

ADDENDUM NO. 4

CITY OF GATESVILLE

**CID 01-STILLHOUSE BRANCH WASTEWATER TREATMENT FACILITY
IMPROVEMENTS**

PROJECT NO.: 2-01590 | TWDB CWSRF NO. 73776

DATE OF ADDENDUM: JUNE 15, 2023

BID OPENING DATE: JUNE 20, 2023

This Addendum forms a part of Contract and clarifies, corrects or modifies original Proposal Documents, dated May 8, 2023. Acknowledge receipt of this addendum in space provided on Proposal Form. Failure to do so may subject bidder to disqualification.

MODIFICATIONS TO PROPOSAL DOCUMENTS

1) Project Manual

a. Section 13 34 19 – Metal Building Systems

Specification “Section 13 34 19 – Metal Building Systems” has been REVISED to include statement that all steel components of the Pre-Engineering Metal Building shall be galvanized.

b. Section 01 30 00 – Administration Requirements

Specification “Section 01 30 00 – Administration Requirements” has been REVISED to include information regarding construction photographs and videos.

c. Section 46 51 36 – Fine Bubble Membrane Disc Aeration System

Paragraph 2.5.C.2.g has been REVISED to exclude 10 days of history statement. Paragraph 2.5.C.2.h has been REVISED to remove the entire statement.

2) Drawings

a. Sheet MD-03

REVISED to include additional information regarding the pipe supports.

CLARIFICATIONS

1) Manufacturer Substitutions

- a. “All manufacturers meeting the equipment specifications are approved whether they are mentioned in the individual specification sections as an approved equal, subject to provisions of American Iron and Steel rules and other project requirements. See General Conditions, Article 6.05.”



Approved by:

A handwritten signature in blue ink, appearing to read "Michael Clough", written over a horizontal line.

Engineer

SECTION 133419 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural-steel framing.
 - 2. Metal roof panels.
 - 3. Metal wall panels.
 - 4. Thermal insulation.
 - 5. Personnel doors and frames.
 - 6. Accessories.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of metal building system component.
- B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and attachments to other work.
- C. Samples: For units with factory-applied finishes.
- D. Delegated-Design Submittal: For metal building systems.
 - 1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
 - 1. Name and location of Project.
 - 2. Order number.
 - 3. Name of manufacturer.
 - 4. Name of Contractor.

5. Building dimensions including width, length, height, and roof slope.
6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
7. Governing building code and year of edition.
8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
11. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.

- C. Material test reports.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 1. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility.
 2. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
 3. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: 25 years from date of Substantial Completion.
- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. American Buildings Company; a Nucor Company.
 - 2. Butler Manufacturing Company; a division of BlueScope Buildings North America, Inc.
 - 3. Ceco Building Systems; an NCI company.
 - 4. Nucor Building Systems.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design metal building system.
- B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 - 1. Design Loads: As indicated on Drawings.
 - 2. Deflection and Drift Limits: No greater than the following:
 - a. Purlins and Rafters: Vertical deflection of 1/240 of the span.
 - b. Girts: Horizontal deflection of 1/240 of the span.
 - c. Metal Roof Panels: Vertical deflection of 1/240 of the span.
 - d. Metal Wall Panels: Horizontal deflection of 1/240 of the span.
 - e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 - f. Lateral Drift: Maximum of 1/400 of the building height.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Fire-Resistance Ratings: Where assemblies are indicated to have a fire-resistance rating, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E119 or ASTM E108 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory," FM Global's "Approval Guide," or from the listings of another qualified testing agency.
- E. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
- F. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
- G. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646 at the following test-pressure difference:
 - 1. Test-Pressure Difference: **2.86 lbf/sq. ft. (137 Pa)**
- H. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: **2.86 lbf/sq. ft. (137 Pa)**
- I. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
- J. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
 - 1. Fire/Windstorm Classification: Class 1A- **90 or 105**.

2. Hail Resistance: SH.
- K. Thermal Performance for Opaque Elements: Provide the following maximum U-factors and minimum R-values when tested according to ASTM C1363 or ASTM C518:
1. Roof:
 - a. U-Factor: .026
 - b. R-Value: R38 (8" R25 + 4" R13) + Thermal Break (R6.5 Continuous Insulation)
 2. Walls:
 - a. U-Factor: .04
 - b. R-Value: 8" R25 (between girts) + Thermal Break (R6.5 Continuous Insulation)

2.3 STRUCTURAL-STEEL FRAMING

- A. *All steel components of the building framing shall be galvanized.*
- B. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
- C. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- D. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- E. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters and rake beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
 2. Frame Configuration: Single gable and One-directional, sloped.
 3. Exterior Column: Uniform depth.
 4. Rafter: Tapered.
- F. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
- G. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either

cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating.

- H. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.

2.4 METAL ROOF PANELS

- A. Standing-Seam, Trapezoidal-Rib, Metal Roof Panels : Formed with interlocking ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
 - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.024-inch (0.61-mm)** nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Exterior Finish: Two-coat fluoropolymer or Siliconized polyester.
 - b. Color: Sherwin-Williams, Coil Coatings; Almond 433R593 or suitable alternative approved by Architect
 - 2. Clips: Two-piece floating to accommodate thermal movement.
 - 3. Joint Type: Mechanically seamed.
 - 4. Panel Coverage: **24 inches (610 mm)**
 - 5. Panel Height: **3 inches (76 mm)**

2.5 METAL WALL PANELS

- A. Exposed-Fastener, Tapered-Rib, Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.018-inch (0.46-mm)** nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Exterior Finish: Two-coat fluoropolymer or Siliconized polyester.
 - b. Color: Sherwin-Williams, Coil Coatings; Almond 433R593 or suitable alternative approved by Architect
 - 2. Major-Rib Spacing: **12 inches (305 mm)** o.c.
 - 3. Panel Coverage: **36 inches (914 mm)**
 - 4. Panel Height: **1.25 inches (32 mm)**

2.6 THERMAL INSULATION

- A. PROVIDED BY: BAY INSULATION SYSTEMS
- B. Faced Metal Building Insulation: ASTM C665 blanket glass fiber type, vinyl-faced, UL flame-spread classification of 25 or less where exposed, with R-value of 25. All seams and joints to be taped, including at exposed structure member edges.
- C. Roof Insulation: 1st layer batt insulation with a nominal 8” thickness (R25) is installed between the purlins, 2nd layer batt insulation with a nominal 4” thickness (R13) is draped over the purlins, a thermal block shall be applied where there is no existing thermal break between metal panel and metal structure and secured to the purlins. The thermal break shall be a min. 1” thermal block with a min. 3.5 R-value.
- D. Retainer Strips: For securing insulation between supports, **0.025-inch (0.64-mm)** nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.

2.7 PERSONNEL DOORS AND FRAMES

- A. Swinging Personnel Doors and Frames: Metal building system manufacturer's standard doors and frames; prepared and reinforced at strike and at hinges to receive factory- and field-applied hardware according to BHMA A156 Series.
 - 1. Hardware:
 - a. Provide hardware for each door leaf, as follows:
 - 1) Hinges: BHMA A156.1. Three plain bearing, standard-weight, full-mortise, stainless-steel, template-type hinges with nonremovable pin.
 - 2) Lockset: BHMA A156.2. Lever Lockset
 - 3) Exit Device: BHMA A156.3. push-bar type.
 - 4) Closer: BHMA A156.4. Surface-applied, standard-duty hydraulic type.
 - 5) Weather Stripping: Vinyl applied to head and jambs, with vinyl sweep at sill.
- B. Finishes for Personnel Doors and Frames:
 - 1. Prime Finish: Factory-apply manufacturer's standard primer immediately after cleaning and pretreating.

2.8 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
- D. Flashing and Trim: Zinc-coated (galvanized) steel sheet, **0.018-inch (0.46-mm)** nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.
- E. Gutters: Zinc-coated (galvanized) steel sheet, **0.018-inch (0.46-mm)** nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum **96-inch (2438-mm-)** long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
 1. Gutter Supports: Fabricated from same material and finish as gutters.
 2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- F. Downspouts: Zinc-coated (galvanized) steel sheet, **0.018-inch (0.46-mm)** nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum **10-foot- (3-m-)** long sections, complete with formed elbows and offsets.
 1. Mounting Straps: Fabricated from same material and finish as gutters.
- G. Roof Curbs: aluminum-zinc alloy-coated steel sheet, **0.048-inch (1.21-mm)** nominal uncoated steel thickness prepainted with coil coating; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.
- H. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.9 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.10 SOURCE QUALITY CONTROL

- A. Special Inspection: Owner will engage a qualified special inspector to perform source quality control inspections and to submit reports.
 - 1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.
- B. Product will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.

2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 2. Locate and space wall girts to suit openings such as doors and windows.
 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, ventilators, and other penetrations of roof and walls.
- H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
1. Tighten rod and cable bracing to avoid sag.
 2. Locate interior end-bay bracing only where indicated.
- I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.
- 3.2 METAL PANEL INSTALLATION, GENERAL
- A. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Locate metal panel splices over structural supports with end laps in alignment.
 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- B. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
1. Install ridge caps as metal roof panel work proceeds.
 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
1. Install clips to supports with self-drilling or self-tapping fasteners.
 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
 5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Pre-drill panels for fasteners.
 6. Provide metal closures at peaks and each side of ridge caps.
- C. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.
1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
 2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
 3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
 4. At metal panel splices, nest panels with minimum **6-inch (152-mm)** end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- D. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.4 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
 2. Shim or otherwise plumb substrates receiving metal wall panels.
 3. When two rows of metal panels are required, lap panels **4 inches (102 mm)** minimum.
 4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Pre-drill panels.
 6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.

7. Install screw fasteners in predrilled holes.
 8. Install flashing and trim as metal wall panel work proceeds.
 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
 10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
 11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

3.5 INSTALLATION

- A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.
1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
 2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
 3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.
 4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.
- B. Blanket Roof Insulation: Comply with the following installation method:
1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal roof panels fastened to secondary framing.
 2. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.
 3. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.
 - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
 4. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.

- a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
 5. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
- C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.
1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.6 DOOR AND FRAME INSTALLATION

- A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.
- B. Personnel Doors and Frames: Install doors and frames according to NAAMM-HMMA 840.
1. At fire-rated openings, install frames according to, and doors with clearances specified in, NFPA 80.
- C. Field Glazing: Comply with installation requirements in Section 088000 "Glazing."
- D. Door Hardware:
1. Install surface-mounted items after finishes have been completed at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
 4. Set thresholds for exterior doors in full bed of sealant complying with requirements for concealed mastics specified in Section 079200 "Joint Sealants."

3.7 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet (3 m)** with no joints allowed within **24 inches (600 mm)** of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than **36 inches (914 mm)** o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with **1-1/2-inch (38-mm)** telescoping joints. Provide fasteners designed to hold downspouts securely **1 inch (25 mm)** away from walls; locate fasteners at top and bottom and at approximately **60 inches (1524 mm)** o.c. in between.
1. Provide elbows at base of downspouts to direct water away from building.
 2. Tie downspouts to underground drainage system indicated.
- E. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
- F. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.
- 3.8 FIELD QUALITY CONTROL
- A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.
 - B. Product will be considered defective if it does not pass tests and inspections.
 - C. Prepare test and inspection reports.

END OF SECTION 133419

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Coordination and Project conditions.
- B. Preconstruction meeting.
- C. Site mobilization meeting.
- D. Progress meetings.
- E. Preinstallation meetings.
- F. Closeout meeting.
- G. *Construction Photographs*
- H. *Audio-Video Recordings*
- I. Alteration procedures.

1.2 COORDINATION AND PROJECT CONDITIONS

- A. Coordinate scheduling, submittals, and Work of various Sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Verify that utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate Work of various Sections having interdependent responsibilities for installing, connecting to, and placing operating equipment in service.
- C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit as closely as practical; place runs parallel with lines of building. Use spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. Coordinate interruptions of all utilities and services. All work shall be in accordance with the requirements of the applicable utility company or agency involved.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of Work of separate Sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.
- G. After Owner's occupancy of premises, coordinate access to Site for correction of defective Work and Work not complying with Contract Documents, to minimize disruption of Owner's activities.

1.3 PRECONSTRUCTION MEETING

- A. Engineer will schedule and preside over meeting after the Agreement has been executed and all bonds and insurance are in affect for the project.

B. Attendance Required: Engineer, Owner, Inspector, and Contractor.

1.4 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at monthly intervals.

B. Engineer will make arrangements for meetings, prepare agenda with copies for participants, and preside over meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, and Engineer, as appropriate to agenda topics for each meeting.

1.5 PRE-INSTALLATION MEETINGS

A. When required in individual Specification Sections, convene preinstallation meetings at Project Site before starting Work of specific Section.

B. Require attendance of parties directly affecting, or affected by, Work of specific Section.

C. Notify Engineer four days in advance of meeting date.

1.6 CLOSEOUT MEETING

A. Schedule Project closeout meeting with sufficient time to prepare for requesting Substantial Completion. Preside over meeting and be responsible for minutes.

B. Attendance Required: Contractor, Engineer, Owner, and others appropriate to agenda.

C. Notify Engineer ten days in advance of meeting date.

1.7 *Construction Photographs*

A. General:

- 1. Photographically document all phases of the Project including preconstruction, construction progress, and post-construction.*
- 2. Engineer shall have right to select subject matter and vantage point from which photographs are to be taken.*
- 3. Digital Images: No post-session electronic editing of images is allowed. Stored image shall be actual image as captured without cropping or other edits*
- 4. Images shall be submitted digitally or on flash drive with each Application for Payment.*

B. Preconstruction and Post-Construction:

- 1. After Effective Date of the Agreement and before Work at Site is started, and again upon issuance of Substantial Completion, take a minimum of 48 photographs of Site and property adjacent to perimeter of Site.*
- 2. Particular emphasis shall be directed to structures both inside and outside the Site.*
- 3. Format: Digital, minimum resolution of 2176 by 3264*

C. Construction Progress Photos:

1. *Photographically demonstrate progress of construction, showing every aspect of Site and adjacent properties as well as interior and exterior of new or impacted structures.*
2. *Weekly: Take 24 photographs using digital, minimum resolution of 2176 by 3264 pixels and 24-bit, millions of colors.*

D. Documentation:

1. *Digital Images:*
 - a. *Electronic image shall have date taken embedded into image.*
 - b. *Archive using a commercially available photo management system that provides listing of photographs including date, keyword description, and direction of photograph.*
 - c. *Label file folders or database records with Project and Owner's name, and month and year images were produced.*

1.8 Audio Video Recordings

A. Prior to beginning the Work on Site or of a particular area of the Work, and again within 10 days following date of Substantial Completion, videograph Site and property adjacent to Site.

B. In the case of preconstruction recording, no work shall begin in the area prior to Engineer's review and approval of content and quality of video for that area.

C. Particular emphasis shall be directed to physical condition of existing vegetation, structures, and pavements within Plant site and areas adjacent to and within the right-of-way or easement, and on Contractor storage and staging areas.

D. Engineer shall have right to select subject matter and vantage point from which videos are to be taken.

E. Audio Video Recordings shall be submitted digitally or on a flash drive.

F. Video Format and Quality:

1. *Digital format, with sound.*
2. *Video:*
 - a. *Produce bright, sharp, and clear images with accurate colors, free of distortion and other forms of picture imperfections.*
3. *Audio:*
 - a. *Audio documentation shall be done clearly, precisely, and at a moderate pace.*
 - b. *Indicate date, project name, and a brief description of the location of recording, including:*
 - 1) *Facility name.*
 - 2) *Street names or easements.*
 - 3) *Addresses of private property.*
 - 4) *Direction of coverage, including engineering stationing, if applicable.*

G. Documentation:

1. *Digital File Label:*
 - a. *Project name.*
 - b. *Applicable location by structure.*
 - c. *Date and time of coverage.*
2. *Project Video Log: Maintain an ongoing log that incorporates above noted label information for video recordings on Project.*

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 ALTERATION PROCEDURES

- A. Entire facility will be occupied for normal operations during progress of construction. Cooperate with Owner in scheduling operations to minimize conflict and to permit continuous usage.
 1. Perform Work not to interfere with operations of occupied areas.
 2. Keep utility and service outages to a minimum and perform only after written approval of Owner.
 3. Clean Owner-occupied areas daily. Clean spillage, overspray, and heavy collection of dust in Owner-occupied areas immediately.
- B. Materials: As specified in product Sections; match existing products with new products for patching and extending Work.
- C. Employ original and/or skilled and experienced installer to perform alteration and renovation Work.
- D. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion. Comply with Section 01 70 00 - Execution and Closeout Requirements
- E. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.
- F. Remove debris and abandoned items from area and from concealed spaces.
- G. Prepare surface and remove surface finishes to permit installation of new Work and finishes.
- H. Close openings in exterior surfaces to protect existing Work from weather and extremes of temperature and humidity.
- I. Remove, cut, and patch Work to minimize damage and to permit restoring products and finishes to original or specified condition.

- J. Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with neat transition to adjacent finishes.
- K. Where new Work abuts or aligns with existing Work, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.
- L. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and submit recommendation to Engineer for review.
- M. Where change of plane of 1/4 inch or more occurs, submit recommendation for providing smooth transition to Engineer for review.
- N. Patch or replace portions of existing surfaces that are damaged, lifted, discolored, or showing other imperfections.
- O. Finish surfaces as specified in individual product Sections.

END OF SECTION

SECTION 46 51 36 - FINE BUBBLE MEMBRANE DISC AERATION SYSTEM

PART 1 – GENERAL

1.1 SCOPE

- A. Furnish all materials and equipment for the fine bubble aeration system in the existing aeration basins and the re-aerator.
- B. Furnish all equipment as shown on the drawings and as specified herein.
- C. Provide services and testing associated with the equipment.
- D. All items furnished by the equipment supplier under this section are for installation by the Contractor.

1.2 EQUIPMENT COMPONENTS INCLUDED

- A. Stainless steel drop legs.
- B. PVC manifolds and air distributors.
- C. PVC diffuser holders, subplates and retainer rings.
- D. Stainless steel supports and anchors
- E. Bolts, nuts and gaskets for aeration system flange connections.
- F. Liquid purge systems.
- G. Membrane disc diffusers with integral O-ring gaskets.
- H. Control System

1.3 RELATED WORK AND COMPONENTS NOT INCLUDED

- A. Air main piping, supports, bolts and gaskets.
- B. Air control valves.
- C. Wall sleeves and seals.
- D. Air flow meters.
- E. Blowers
- F. Dissolved Oxygen Meters
- G. Air Pressure Meters

1.4 SUBMITTALS

- A. Submit information to establish compliance with the specifications in accordance with the provisions of Section 01 33 00 - Submittal Procedures.
- B. Submittal drawings showing plan, elevations and cross sections of the equipment.
- C. Component details of the aeration equipment showing diffusers, diffuser holders, gaskets, retainer rings, supports, threaded union and/or flanged joints and a purge system.
- D. Materials and Manufacturing specifications.
- E. Equipment booklet including:
 - 1. Equipment data sheets
 - 2. Performance data including oxygen transfer calculations.
 - 3. Head loss calculations and pressure requirements.
 - 4. Descriptive literature and bulletins.
 - 5. Operation and maintenance manual with installation instructions.
- F. Detailed list of any exceptions to these specifications. Include specification reference and proposed alternative with reason stated for exception.
- G. Membrane longevity tests reports in accordance with Section 2. 2.D.8.
- H. Certified Oxygen Transfer Performance Curve(s)
 - 1. Submit certified oxygen transfer performance curves to demonstrate capability of the aeration equipment to meet the specified oxygen transfer requirements.
 - 2. Base oxygen transfer curves on the following criteria:
 - a. A minimum of 3 tests for each specified condition in complete accordance with ASCE Clean Water Test Procedure (2006 or latest edition)
 - b. Tests conducted by an aeration testing firm in a full-scale aeration test tank (minimum of 200 sq. ft.) at the specified submergence and water depth with a diffuser density equivalent to the specified tank configuration. Diffuser density is defined as the ratio of the total tank surface area to the total active diffuser surface area.
 - c. Tests conducted with air rate and mass rate of oxygen transfer directly proportional to the ratio of the shop test tank volume and the design tank volume.
 - d. Plot of standard condition pounds of oxygen transferred per day per 1000 cubic feet of tank volume versus standard condition cubic feet of air per minute per 1000 cubic feet of tank volume.
(lbs-O₂/day/1000 cubic feet-tank) vs. (SCFM/1000 cubic feet-tank)
 - i. Standard conditions of oxygen transfer are defined as 68° F, 1 atmosphere ambient pressure, clean water.

- ii. Standard air is defined as 68° F, 1 atmosphere, 36% R.H., containing 23% oxygen by weight.
3. Certify and stamp all curves by a Professional Engineer.
4. Submit curves for all specified conditions for approval by the Engineer prior to manufacturing aeration equipment.

1.5 SYSTEM DESIGN AND PERFORMANCE

- A. System Design and aerator layout to be as shown on the plans, or similar if different quantities of diffusers are required.
- B. System requirements are shown on the Aeration System Data Sheet supplement following this Specification.

1.6 WARRANTY

- A. Warranty on equipment and installation is one (1) year from Final Completion, in accordance with Article 6.19 of the General and Supplemental Conditions.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Provide a complete aeration system including disc aerators, manifolds, piping, supports, purge system and dropleg(s) to above the liquid surface as specified herein.
- B. The manufacturer shall have experience in the design, manufacturing, supplying, and commissioning of fine bubble membrane disc aeration equipment of the type specified for this project. The equipment quoted shall be of a proven design and shall be referenced by at least ten installations of similar size, having been in successful operation for a period of not less than five years.

2.2 MATERIALS, FABRICATION AND FINISHING

- A. Stainless Steel – Pipe, Fittings and Supports
 1. Fabricate all welded parts and assemblies from sheets and plates of 304L stainless steel with a 2D finish conforming to ASTM A240, 554, 774, 778.
 2. Fabricate non-welded parts and flanges from sheets, plates or bars of 304 stainless steel conforming to ASTM A240 or ASTM A276.
 3. Welds & Welding Procedure
 - a. Weld in the factory according to AWS Standards. Provide a cross section equal to or greater than the parent metal.
 - b. Provide full penetration butt welds to the interior surface with gas shielding of interior and exterior of joint.

- c. Continuously weld both sides of face rings and flanges to eliminate potential for crevice corrosion.
- 4. Corrosion Protection and Finishing - Clean all welded stainless-steel surfaces and welds after fabrication by using the following procedure:
 - a. Pre-clean all outside weld areas to remove weld splatter with stainless steel brushes and/or deburring and finish grinding wheels.
 - b. Finish and clean all interior and exterior welds and piping by full immersion pickling and rinse with water to remove all carbon deposits and contaminants to regenerate a uniform corrosion resistant chromium oxide film per ASTM A380 Section 6.2.11, Table A2.1 Annex A2 and Section 8.3.
 - c. Corrosion protection techniques not utilizing full immersion methods are unacceptable and will be cause for rejection of the equipment.
- B. Natural Rubber – Furnish all fixed and expansion joint O-ring gaskets of natural rubber/SBR with a Shore A durometer of 45 ± 5 .

C. Polyvinyl Chloride (PVC) – Pipe and Fittings

- 1. Produce all PVC pipe and fittings from PVC compound with a minimum tensile strength of 7000 psi.
- 2. Provide lower drop pipe, manifold and air distributors as follows:

Diameter	Wall Thickness	ASTM
4-inch	SDR 33.5	D3915, 3034
6-inch & larger	Schedule 40	D1784, 1785, 2466

- 3. Factory solvent-weld all PVC joints and diffuser holders. Field solvent welding is NOT permitted.

D. EPDM – Membrane Diffusers and Gaskets

- 1. Manufacture circular membrane diffuser discs with integral O-ring of EPDM synthetic rubber compound with precision die formed slits. Thermoplastic materials (i.e., plasticized PVC or polyurethane) are not acceptable.
- 2. Add carbon black to the material for resistance to ultraviolet light.
- 3. Design diffuser as one-piece injection molded part with a minimum thickness of 0.080 inches for 9-inch diameter unit.
- 4. Limit the maximum tensile strength of the diffuser to 10 psi when operating at 2.4 SCFM/sq. ft. of material. Furnish proportionately thicker material for larger diameter disc diffusers to limit the maximum tensile stress and to resist stretching.
- 5. Produce diffusers free of tears, voids, bubbles, creases or other structural defects.
- 6. Furnish diffuser material to meet the following requirements:

Item	Value/Units	ASTM
Base Polymer	EPDM	D573
UV Resistance	Carbon Black	

Specific Gravity	1.25 or less	
Durometer – Minimum	58% ± 5%	D2240
Modulus of Elasticity	500 psi	D412
Ozone Resistance (72 hrs: 40°C pphm)	No cracks @ 2X magnification	D1171 Test A
Tensile Strength	1200 psi	D412
Elongation - % - Retained 70 hrs @ 100°C - minimum at break	75% Max 350%	D573 D412

7. Quality Control – Test diffuser using primary sampling criteria outlined in Military Standard 105E.
8. MEMBRANE LONGEVITY - Longevity of the proposed membrane diffusers shall have been demonstrated in at least three full-scale municipal installations operating continuously for a minimum of three years. Test reports, prepared by an independent testing agency, shall confirm membrane longevity through compliance with the following maximum allowed percent (+/-) change in each membrane property. Tests conducted in-house by the Supplier shall not be acceptable.

Data for a minimum of three diffusers from each installation shall be provided.

<u>Property</u>	<u>Maximum Percent Change</u>
• Durometer	5%
• Weight	5%
• Permanent Set	0.5%

2.3 – FINE BUBBLE AERATION SYSTEM COMPONENTS

- A. Drop Legs – Provide a stainless-steel drop leg from the air main connection to the drop leg connection on the manifold.
 1. Provide a stainless steel Van Stone style flange with a 150-pound drill pattern for the top connection.
 2. Provide a stainless-steel band clamp coupling with gasket for the lower dropleg to manifold connection.
- B. Manifolds – Provide PVC manifolds for connection to the air distribution headers.
 1. Fabricate manifolds with fixed threaded union or flanged joints for connection to the air distributors.
 2. Design manifold, distributor connections and supports to resist thrust generated by expansion/contraction of the air distributors over a temperature range of 125° F.
 3. Support manifold with a minimum of two supports.
 4. Connect manifolds with fixed threaded union or flanged joints to prevent rotation or blow apart.

- C. Air Distributors and Diffuser Holders – Provide air distributors perpendicular to the air manifold
 - 1. Fabricate distributors with single diffuser holders, solvent welded to the crown of the air distributor for complete air seal and strength.
 - 2. Provide minimum solvent weld area of 15 square inches.
 - 3. Design distributors and holders to resist a dead load of 200 lbs applied vertically to the outer edge of the diffuser holder.
 - 4. Provide threaded removable end caps complete with gasket, threaded coupling and end plate for cleanout at the end of each distributor.

- D. Air Distributor and Manifold Connection Joints
 - 1. Join air distributor sections with positive locking fixed threaded union or flange type joints for all submerged header joints to prevent blow apart and rotation.
 - 2. Bell and spigot, slip on or expansion type joints are not acceptable for submerged joints.
 - 3. Design threaded union joints that prevent rotation by directly locking spigot section connected to one end of the distribution header, and a threaded socket section connected to the mating distribution header. “O” ring gasket and a threaded screw on retainer ring to provide complete seal. Factory solvent-weld all joints. Joints that rely on friction alone or use the “O” ring to prevent rotation shall not be acceptable.
 - 4. Design flange joints with an angle face ring, follower flange with a 125-pound drill pattern and stainless-steel hardware.

- E. Supports – Provide each section of manifold and air distributor with a minimum of two (2) supports.
 - 1. Limit maximum support spacing to 8 feet.
 - 2. Design all supports to allow for thermal expansion and contraction forces over a temperature range of 125° F and to minimize stress build up in the piping system.
 - 3. Design supports to be adjustable without removing the air distributor from the support.
 - 4. Design supports to allow for complete removal from the tank to facilitate installation of additional headers and in-tank maintenance.
 - 5. Manifold Support – 6-inch diameter and larger
 - a. Design supports to include: hold down guide straps, support structure and anchor bolts.
 - b. Design guide straps with a 2-inch minimum width to eliminate point load on manifold and minimize binding.
 - c. Design support for 2-inches plus or minus vertical adjustment for leveling of manifold.
 - d. Attach supports to tank floor with two stainless steel anchor bolts.
 - 6. Air Distributor and Manifold Supports – 3- and 4-inch diameter.
 - a. Provide guide and fixed type supports to allow expansion/contraction.

- b. Design supports with hold down straps, support structure and anchor bolt.
 - c. Design support for 1 1/2-inch (plus or minus) vertical adjustment for leveling air distributor to plus or minus 1/4-inch.
 - d. Guide support
 - 1. Guide straps to have 1 1/2-inch wide top and bottom contoured bearing surface with chamfered edges to minimize binding and resistance to movement of air distributor under full buoyant uplift load.
 - 2. Design strap with 1/8-inch clearance around distributor so strap is self-limiting and cannot be over tightened.
 - e. Fixed supports
 - 1. Fixed straps to have 1 1/2-inch wide top and bottom contoured bearing surface with punched burrs to positively grip the air distributor when tightened.
 - 2. Design strap to be self-limiting to prevent stressing the distributor if the clamp is over tightened.
 - f. Attach supports to tank floor with one stainless steel anchor bolt.
- F. Diffuser Assemblies – Furnish diffuser assemblies including diffuser, diffuser gasket, holder, retaining ring and air flow control orifice.
- 1. Membrane Diffuser
 - a. Incorporate an integral check valve into the membrane diffuser.
 - b. Design and test diffusers for a dynamic wet pressure (DWP) of 12 inches \pm 20% water column @ 1.0 SCFM/diffuser and 2 inches submergence.
 - c. Visual Uniformity – Observe diffusers for uniform air distribution across the active surface of the diffuser at 1.0 SCFM/diffuser and 2 inches submergence. Active surface is defined as the perforated horizontal projected area of the diffuser.
 - d. Quality Control – Test diffuser using primary sampling criteria outlined in Military Standard 105E.
 - 2. Diffuser Holders, Support Plate and Retainer Rings
 - a. Design holder with air flow control orifice and plenum chamber below the diffuser. Holder to provide peripheral support for the diffuser.
 - b. Diffuser Support Plate – Provide a PVC support plate to form an air plenum under the diffuser and support for the membrane when the air is off.
 - c. Design retainer ring to seal the diffuser and O-ring in the holder to prevent air leakage around gasket.
 - d. Design retainer ring threads with minimum cross section of 1/8 inch and allow for one complete turn to engage threads.

G. Anchor Bolts

1. Design anchor bolts for embedment in 4000 psi concrete with a pullout safety factor of 4.
2. Provide a mechanical stainless steel expansion type anchor bolt system.

H. Liquid Purge System - Provide a liquid purge system to drain the entire submerged aeration piping system for each aeration grid including airlift purge eductor line and control valve.

2.4 SPARE AERATION PARTS

A. Package spare parts in a separate container clearly marked as "Spare Parts" and provide inventory list on exterior of the container.

1. Furnish 10 diffuser elements and gaskets
2. Furnish 10 diffuser holder retainer rings
3. Furnish 10 diffuser holders
4. Furnish 5 air distributor supports
5. Furnish 2 manifold supports
6. Furnish 2 air distributor repair couplings
7. Furnish 2 fixed joint assemblies

2.5 CONTROL PANEL

A. The aeration equipment supplier shall furnish a control panel that shall include a Graphic Operator Interface, Programmable Logic Controller, Control Switches, and Pilot lights that are designed to automatically control aeration in the aeration basins.

1. Panel Enclosure

- a. The control panel enclosure shall be a heavy duty, NEMA 12, enclosure with a flange mounted disconnect if three-phase power is required. The panel shall be made of 10-gauge steel and fully braced. The doors shall be heavy duty 3-point latching doors with a padlocking handle. The master circuit breaker disconnect shall be interlocked with the doors.
- b. Control power shall be provided by a transformer if three-phase power is required. In addition, a voltage filter and surge protective device shall be used for PLC and HMI power supply. The voltage filter will combine active tracking technology with UL listed surge protection against the full spectrum of voltage transients and surges. It must continuously track the input AC line power and respond instantly upon detecting extraneous high frequency noise and high voltage transients. The device must be UL1449 and UL1283 listed.
- c. Surge suppressers shall be used with all relays and contactors. All control voltage branch feeders shall be protected by circuit breakers or fuses.
- d. Control relays shall be industrial plug-in type, rated at 7 to 10 amps.

- e. Motor starters shall be UL Listed as a self-protected control device type of combination starter [rated at 42,000 AIC].
 - f. Terminal blocks shall be high-density type, rated for 600 VAC, 30 amp minimum. Ten percent spare terminals shall be provided. All devices shall be clearly marked and identified on the inside of the panel. All terminals and wires shall be clearly tagged in accordance with the schematic and wiring diagrams.
 - g. Pilot lights shall be industrial Monolithic style, 22mm devices, or equal. A "Hand-Off-Auto" switch will be provided for each motor. Selector switches shall be industrial, NEMA 4/13, 30mm, water/oil tight devices. The Auto position will allow automatic PLC operation while the Hand position will allow the operator to bypass the PLC when operating equipment.
- B. Programmable Logic Controller (PLC)
- 1. The Programmable Logic Controller (PLC) shall have a built-in Ethernet port for network communications.
 - 2. Acceptable Manufacturers: Allen Bradley CompactLogix
- C. Human Machine Interface (HMI)
- 1. A Graphic Operator Interface Terminal (HMI) shall be mounted on the front of the panel for control of the system and shall provide graphic display of the process parameters and equipment status on a color display. The HMI shall also allow for entry of setpoint changes for system control. The display shall be 15.5" widescreen touchscreen, aspect ratio 16:9. The display shall be connected to a DIN rail mounted industrial computer.
 - 2. Minimum HMI functions shall include:
 - a. Graphical display of all status information available for each device in the biological treatment system in the form of a pop-up window for quick and easy access.
 - b. Display all smart sensor status information available from the sensors.
 - c. Electronic O&M Manuals for all hardware provided by the aeration system manufacturer shall reside on the HMI and be quickly obtained by pushing a button.
 - d. Alarm screen that allows the operator to select an alarm and push a button to display troubleshooting tips for that alarm.
 - e. Easy navigation set up with control mode select buttons for each basin along the left and HMI screen navigation buttons along the top.
 - f. Maintenance dashboard screen with quick read gauges of maintenance life span for all biological treatment devices requiring maintenance.
 - g. Historical trend screen displays ~~10 days of key~~ recent history of process variables, logged once per minute, including, where applicable, each basin's DO, DO Setpoint, Air Control Valve Position, Air Pressure and Clock.

~~h. HMI software shall provide a minimum of one (1) secure client, one (1) web client and one (1) SMA client license for operation staff use.~~

A. Remote connection

1. A webport with a built-in four-port Ethernet switch shall be provided to allow direct access for online technical support via a standard internet connection.
2. A customer account shall be set up by the supplier to allow operations staff access to view the plant HMI via the client licenses using a computer or other portable electronic device for the duration of the supplier's warranty period. Starting at the expiration of the warranty period an annual fee shall be assessed by the biological treatment supplier to maintain the customer account/access.

B. Biological Process Control Logic

1. The operator shall be able to enable or disable any of the process control logic functions at any time through the HMI. When a control logic function is disabled, the equipment may be operated manually through operator inputted setpoints.
2. Blower Control: The control system will interface with the blowers to provide the proper amount of air required for the system.
3. The control system will include the Aeration Basin controllers, as well as instruments for monitoring process parameters, as detailed in other Specification Sections
4. The equipment that will be monitored and/or operated by the Control Panel include the following:
 - a. Blower operation and speed
 - b. Motorized air control valves for each aeration basin
 - c. Dissolved Oxygen monitors for each aeration basin
 - d. Air piping pressure monitor
 - e. Air flowmeters to each aeration basin

PART 3 – EXECUTION

3.1 – INSTALLATION PROCEDURE

A. Coordinate installation with the Operator.

1. The Operator will drain down the Aeration Basin and clean the basin before the installation of the aeration equipment.
2. Only one Aeration Basin at a time can be used for the installation of the equipment. The other basin will need to be operational to continue wastewater treatment.
2. Follow equipment manufacturer's recommendations for sequencing of equipment installation.

3. Layout and install support anchors in accordance with equipment manufacturer's recommendations and anchor setting plan.
 4. Level aeration system such that all diffusers connected to a header are within plus or minus 1/4-inch of a common horizontal plane.
- B. The first aerator installation will be installed, tested and operational before the second Aeration Basin is drained.
1. At least 2 blowers will be operational for the test of the first aerator grid.
 2. The DO Meters in the first Aeration Basin will be installed, tested and operational.

3.2 – AERATION SYSTEM TESTING

- A. Each grid of diffusers shall be tested separately for level installation and even distribution of air throughout the grid, and proper diffuser operation.
- B. The Aeration Basin shall be filled with clean water event to the top of the diffusers to verify that they have been installed to within ¼-inch vertical height. Height of diffusers outside this tolerance shall be adjusted.
- C. The Aeration Basin will then be filled with clean water to 1 foot above the diffusers and visually inspected for leaks and proper operation.
- D. The Aeration Basin will then be filled with clean water to the operating level and visually inspected for leaks and proper operation. Air system pressure readings shall also me made to confirm proper operation.

3.3 – INSTALLATION/START UP SERVICES

- A. Provide the services of a factory representative for two (2) day(s) to verify the proper installation of the equipment.
- B. Provide the services of a factory representative for two (2) day(s) to instruct Owner's personnel on operation and maintenance.

3.4 – WARRANTY

- A. Warrant all parts to be free from defects in materials and workmanship for a period of one year after installation or 18 months after delivery, whichever occurs first.
- B. Furnish replacement parts to the Owner for any items found to be defective within the one-year warranty period.

END OF SECTION

FINE BUBBLE DIFFUSER DATA SHEET

Basis of Design

Manufacturer and Make: Sanitaire Silver Series II 9" Diameter

Other Acceptable Manufacturers: EDI FlexAir Basic

Aeration Basin System Design and Performance: Design aeration system to transfer not less than the following pounds of oxygen per day in clean water at 14.7 PSI, 20°C and zero dissolved oxygen at the specified submergence, air rate and pressure.

	Each Aeration Basin	
Std. O2 Transfer Rate (SOTR)	11,167	lbsO ₂ /day
Volumetric Air Rate	1,635	SCFM
Operating Pressure at Top of Dropleg	6.56	psig
Diffuser Submergence (@SWD)	12.2	ft

Aeration Basin Dimensions:

Dimension Each Aeration Basin	
Length	220.0 ft
Width	26.0 ft
Side Water Depth	13.0 ft

Re-Aerator Design and Performance: Design aeration system to transfer not less than the following pounds of oxygen per day in clean water at 14.7 PSI, 20°C and zero dissolved oxygen at the specified submergence, air rate and pressure.

	Re-Aerator	
Std. O2 Transfer Rate (SOTR)	338	lbsO ₂ /day
Volumetric Air Rate	70	SCFM
Operating Pressure at Top of Dropleg	4.66	psig
Diffuser Submergence (@SWD)	9.0	ft

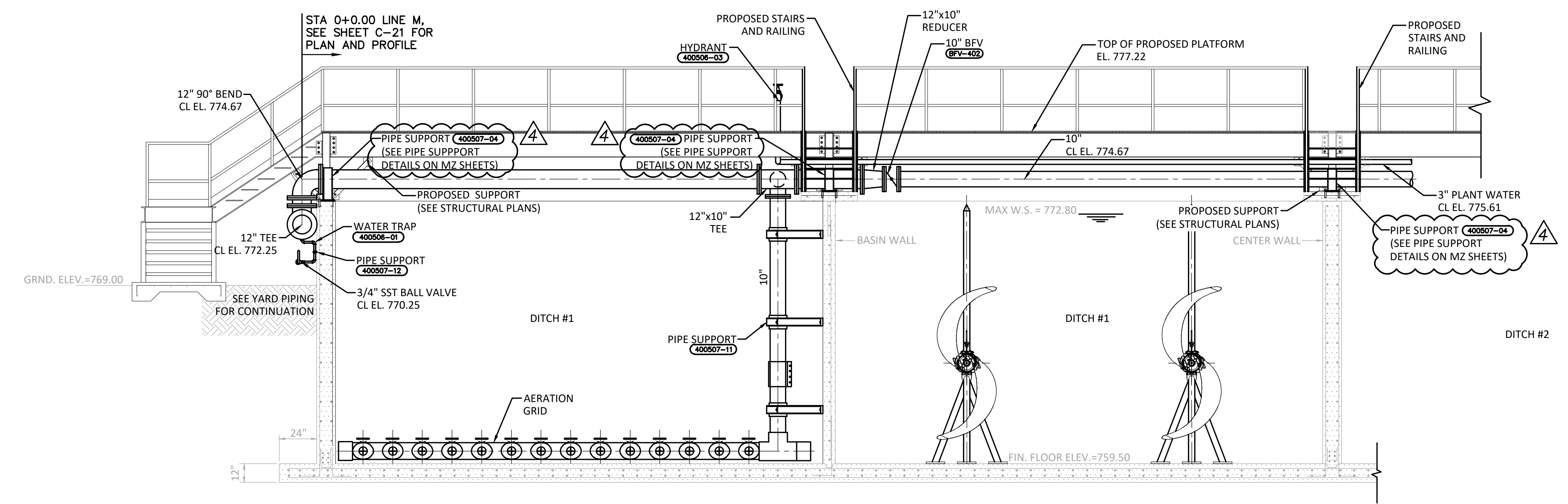
Re-Aerator Dimensions:

Re-Aerator Dimensions	
Length	11.0 ft
Width	11.0 ft
Side Water Depth	10.0 ft

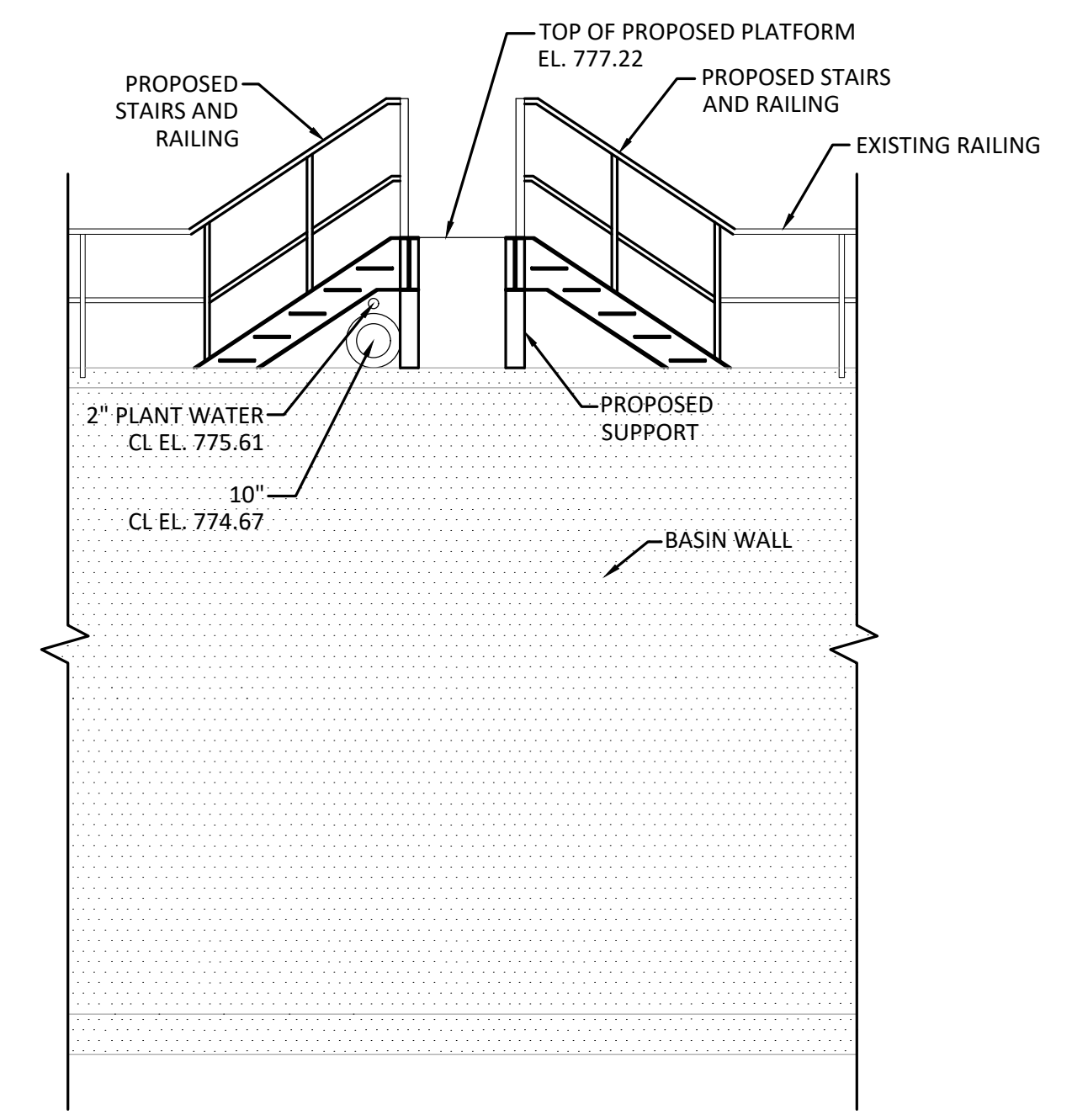
\\LUCID\PROJECTS\PROJECTS\2-01590\2 DESIGN\2.0 CAD\WTP\W-ERATION BASIN.DWG, AERATION BASIN SEC. 6/14/2023 11:46:06 AM, panderson

GENERAL NOTES

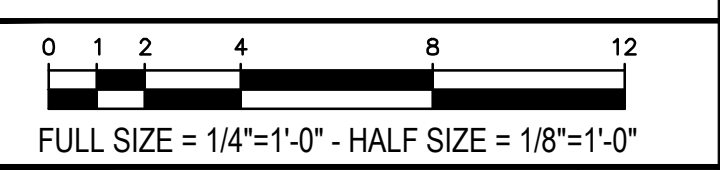
- SEE MANUFACTURER FOR CONNECTION DETAILS.
- PIPE SUPPORTS BETWEEN BASIN WALLS ARE TO BE ATTACHED TO WALKWAY. COORDINATE WITH WALKWAY PROVIDER FOR CONSIDERATION OF ADDITIONAL WEIGHT AND STRESSES IN WALKWAY DESIGN.



SECTION 1
1/4" = 1'-0"
MD03



SECTION 2
1/4" = 1'-0"
MD03



REV.	DESCRIPTION	DATE
ADDENDUM #4		6-14-23
ADDENDUM #3		6-13-23
ADDENDUM #2		6-1-23
ADDENDUM #1		5-23-23



CITY OF GATESVILLE
CITY OF GATESVILLE - STILLHOUSE WWTF UPGRADE AND EXPANSION

AERATION BASIN SECTIONS

DATE: 5-8-23
MICHAEL CLOUGH

DESIGNED	J. JENKINS
DRAFTED	M. CLOUGH
CHECKED	J. JENKINS
PROJECT NO.	2-01590

DRAWING NO. **MD-03**

