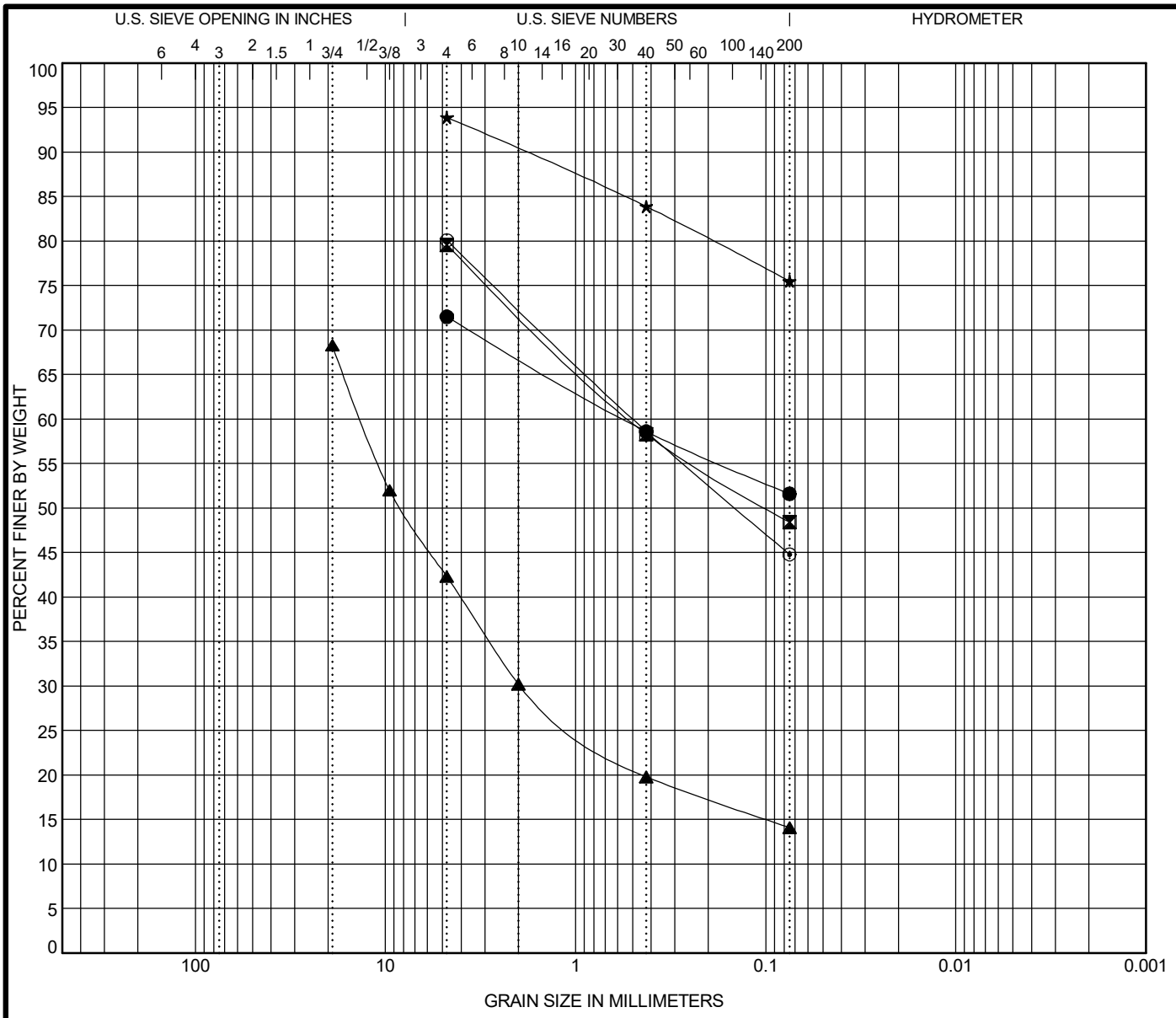
SUMMARY of PIEZOMETER READINGS BV-1

PROJECT: Clearwell - Beaver Water District LOCATION: Lowell, Arkansas

JOB No.: 23-0104

Date	Surface Elevation (ft)	Depth from surface (ft)	Elevation of groundwater
4/15/2024	1364.6	27.08	1337.52
4/22/2024	1364.6	27.42	1337.18
4/29/2024	1364.6	27.33	1337.27
5/16/2024	1364.6	27.67	1336.93
5/30/2024	1364.6	28.67	1335.93
6/10/2024	1364.6	29.33	1335.27
7/1/2024	1364.6	30.58	1334.02

APPENDIX D



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	BV-01	13.5						
⊠	BV-01	23.5	SILTY SAND with GRAVEL(SM)	47	29	18		
▲	BV-01	33.5	CLAYEY GRAVEL with SAND(GC)	43	24	19		
★	BV-02	23.5	FAT CLAY with SAND(CH)	60	24	36		
⊙	BV-02	28.5						

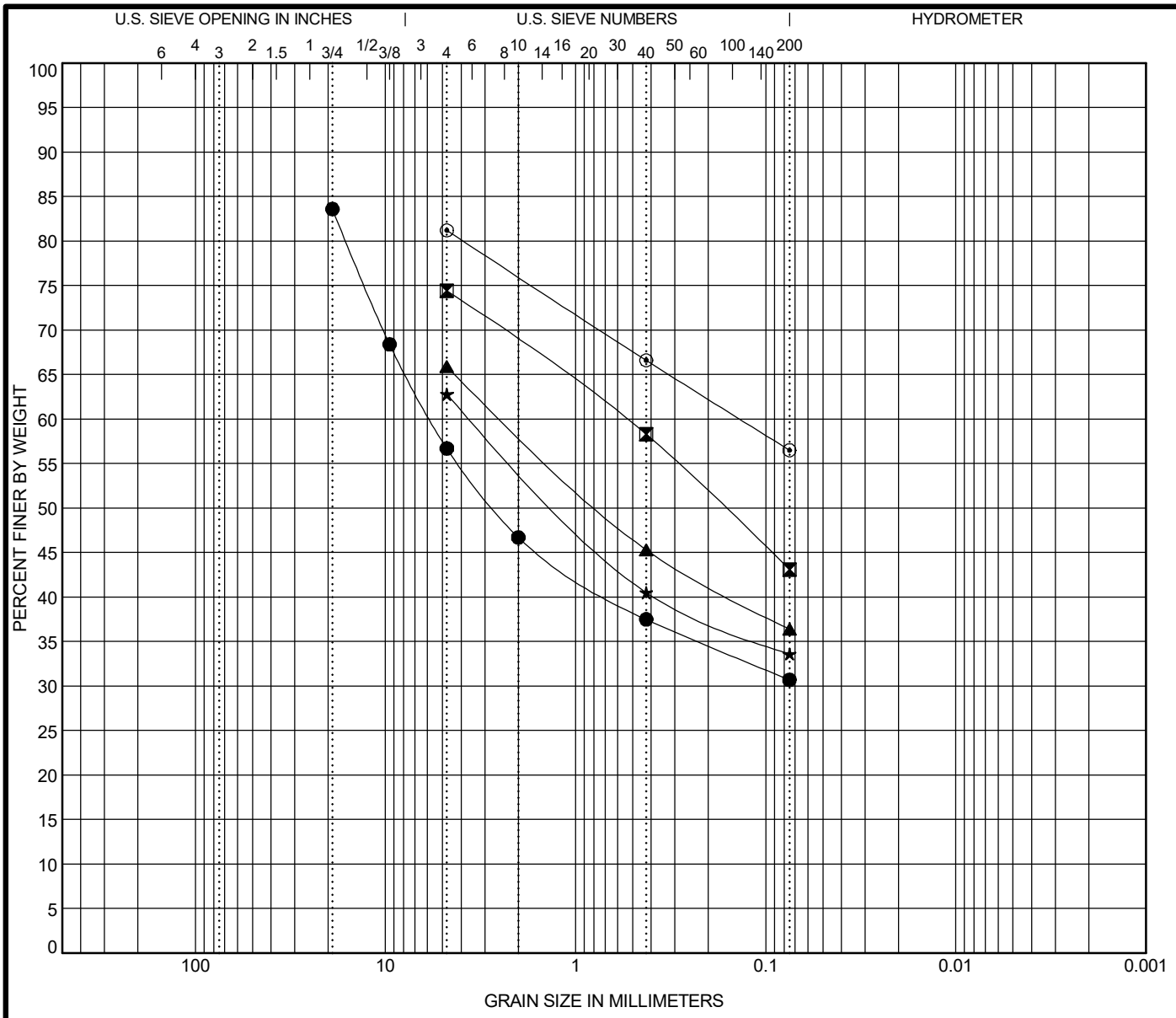
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BV-01	13.5	4.75	0.552			0.0	19.9	51.6	
⊠	BV-01	23.5	4.75	0.515			0.0	31.2	48.4	
▲	BV-01	33.5	19	13.35	1.941		26.0	28.2	14.1	
★	BV-02	23.5	4.75				0.0	18.4	75.5	
⊙	BV-02	28.5	4.75	0.497			0.0	35.3	44.8	

UES™

GRAIN SIZE DISTRIBUTION

Beaver Water District Clearwell
Lowell, AR
23-0104

US GRAIN SIZE CLEARWELL.GPJ US LAB.GDT 6/14/24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	BV-02	33.5						
⊠	BV-03	33.5						
▲	BV-04	38.5						
★	BV-05	13.5						
⊙	BV-05	33.5	**SANDY FAT CLAY with GRAVEL(CH)**	**57**	**20**	**37**		

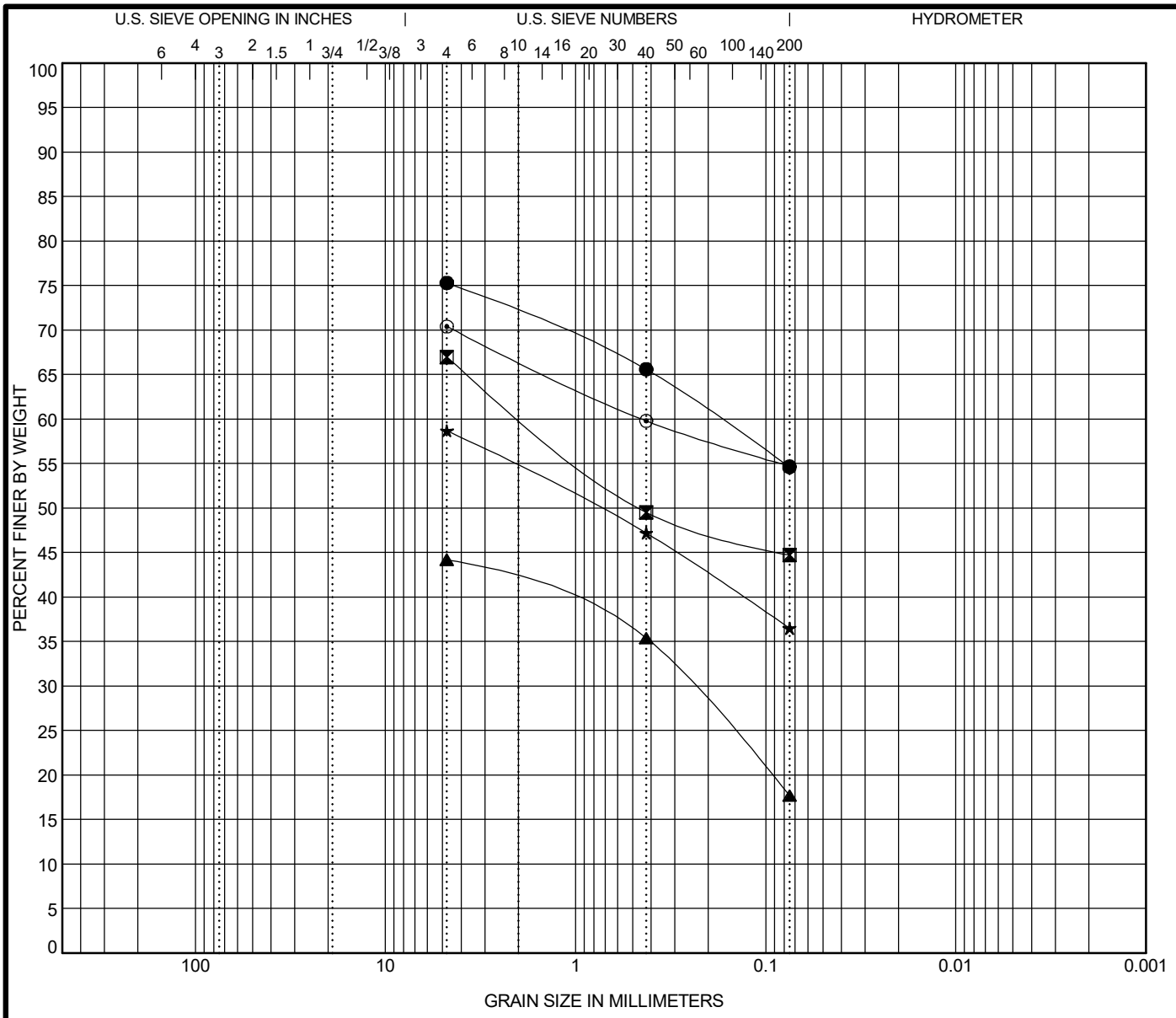
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BV-02	33.5	**19**	**5.776**			**26.9**	**26.0**	**30.7**	
⊠	BV-03	33.5	**4.75**	**0.548**			**0.0**	**31.3**	**43.1**	
▲	BV-04	38.5	**4.75**	**2.379**			**0.0**	**29.5**	**36.4**	
★	BV-05	13.5	**4.75**	**3.508**			**0.0**	**29.2**	**33.6**	
⊙	BV-05	33.5	**4.75**	**0.137**			**0.0**	**24.7**	**56.5**	

UES™

GRAIN SIZE DISTRIBUTION

Beaver Water District Clearwell
Lowell, AR
23-0104

US GRAIN SIZE CLEARWELL.GPJ US LAB.GDT 6/14/24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	BV-05	48.5	GRAVELLY FAT CLAY with SAND(CH)	66	18	48		
⊠	BV-06	8.5	CLAYEY GRAVEL with SAND(GC)	81	28	53		
▲	BV-06	33.5	CLAYEY GRAVEL with SAND(GC)	54	16	38		
★	BV-07	13.5	CLAYEY GRAVEL with SAND(GC)	85	35	50		
⊙	BV-07	23.5						

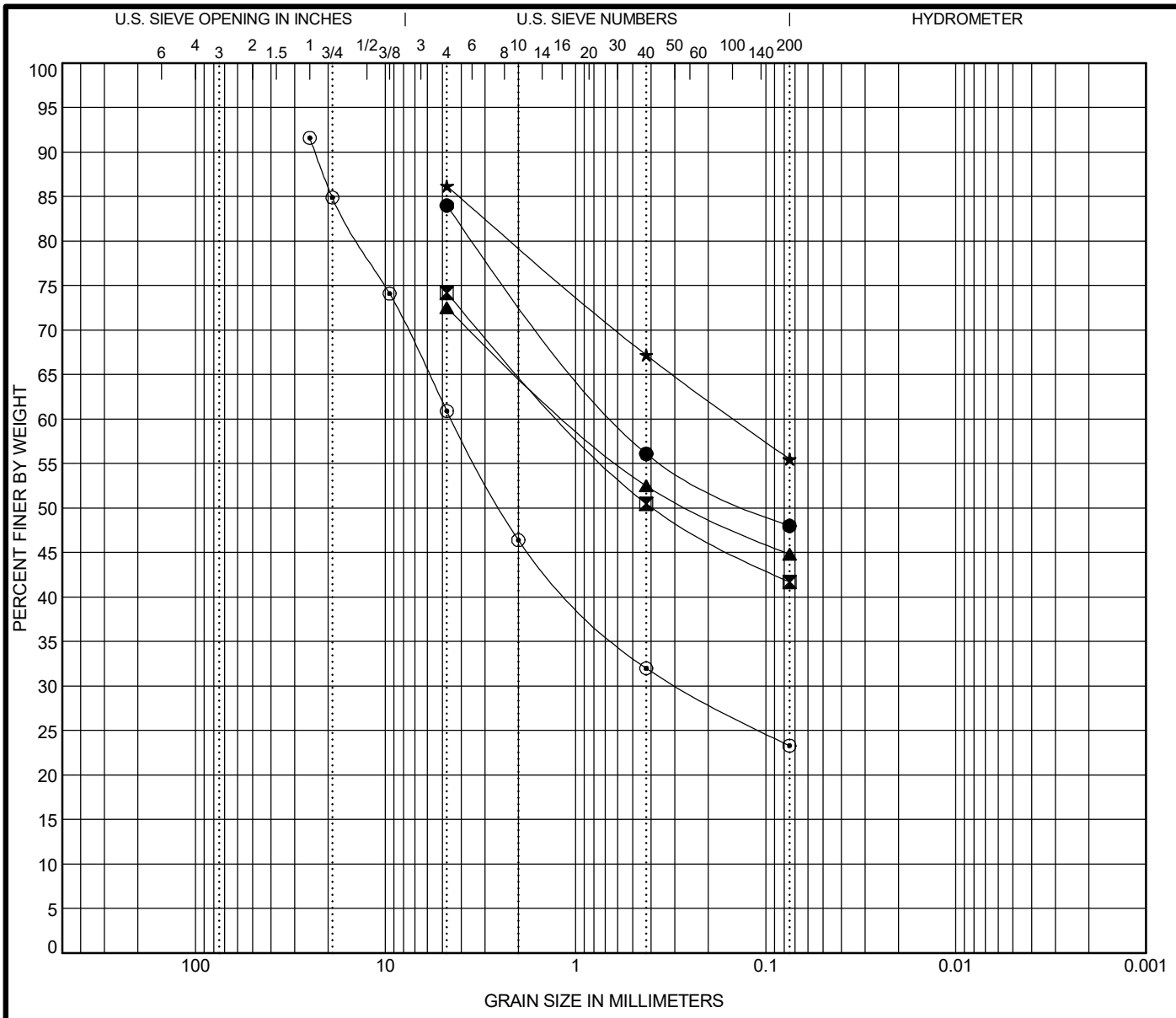
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BV-05	48.5	4.75	0.176			0.0	20.7	54.6	
⊠	BV-06	8.5	4.75	1.809			0.0	22.3	44.7	
▲	BV-06	33.5	4.75		0.25		0.0	26.5	17.7	
★	BV-07	13.5	4.75				0.0	22.2	36.5	
⊙	BV-07	23.5	4.75	0.445			0.0	15.7	54.7	

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GRAIN SIZE DISTRIBUTION

Beaver Water District Clearwell
Lowell, AR
23-0104

US GRAIN SIZE CLEARWELL.GPJ US LAB.GDT 6/14/24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	BV-08 8.5						
⊠	BV-08 18.5						
▲	BV-09 2.0						
★	BV-09 18.5	**SANDY FAT CLAY(CH)**	**60**	**27**	**33**		
⊙	BV-09 38.5						

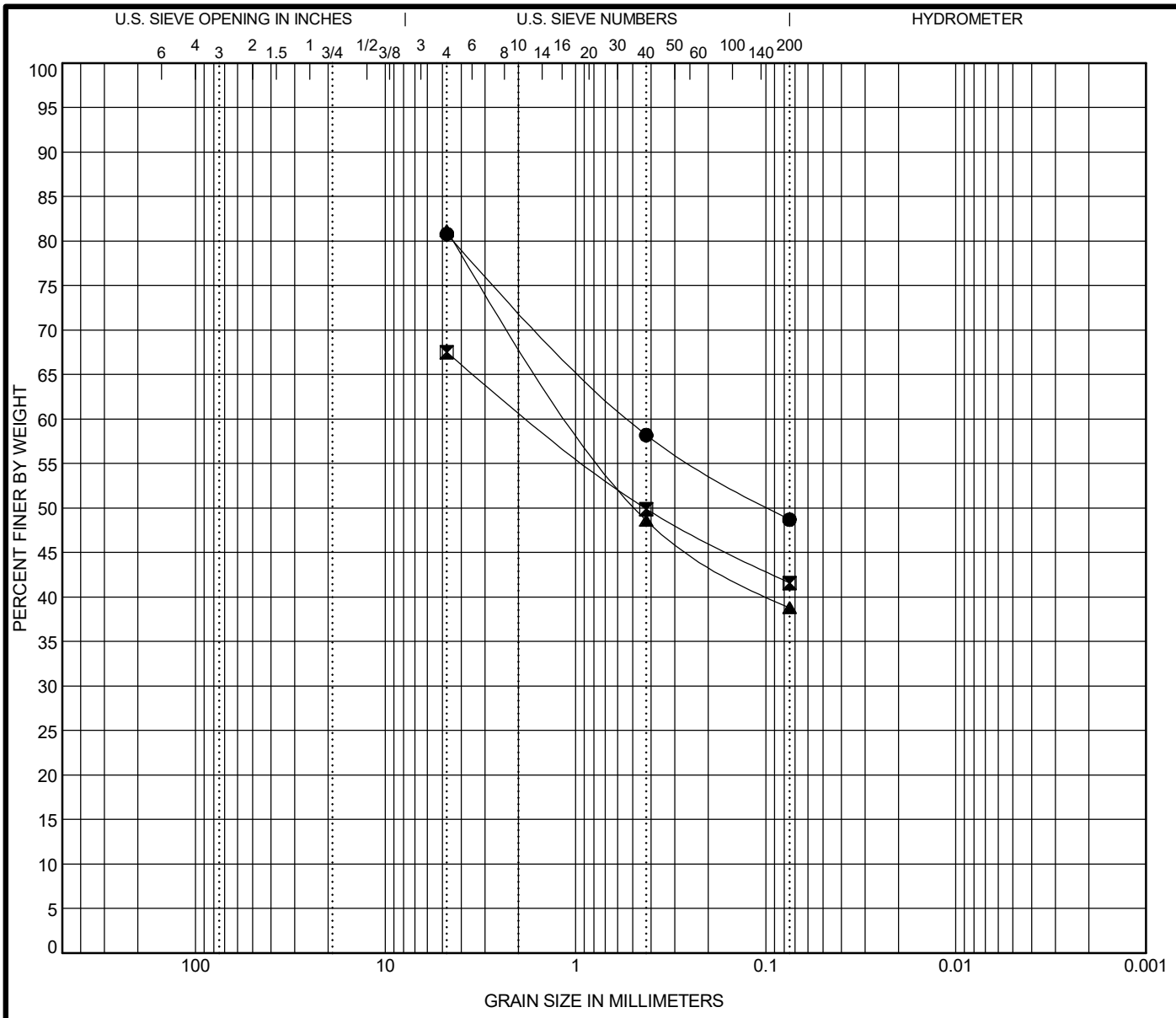
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BV-08 8.5	**4.75**	**0.596**			**0.0**	**36.0**	**48.0**	
⊠	BV-08 18.5	**4.75**	**1.118**			**0.0**	**32.5**	**41.7**	
▲	BV-09 2.0	**4.75**	**1.051**			**0.0**	**27.7**	**44.8**	
★	BV-09 18.5	**4.75**	**0.146**			**0.0**	**30.7**	**55.5**	
⊙	BV-09 38.5	**25**	**4.502**	**0.285**		**30.7**	**37.6**	**23.3**	

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GRAIN SIZE DISTRIBUTION

Beaver Water District Clearwell
Lowell, AR
23-0104

US GRAIN SIZE CLEARWELL.GPJ US LAB.GDT 6/14/24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● BV-10	6.0						
⊠ BV-10	23.5	**CLAYEY GRAVEL with SAND(GC)**	**61**	**29**	**32**		
▲ BV-10	38.5						

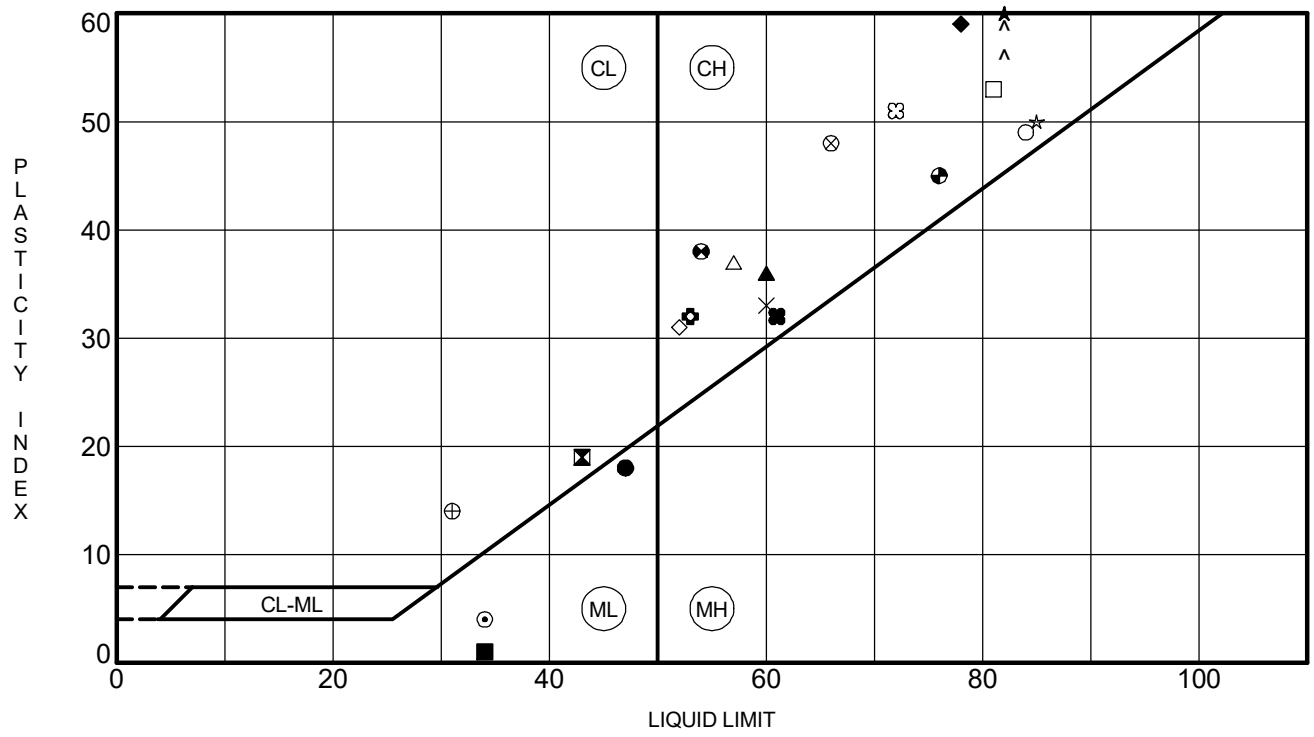
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● BV-10	6.0	**4.75**	**0.515**			**0.0**	**32.1**	**48.7**	
⊠ BV-10	23.5	**4.75**	**1.698**			**0.0**	**25.9**	**41.6**	
▲ BV-10	38.5	**4.75**	**0.988**			**0.0**	**42.4**	**38.8**	

UES™

GRAIN SIZE DISTRIBUTION

Beaver Water District Clearwell
Lowell, AR
23-0104

US GRAIN SIZE CLEARWELL.GPJ US LAB.GDT 6/14/24



	Specimen Identification		LL	PL	PI	Fines	Classification
●	BV-01	23.5	47	29	18	48	SILTY SAND with GRAVEL(SM)
⊠	BV-01	33.5	43	24	19	14	CLAYEY GRAVEL with SAND(GC)
▲	BV-02	23.5	60	24	36	76	FAT CLAY with SAND(CH)
★	BV-03	43.5	82	20	62		
⊙	BV-04	28.5	34	30	4		
✿	BV-05	4.0	53	21	32		
○	BV-05	18.5	84	35	49		
△	BV-05	33.5	57	20	37	57	SANDY FAT CLAY with GRAVEL(CH)
⊗	BV-05	48.5	66	18	48	55	GRAVELLY FAT CLAY with SAND(CH)
⊕	BV-06	2.0	31	17	14		
□	BV-06	8.5	81	28	53	45	CLAYEY GRAVEL with SAND(GC)
⊛	BV-06	33.5	54	16	38	18	CLAYEY GRAVEL with SAND(GC)
◕	BV-07	4.0	76	31	45		
☆	BV-07	13.5	85	35	50	37	CLAYEY GRAVEL with SAND(GC)
⊠	BV-07	33.5	72	21	51		
■	BV-08	23.5	34	33	1		
◆	BV-08	33.5	78	19	59		
◇	BV-09	8.5	52	21	31		
╳	BV-09	18.5	60	27	33	56	SANDY FAT CLAY(CH)
✖	BV-10	23.5	61	29	32	42	CLAYEY GRAVEL with SAND(GC)

UES™

ATTERBERG LIMITS RESULTS

Beaver Water District Clearwell
Lowell, AR
23-0104

US ATTERBERG LIMITS CLEARWELL.GPJ US LAB.GDT 6/14/24

APPENDIX E

Surface Elevation: 1376.9 Datum _____ Completion Date: 1/9/25

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	SHEAR STRENGTH, tsf (Δ - UU/2, ○ - QU/2, □ - SV; 0.5 1.0 1.5 2.0 2.5) / STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT) / WATER CONTENT, % PL 10 20 30 40 50 LL
	Soft, brown, silty CLAY, with trace organics		1-2-1	SS1	
	Hard, red, orange, tan, sandy CLAY, with numerous chert fragments		12-13 -50/5	SS2	63 51318"
	Chert layer at 3ft				
5	Hard, red, tan, CLAY, with numerous chert fragments and sandy seams		10-21-28	SS3	
	Hard, red, tan, orange, sandy CLAY, with numerous chert fragments		19-26 -50/5	SS4	76 52625"
	Chert layer at 8.5ft		50/6	SS5	S-6"
10					
			3-17-21	SS6	
15					
			5-20-28	SS7	
20	Boring terminated at 20ft				

DRAFT

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM
WASHBORING FROM ___ FEET
BMF DRILLER MSE LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 1/13/25	Date:	Date:

UES™

BWD 80 MDG Plant (Boring Group FTM)
Lowell, Arkansas

LOG OF BORING: FTM-1

Project No. 24186.00237

LOG OF BORING 2020.JDM 24186.00237_FTM.GPJ GTINC.0638301.GPJ 1/14/25

Surface Elevation: 1372.6 Datum _____ Completion Date: 1/13/25

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	SHEAR STRENGTH, tsf (Δ - UU/2, ○ - QU/2, □ - SV; 0.5 1.0 1.5 2.0 2.5) / STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT) / WATER CONTENT, % PL 10 20 30 40 50 LL
	Soft, brown, silty CLAY, with trace organics		1-1-2	SS1	
	Very stiff, tan, brown, reddish-brown, silty CLAY, with numerous chert fragments		3-9-18	SS2	
	Chert layer at 3.5ft				
5	Hard, red, dark red, CLAY, with some sandy seams and numerous chert fragments		6-15-17	SS3	
	More chert below 6ft		12-23-47	SS4	70
	Hard, red, orange, tan, sandy CLAY, with occasional clay seams and numerous chert fragments		24-38 -50/4	SS5	88 43830"
10					
			3-40-22	SS6	62
15					
	Very stiff with less chert below 17.5ft		5-10-7	SS7	
20	Boring terminated at 20ft				

DRAFT

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM
WASHBORING FROM ___ FEET
BMF DRILLER MSE LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 1/13/25	Date:	Date:

UES™

BWD 80 MDG Plant (Boring Group FTM)
Lowell, Arkansas

LOG OF BORING: FTM-2

Project No. 24186.00237

LOG OF BORING 2020.JDM 24186.00237_FTM.GPJ GTINC.0638301.GPJ 1/14/25

Surface Elevation: 1372.9 Datum _____ Completion Date: 1/13/25

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Soft, brown, gray, tan, silty CLAY		1-1-1	SS1
	Hard, red, reddish-brown, tan, sandy CLAY, with numerous chert fragments		4-20-21	SS2
	Chert layer at 4ft		50/6	SS3
5				
	Hard, red, tan, CLAY, with numerous chert fragments		7-19-19	SS4
	Hard, red, tan, orange, sandy CLAY, with occasional clay seams and numerous chert fragments		5-20-42	SS5
10				
	More sand below 13ft		4-18-50/3	SS6
15				
	Very stiff below 18ft		7-10-9	SS7
20	Boring terminated at 20ft			

SHEAR STRENGTH, tsf
Δ - UU/2 ○ - QU/2 □ - SV
0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE
(ASTM D 1586)
▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %
PL 10 20 30 40 50 LL

S-6"
62
68
3190"

DRAFT

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM
WASHBORING FROM ___ FEET
BMF DRILLER MSE LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 1/13/25	Date:	Date:

UES™

BWD 80 MDG Plant (Boring Group FTM)
Lowell, Arkansas

LOG OF BORING: FTM-3

Project No. 24186.00237

LOG OF BORING 2020.JDM 24186.00237_FTM.GPJ GTINC.0638301.GPJ 1/14/25

Surface Elevation: 1372 Datum _____ Completion Date: 1/13/25

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Soft, brown, clayey SILT, with trace organics		0-2-1	SS1
	Medium stiff, brown, tan, gray, sandy CLAY, with numerous chert fragments		2-2-3	SS2
5			4-8-7	SS3
	Very stiff, tan, gray, red, brown, CLAY, with numerous chert and limestone fragments			
	Hard below 6ft		5-22-33	SS4
	Sandy seams below 8ft			
10			3-11-21	SS5
	Very stiff, tan, red, orange, sandy CLAY, with numerous chert and limestone fragments		6-12-12	SS6
15				
	Very dense, orange, tan, red, clayey SAND, with numerous chert and limestone fragments		19-23-32	SS7
20	Boring terminated at 20ft			

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

DRAFT

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

BMF DRILLER MSE LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 1/13/25	Date:	Date:

UES™

BWD 80 MDG Plant (Boring Group FTM)
Lowell, Arkansas

LOG OF BORING: FTM-4

Project No. 24186.00237

LOG OF BORING 2020.JDM 24186.00237_FTM.GPJ GTINC.0638301.GPJ 1/14/25

Surface Elevation: 1382.1 Datum _____ Completion Date: 1/14/25

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Soft, brown, silty CLAY, with trace organics		2-1-2	SS1
	Hard, red, brownish-red, tan, CLAY, with some sandy seams and numerous chert fragments		10-25-31	SS2
5			11-20-24	SS3
	Hard, red, orange, tan, sandy CLAY, with numerous chert and limestone fragments		7-34-25	SS4
	Occasional clay seams below 8ft		4-8-26	SS5
10				
	Chert layer at 13.5ft		50/6	SS6
15				
	Very stiff, with some white weathered limestone below 19ft		3-7-10	SS7
20	Boring terminated at 20ft			

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

S-6"

DRAFT

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

BMF DRILLER MSE LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 1/14/25	Date:	Date:

UES™

BWD 80 MDG Plant (Boring Group FTM)
Lowell, Arkansas

LOG OF BORING: FTM-5

Project No. 24186.00237

LOG OF BORING 2020.JDM 24186.00237_FTM.GPJ GTINC.0638301.GPJ 1/14/25

Surface Elevation: 1388.2 Datum _____ Completion Date: 1/14/25

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Soft, brown, clayey SILT, with trace chert fragments and organics		1-1-2	SS1
	Hard, brownish-red, red, tan, CLAY, with numerous chert fragments and some sandy seams		6-12-20	SS2
5	Chert layer at 5ft		11-15 -50/4.5	SS3
	Chert layer at 7ft		6-38-50/3	SS4
	Hard, red, orange, tan, sandy CLAY, with numerous chert fragments and some clay seams		5-24-19	SS5
10	Very stiff below 13ft			
			8-11-12	SS6
15	Hard below 18ft			
			7-12-25	SS7
20	Boring terminated at 20ft			

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

65

10.51511"

88

3392"

DRAFT

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

BMF DRILLER MSE LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 1/14/25	Date:	Date:

UES™

BWD 80 MDG Plant (Boring Group FTM)
Lowell, Arkansas

LOG OF BORING: FTM-6

Project No. 24186.00237

LOG OF BORING 2020.JDM 24186.00237_FTM.GPJ GTINC.0638301.GPJ 1/14/25

Surface Elevation: 1397.3 Datum _____ Completion Date: 1/14/25

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Soft, brown, tan, silty CLAY, with trace organics		1-1-2	SS1
	Very stiff, red, gray, tan, CLAY, with some chert fragments		2-9-9	SS2
	Hard, with no gray, and more chert and limestone fragments below 4ft			
5	Chert layer at 5ft		5-16-22	SS3
			14-27 -50/5	SS4
	Sandy seams below 8ft			
	Chert layer at 9ft		10-14 -50/5.5	SS5
10				
	More sand below 12ft			
			3-7-17	SS6
15				
	Hard, red, tan, orange, sandy CLAY, with numerous chert fragments and occasional clay seams		8-25-29	SS7
20	Boring terminated at 20ft			

SHEAR STRENGTH, tsf
Δ - UU/2 ○ - QU/2 □ - SV
0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE
(ASTM D 1586)
▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %
PL 10 20 30 40 50 LL

77
52720"
64
11.5141"

DRAFT

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM
WASHBORING FROM ___ FEET
BMF DRILLER MSE LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 1/14/25	Date:	Date:

UES™

BWD 80 MDG Plant (Boring Group FTM)
Lowell, Arkansas

LOG OF BORING: FTM-7

Project No. 24186.00237

LOG OF BORING 2020.JDM 24186.00237_FTM.GPJ GTINC 0638301.GPJ 1/14/25

Surface Elevation: 1400.7 Datum _____ Completion Date: 1/14/25

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff, brown, tan, clayey SILT, with trace organics		2-3-4	SS1
	Hard, red, tan, orange, gray, sandy CLAY, with numerous chert fragments		11-31 -50/5	SS2
5	Very stiff, red, dark red, CLAY, with numerous chert fragments		13-11-13	SS3
	Hard, with some sandy seams below 6ft		3-19-12	SS4
	Chert layer at 9ft		14-50/4	SS5
10	Chert layer at 12ft-14ft		50/3	SS6
15	Very stiff, with less chert below 17ft		8-8-15	SS7
20	Boring terminated at 20ft			

SHEAR STRENGTH, tsf
Δ - UU/2 ○ - QU/2 □ - SV
0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE
(ASTM D 1586)
▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %
PL 10 20 30 40 50 LL

81
53117"
414"
S-3"

DRAFT

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM
WASHBORING FROM ___ FEET
BMF DRILLER MSE LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: MSE	Checked by:	App'vd. by:
Date: 1/14/25	Date:	Date:

UES™

BWD 80 MDG Plant (Boring Group FTM)
Lowell, Arkansas

LOG OF BORING: FTM-8

Project No. 24186.00237

LOG OF BORING 2020.JDM 24186.00237_FTM.GPJ GTINC.0638301.GPJ 1/14/25

APPENDIX B – Draft SWPPP for Construction Activity

(FOR REFERENCE ONLY, NOT A CONTRACT DOCUMENT)

(FINAL PERMIT TO BE PROVIDED WHEN AVAILABLE)

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Stormwater Pollution Prevention Plan (SWPPP) for Construction Activity for Large Construction Sites

National Pollutant Discharge Elimination System (NPDES)
General Permit # ARR150000

Prepared for:
Beaver Water District

Date:
12/02/2024

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Revised date: 10/20/2016

Project Name and Location: Beaver Water District Water Treatment Plant Expansion Project, Benton County, Arkansas.

Property Parcel Number (*Optional*): _____

Operator Name and Address: 301 N Primrose Rd, Lowell, AR 72745

Site Description

A. Project description, intended use after NOI is filed: This project includes the construction of a 16 MG Clearwell structure with an overflow drainage trough and associated site grading and piping approximately 70 feet south of Nail Ave, extending south, and approximately 400 feet east of Primrose Road, extending east. The project also includes the installation of approximately 3,425 linear feet of 48" water transmission main beginning east of Primrose Road and continuing south approximately 50 feet from and parallel to Primrose Road. Approximately 1,200 feet south of Frisco Church Road, the water main extends perpendicular to Primrose Road and parallel to Frisco Church Road for 1,225 feet.

B. Sequence of major activities which disturb soils:

General Sequence of activities:

1. Obtain all necessary permits (if required).
2. Know and maintain an Arkansas Department of Energy & Environment - Division Environmental Quality (ADEQ) approved Stormwater Pollution Prevention Plan (SWPPP) implemented for construction sites.
3. Inform all personnel and subcontractors of SWPPP and relate where to post the Construction Site Notice and house SWPPP.
4. Have all existing utilities located.
5. Install tree preservation, erosion and sediment control devices in accordance with the Plans and this SWPPP.
6. Grade the site per the grading plan.
7. Construct Improvements (see Plan Set). Maintain temporary erosion and sediment control devices as needed.
8. Bring all areas to final grade.
9. Stabilize all areas, place topsoil, landscaping, and sod.
10. When all construction is completed, the site is 100% stabilized at 80% density, and approved by the Engineer, remove all temporary sediment control BMPs. Stabilize with sodding or seeding any areas disturbed by their removal.

a. Total Area[1]: 9.1 Acres

Disturbed Area[2]: 9.1 Acres

b. Soils Information:
   i. Runoff Coefficient Pre-Construction (See Appendix A) : 0.2
   ii. Runoff Coefficient Post-Construction (See Appendix A) : 0.55
   iii. Describe the soil or the quality of any discharge from the Phase II site:

Soil Series	Hydrologic Soil Group
Captina silt loam, 1 to 3 percent slopes	C/D
Johnsburg silt loam, 0 to 2 percent slopes	D
Tonti gravelly silt loam, 3 to 8 percent slopes	C

C. Responsible Parties

Be sure to assign all SWPPP related activities to an individual or position; even if the specific individual is not yet known (i.e. contractor has not been chosen).

Individual/Company	Phone Number	Service Provided for SWPPP (i.e., Inspector, SWPPP revisions, Stabilization Activities, BMP Maintenance, etc.)
Beaver Water District	(479)-756-3651	Owner/Permittee
Contractor (TBD)		SWPPP revisions, Stabilization Activities, BMP Maintenance, etc.
Olsson	(479) 443-3404	SWPPP Developer

D. Receiving Waters
   a. The following waterbody (or waterbodies) receives stormwater from this construction site: The project drains directly into an unnamed tributary of Puppy Creek, thence to Puppy Creek, thence to Spring Creek, thence to Osage Creek, thence to the Illinois River, and ultimately to the Arkansas River.

[1]Increases in total acreage require an additional acreage request, an updated SWPPP and a $200 modification fee to be submitted to ADEQ.

[2]Increases in only disturbed acreage require an additional acreage request and an updated SWPPP to be submitted to ADEQ.

   b. Is the project located within the jurisdiction of an MS4? ☐ Yes ☒ No
      i. If yes, Name of MS4: _____
   c. Ultimate Receiving Water:
      ☐ Red River ☐ Mississippi River
      ☐ White River ☒ Arkansas River

☐ Ouachita River ☐ St. Francis River

E. Documentation of Permit Eligibility Related to the 303(d) list and Total Maximum Daily Loads (TMDL) (https://www.adeq.state.ar.us/water/planning/)

a. Does the stormwater enter a waterbody on the 303(d) list or with an approved TMDL? ☒ Yes ☐ No

b. If yes:

i. Waterbody identified on 303(d) list: Illinois River

ii. Pollutant addressed on 303(d) list or TMDL: Sulfate, turbidity, *E. coli*

iii. This specific project, or generally construction activity i.e. surface erosion, is identified on 303(d) list or associated assumptions and allocations identified in the TMDL for the discharge: ☐ Yes ☒ No

iv. Additional controls implemented: _____

F. Attainment of Water Quality Standards After Authorization

a. The permittee must select, install, implement, and maintain BMPs at the construction site that minimize pollutants in the discharge as necessary to meet applicable water quality standards. In general, except in situations explained below, the SWPPP developed, implemented, and updated to be considered as stringent as necessary to ensure that the discharges do not cause or contribute to an excursion above any applicable water quality standard.

b. At any time after authorization, the Department may determine that the stormwater discharges may cause, have reasonable potential to cause, or contribute to an excursion above any applicable water quality standard. If such a determination is made, the Department will require the permittee to:

i. Develop a supplemental BMP action plan describing SWPPP modifications to address adequately the identified water quality concerns and submit valid and verifiable data and information that are representative of ambient conditions and indicate that the receiving water is attaining water quality standards; or

ii. Cease discharges of pollutants from construction activity and submit an individual permit application.

I understand and agree to follow the above text regarding the attainment of water quality standards after authorization. ☒ Yes ☐ No

G. Site Map Requirements (Attach Site Map):

a. Pre-construction topographic view;

b. Direction of stormwater flow (i.e., use arrows to show which direction stormwater will flow) and approximate slopes anticipated after grading activities;
c. Delineate on the site map areas of soil disturbance and areas that will not be disturbed under the coverage of this permit;
d. Location of major structural and nonstructural controls identified in the plan;
e. Location of main construction entrance and exit;
f. Location where stabilization practices are expected to occur;
g. Locations of off-site materials, waste, borrow area, or equipment storage area;
h. Location of areas used for concrete wash-out;
i. Location of all surface water bodies (including wetlands) with associated natural buffer boundary lines. Identify floodplain and floodway boundaries, if available;
j. Locations where stormwater is discharged to a surface water and/or municipal separate storm sewer system if applicable,
k. Locations where stormwater is discharged off-site (should be continuously updated);
l. Areas where final stabilization has been accomplished and no further construction phase permit requirements apply;
m. A legend that identifies any erosion and sediment control measure symbols/labels used in the site map and/or detail sheet; and
n. Locations of any storm drain inlets on the site and in the immediate vicinity of the site.

H. Stormwater Controls
    a. Initial Site Stabilization, Erosion and Sediment Controls, and Best Management Practices:
        i. Initial Site Stabilization: <u>Construction will progress as indicated in the sequence of major activities noted in the Plan Set and this SWPPP. Erosion and sediment control measures shall be installed prior to beginning any construction activities as noted on the Erosion Control Sheets. Erosion control devices will be maintained throughout construction activities.</u>
        ii. Erosion and Sediment Controls: <u>Erosion and sediment controls shall include silt fences and sediment barriers. Additionally, to control wind erosion, disturbed areas shall be sprayed with water on an as-needed basis according to site conditions.</u>

iii. If periodic inspections or other information indicates a control has been used inappropriately or incorrectly, the operator will replace or modify the control for site situations: ☒Yes ☐No

If No, explain: _____

iv. Off-site accumulations of sediment will be removed at a frequency sufficient to minimize off-site impacts: ☒Yes ☐No

If No, explain: _____

v. Sediment will be removed from sediment traps or sedimentation ponds when design capacity has been reduced by 50%: ☒Yes ☐No

If No, explain: _____

vi. Litter, construction debris, and construction chemicals exposed to stormwater shall be prevented from becoming a pollutant source for stormwater discharges: ☒Yes ☐No

If No, explain: _____

vii. Off-site material storage areas used solely by the permitted project are being covered by this SWPPP: ☐Yes ☒No

If Yes, explain additional BMPs implemented at off-site material storage area: _____

b. Stabilization Practices

i. Description and Schedule: Permanent seeding and mulch cover shall be utilized as the primary stabilization practice. Seeding shall be performed by hydro-seeding, by hand, or by a mechanical broadcasting method. Seeding rates and types shall be in accordance with the Contract Documents on which construction activities have ceased (temporarily or permanently). Sodding shall be placed in accordance with the project plans. Exposed bare earth sections should be protected by evenly distributed hay, straw, or wood mulch before a rain event. Dust shall be controlled by sufficiently wetting dusty areas, as needed. To all extents possible, construction activities shall be isolated as to limit areas of disturbance. Areas where construction ceases for more than 14 days shall be stabilized with a seed/straw mulch at a coverage rate of 2 tons/acre. Accumulated sediment and erosion control devices will be removed after 100% stabilization at 80% density.

ii. Are buffer areas required? ☐Yes ☒No

If Yes, are buffer areas being used? ☐Yes ☒No

If Yes, describe natural buffer areas: _____

_____

If No, explain why not:_____

_____

iii. A record of the dates when grading activities occur, when construction activities temporarily or permanently cease on a portion of the site, and when stabilization measures are initiated shall be included with the plan.
☒Yes ☐No

If No, explain: _____

_____

iv. Deadlines for stabilization:

1. Stabilization procedures will be initiated 14 days after construction activity temporarily ceases on a portion of the site.
2. Stabilization procedures will be initiated immediately in portions of the site where construction activities have permanently ceased.

c. Structural Practices

i. Describe any structural practices to divert flows from exposed soils, store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site: Silt fences and sediment barriers shall be in place during ongoing earthwork operations.

ii. Describe Velocity Dissipation Devices: Silt fences shall be place at construction limits. Sediment barriers shall be placed in areas of concentrated stormwater flow.

iii. Sediment Basins:

Are 10 or more acres draining to a common point? ☐Yes ☒No

Is a sediment basin included in the project? ☐Yes ☒No

If Yes, what is the designed capacity for the storage?

☐3600 cubic feet per acre = : _____

or

☐10 year, 24 hour storm = :_____

☐ Other criteria were used to design basin: _____

_____

If No, explain why no sedimentation basin was included and describe required natural buffer areas and other controls implemented instead: Due to being a linear project, sediment basins will not be needed during construction. Offsite drainage

area will be picked up by area inlets and drainage ditches. Offsite drainage area consists of undeveloped pasture, a water treatment plant, and residential properties. No sedimentation will be accumulated from offsite area.

I. Other Controls

a. Solid materials, including building materials, shall be prevented from being discharged to Waters of the State: ☒Yes ☐No

b. Off-site vehicle tracking of sediments and the generation of dust shall be minimized through the use of:

☒A stabilized construction entrance and exit

☒Vehicle tire washing

☒Other controls, describe: Existing roads will be used to access construction site where practicable. Contractor shall mechanically sweep street daily as required to keep construction entrance area clean.

c. Temporary Sanitary Facilities: Portable sanitary waste systems will be required at all times during construction. All sanitary waste will be collected from the portable units as necessary or as required by local regulation by a licensed sanitary waste management contractor. The waste management contractor shall empty the portable sanitary waste systems on a regular basis or when issues arise. Caution will be used during any sanitary sewer relocations.

d. Concrete Waste Area Provided:

☒Yes

☐No. Concrete is used on the site, but no concrete washout is provided.

Explain why: _____

_____

☐N/A, no concrete will be used with this project

e. Fuel Storage Areas, Hazardous Waste Storage, and Truck Wash Areas: At a minimum, any products in the following categories shall be considered hazardous: paints, acids for cleaning masonry surfaces, cleaning solvents, asphalt products, chemical additives for soil stabilization, or concrete curing compounds and additives. In the event of a spill which may be hazardous, the spill coordinator designated by the Contractor should be contacted immediately. Beaver Water District shall also be notified immediately following notification of the spill coordinator. All hazardous waste materials will be disposed of as specified by local or state regulations or by the product manufacturer. Fuel storage will be at least 300 feet from known wetlands or other waterbodies and shall have secondary containment as required by state and federal law. Products will be kept in original containers in covered areas unless they are not resealable.

Original labels and material safety data will be retained; they contain important product information. If surplus products must be disposed of, manufacturers' or local and State recommended methods for proper disposal will be followed.

J. Non-Stormwater Discharges

a. The following allowable non-stormwater discharges comingled with stormwater are present or anticipated at the site:

☐ Fire-fighting activities;

☐ Fire hydrant flushings;

☒ Water used to wash vehicles (where detergents or other chemicals are not used) or control dust in accordance with Part II.A.4.H.2;

☒ Potable water sources including uncontaminated waterline flushings;

☒ Landscape Irrigation;

☒ Routine external building wash down which does not use detergents or other chemicals;

☒ Pavement wash waters where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled materials have been removed) and where detergents or other chemicals are not used;

☒ Uncontaminated air conditioning, compressor condensate (See Part I.B.13.C of the permit);

☐ Uncontaminated springs, excavation dewatering and groundwater (See Part I.B.13.C of the permit);

☐ Foundation or footing drains where flows are not contaminated with process materials such as solvents (See Part I.B.13.C of the permit);

b. Describe any controls associated with non-stormwater discharges present at the site: To all extents possible, non-stormwater discharges shall be minimized. Discharges shall be monitored and terminated as soon as possible.

K. Permanent Controls for Post-Construction Stormwater Management:

Describe measures installed during the construction process to control pollutants in stormwater discharges that will occur after construction operations have been completed: No permanent controls will be installed.

L. Applicable State or Local Programs: The SWPPP will be updated as necessary to reflect any revisions to applicable federal, state, or local requirements that affect the stormwater controls implemented at the site. ☒ Yes ☐ No

M. Inspections

a. Inspection frequency:

☒ Every 7 calendar days

or

☐ At least once every 14 calendar days and within 24 hours of the end of a storm even 0.25 inches or greater (a rain gauge must be maintained on-site)

b. Inspections:

Completed inspection forms will be kept with the SWPPP.

☒ ADEQ's inspection form will be used (See Appendix B)

or

☐ A form other than ADEQ's inspection form will be used and is attached (See inspection form requirements Part II.A.4.L.2)

c. Inspection records will be retained as part of the SWPPP for at least 3 years from the date of termination.

d. It is understood that the following sections describe waivers of site inspection requirements. All applicable documentation requirements will be followed in accordance with the referenced sections.

i. Winter Conditions (Part II.A.4.L.4)

ii. Adverse Weather Conditions (Part II.A.4.L.5)

N. Maintenance:

The following procedures to maintain vegetation, erosion and sediment control measures and other protective measures in good, effective operating condition will be followed: All erosion and sediment controls shall be maintained in good working order. If a repair is necessary, it shall be done at the earliest date possible, but no later than three (3) calendar days after the surrounding exposed ground has dried sufficiently to prevent further damage from heavy equipment. The areas adjacent to creeks and drainage ways shall have priority followed by devices protecting any drainage ditches.

Any necessary repairs will be completed, when practicable, before the next storm event, but not to exceed a period of 3 business days of discovery, or as otherwise directed by state or local officials.

O. Employee Training:

The following is a description of the training plan for personnel (including contractors and subcontractors) on this project: Training shall be given by a knowledgeable and qualified trainer to all project related personnel prior to them working at the project site. The Contractor shall be required to have a qualified individual as defined in the permit.

**Note, Formal training classes given by universities or other third-party organizations are not required but recommended for qualified trainers; the

permittee is responsible for the content of the training being adequate for personnel to implement the requirements of the permit.

Certification

"I certify under penalty of law that this document and all attachments such as Inspection Form were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Signature of Responsible or Cognizant Official: _____

Title: _____ Date: _____