PROJECT SPECIFICATIONS

FOR

Greater Dayton Regional Transit Authority

Building 601 Diesel Tank Replacement

601 Longworth Street
Dayton, Ohio 45402

CONSTRUCTION SET

November 17, 2023

CA Project No. 634-7069-00

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02 05 00 SITE REMEDIATION

PART 1 - GENERAL

1.1 The Underground Storage Tank (UST) system in currently undergoing remediation following a release from Tank T00002. BUSTR has assigned the incident Release Number 57010488-N00005. With the open excavation, one of the following two alternate remedial actions presented herein are proposed to be implemented.

A. Alternate #1: Include emplacement and mixing of amendments (oxidants) within the bottom of excavation floor footprint. The amendments are designed to accelerate the destruction/degradation of total petroleum hydrocarbons (TPH). Contractor will evenly apply Provect-OX2™, or similar, (a ferric iron-activated mixture of potassium persulfate and sodium persulfate with ferrate stabilizer and pH buffer) at a rate of 9 pounds per square foot throughout the base of the excavated area, and then mix to a depth of 3 feet below excavation floor elevation. Mixing with a backhoe bucket should be conducted at an average rate of approximately 1 minute per cubic yard of amended soil (approximately 2.5 hours for the excavated area). Once mixing is completed, the Contractor will spread and lightly compact soil to an approximately level grade, and evenly apply approximately 10,000 gallons (eight gallons per square foot) of tap water. Contractor to coordinate with Owner's Environmental Consultant. Owner's Environmental Consultant will coordinate Remedial Action and approval with BUSTR.

B. Alternate #2: Contractor will evenly apply a bio amendment consisting of an enhanced microbial blend, such as TersOx™ Microbe with a nutrient blend, throughout the base of the excavated area. The amendment may be applied using a pump and spray nozzle from the top of the exaction and mixing will not be conducted. The contractor shall include two days of labor for emplacement of a to be determined amendment within the bottom of the excavation floor footprint.

C. The Owner shall obtain preapproval from the Bureau of Underground Storage Tank Regulations (BUSTR) and the Petroleum Underground Storage Tank Release Compensation Board (PUSTRCB). The Contractor shall consult with the Owner the status of such approval prior to implementing any of the above remediation alternatives.

PART 2 - PRODUCTS

A. Provect-OX2 is a trademarked extended release, self-activating Insitu Chemical Oxidation (ISCO) product with Enhanced Bioremediation Reagent. (https://www.provectusenvironmental.com/provect-ox2/). An equivalent product incorporating ferric iron-activated mixture of potassium persulfate and sodium persulfate may be proposed for use by the Contractor with a suggested application dosage.

B. TersOx™ Microbe is a blend of preselected, adapted microorganisms formulated for a broad range of bioremediation programs for crude petroleum, gasoline, and diesel fuel, machining oils, hydraulic fluids, solvents, monomers and other petroleum derivatives. (https://www.surbec.com/products/tersox-microbe).

02 65 00 UNDERGROUND FUEL OIL STORAGE SYSTEM REMOVAL

PART 1 - GENERAL

1.1 The work consists of the removal of three (3) underground fuel oil storage tanks, concrete pads, related piping, piping trench, and accessories shall be as shown on the drawings and as specified herein.

A. Contractor to verify conditions, existing locations of all tanks, dimension in field, and notify Owner/ Architect/ Engineer of any conflicts.

B. Excavation, removal, and disposal of three (3) underground storage tanks (USTs), concrete pads under all tanks, submersible fuel pumps, and associated piping used to store petroleum products in accordance with the State of Ohio Administrative Code under the Bureau of Underground Storage Tank Regulations (BUSTR), Federal, State, and local regulations.

C. The (3) USTs to be removed and disposed are:

1. Two (2) 20,000-gallon diesel fuel fiberglass tanks

a. Tank T00002 was previously taken out of service following Release Number 57010488-N00005.

2. One (1) 2,000-gallon new oil fiberglass tank

1.2 References

1. Ohio Bureau of Underground Storage Tank Regulations (BUSTR), Technical Guidance Manual, 2017

2. Ohio Administrative Code (OAC) 1301:7-9-12, OAC 1301:7-9-13, OAC 1301:7-9-16, and OAC 1301:7-9-17, effective date September 1, 2017

3. Ohio Fire Code, OAC 1301:7-7

4. UL1316:2018, Standard for Fiber Reinforced Underground Tanks for Flammable and Combustible Liquids

5. American Petroleum Institute Recommended Practice 1604: *Closure of Underground Petroleum Storage Tanks*,

6. American Petroleum Institute Publication 2015 Safe Entry and Cleaning Petroleum Storage Tanks

7. National Institute of Occupational Safety and Health (NIOSH) Publication 80-106: *Criteria for a Recommended Standard Working in Confined Space*.

1.3 Underground fuel storage system removal work must be supervised by a certified UST Contractor. Certification shall be furnished to the Owner/ Architect/ Engineer prior to performing work on this project.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 Excavation

A. Refer to 31 23 00.

3.2 DISPOSAL OF PETROLEUM CONTAMINATED SOIL

A. Excavated material shall be directly loaded into trucks and disposed of off-site as petroleum-contaminated soil (PCS) based on prior analytical results. Contractor to confirm if additional analytical is required for disposal by the disposal facility. No more than 12 inches of native soil shall be removed from the side walls, bottom of tank cavity excavations, piping trenches, and dispensing unit areas without prior approval of the State Fire Marshall. Coordination with the State Fire Marshall will be conducted by the Owner's Environmental Consultant under separate contract to obtain approval.

B. Should soil removal from the excavation require stockpiling prior to disposal, it shall be placed on concrete or asphalt pad or underlain with a synthetic linear and temporarily stored at the site (maximum 120 days) awaiting permanent disposal. Soil shall also be covered with a synthetic liner to prevent precipitation infiltration and surrounded with a berm. Sufficient room may not be available for on-site storage of all excavated soil. Make provisions for either immediate disposal or a temporary off-site storage facility complying with all state and federal requirements. Any temporary off-site storage may require compliance with OEPA manifesting regulations.

C. The contract price for soil removal required in conjunction with the tank work shall be predicated on the premise that the soil is non-hazardous, PCS soil. The contract price for the concrete removal shall be predicated on the premise that the concrete is construction and demolition (C&D) debris.

A. TANK AND CONCRETE PAD REMOVAL AND DISPOSAL

1. Extreme caution shall be exercised in the removal process which shall be in accordance with all standards, rules and regulations of the authority (or authorities) having jurisdiction. Tank(s), sump(s) and piping shall be regularly monitored to ensure that an accumulation of exposure vapors does not occur. The process shall involve not less than the following steps:

2. Remove as much product as possible from the tanks. Transfer any usable product as directed by the Owner/ Architect/ Engineer.

3. Completely disconnect, at the source, all electrical power to the components being removed.

4. Carefully expose the underground piping and tank and sump tops.

5. With due consideration for type of system (suction or pressure product lines), relieve vacuum and/or checks to allow all product in the lines to drain into the tank. Use hand pump if necessary to ensure that all lines have been evacuated.

6. Manually remove remaining product (and sludge, if present) from tanks. Containment and disposal shall be in accordance with approved methods.

7. Tanks shall be rendered "vapor-free" by an approved method such as placing solid carbon dioxide (dry ice) in the tank or by forced-air ventilation of the tank. Dry ice, if used, shall be provided at the rated of 1.5 lbs. per 100 gallons of tank capacity. The dry ice should be crushed and spread evenly in the tank. If the forced ventilation method is used, any exhaust fans used to withdraw vapors must be of explosion-proof construction.

8. After the tanks have been tested (per applicable NFPA standards) and found to be "vapor-free", the top of the tank shall be forcibly opened to allow full uninhibited ventilation.

9. Backfill shall be removed and tanks shall be removed from the excavation. Do not depend on the tanks lifting lugs. Lift cables should encircle the tanks for maximum safety. Depending on soil conditions, appropriate provisions shall be made to protect the workers in or near the excavation as well as adjacent structures, pads and drives.

10. Tanks shall then be crushed, sectioned or perforated, and disposed of in an approved manner.

B. Certify, in writing to the Owner, that the tanks have been crushed, sectioned or perforated and have been disposed of in conformance with all applicable federal, state and local codes, rules and regulations. Provide Tank Closure Reports. Provide written confirmation from disposal facility of tank acceptance.

C. All system accessories (piping, piping trench, vents, etc.) as shown on the drawing shall also be removed. Disposal of these items shall be as directed by the Owner/ Architect / Engineer.

3.3 CLOSURE ASSESSMENT

A. Notify the Owner/ Architect/ Engineer and governing authorities at least fourteen (14) working days prior to excavation to allow the parties to be present during excavation and prepare for the BUSTR Closure Assessment.

B. Inform the Owner/ Architect/ Engineer of any visual or other sensory signs of fuel or hydrocarbon releases to the soils or groundwater adjacent to the tanks or piping and halt further work or dewatering activity upon such detection. This visual assessment shall also identify past or present operational problems, which will be used to bias soil sample collection areas.

C. Do not disturb the excavation area after discovery of any fuel oil or hydrocarbons in the excavation area and do not proceed with work which might cause disturbance of the excavation until given a Notice to Proceed by the Owner/ Architect/ Engineer.

D. The Owner’s Environmental Consultant under separate contract shall conduct a BUSTR Closure Assessment for the UST system closure. Soil and groundwater samples will be collected by the Owner’s Environmental Consultant. Contractor shall provide required backup for the BUSTR Closure Assessment Report.

E. Assist with collection of soil or groundwater samples such as providing a backhoe for bottomhole sampling, ventilation of the excavation, means of safe entry to and egress from the excavation, etc. if requested by the Owner.

END OF SECTION

02 70 00 MONITORING AND RECOVERY WELL ABANDONMENT

PART 1 - GENERAL

1.1 Monitoring Well and Recovery Well Abandonment

A. The following Monitoring wells (MWs) and Recovery wells (RWs) that are located within the excavation extent shown on the drawings shall be decommissioned and sealed prior to excavation work in accordance with the Ohio EPA's "Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring", Chapter 9: *Sealing Boreholes and Decommissioning Monitoring Wells* (Rev. 3, September 2016).

B. Notify the Owner, Engineer, and governing authorities at least seven (7) working days prior to abandonment to allow the parties to be present. The Owner's Environmental Consultant will be onsite for oversight.

C. Contractor shall maintain documentation of the procedures and materials used (including predicted volume of grout, volume of grout used, and an explanation if any discrepancy exists between these values).

D. The Ohio Revised Code 1521.05(C) requires that a well sealing report be filed with the Ohio Department of Natural Resources (ODNR). Well sealing reports shall be prepared and provided to the Owner's Environmental Consultant prior to filing with ODNR.

E. The Owner's Environmental Consultant will provide the well sealing reports to BUSTR on behalf of the Owner.

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:
   1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete Subcontractor.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, and testing agency.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Waterstops.
6. Curing compounds.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Semirigid joint filler.
11. Joint-filler strips.
12. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

E. Field quality-control reports.

F. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.10 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301 (ACI 301M).

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.3 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type I, Type II, Type III gray.
2. Fly Ash: ASTM C 618, Class F or C.
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
4. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

F. Water: ASTM C 94/C 94M and potable.

2.4 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.6 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Slag Cement: 50 percent.
4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
5. Silica Fume: 10 percent.
6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
7. Combined Fly Ash or Pozzolans, Slag Cement, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.

2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.7 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Normal-weight concrete.

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Maximum W/C Ratio:.55.
3. Slump Limit: 4 inches (100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).

B. Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Maximum W/C Ratio: 0.50.
3. Minimum Cementitious Materials Content: 520 lb/cu. yd. (309 kg/cu. m).
4. Slump Limit: 4 inches (100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
6. Slump Limit: 4 inches (100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.3 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.4 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.6 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.7 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.8 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.9 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.10 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:
1. Verification of use of required design mixture.
2. Concrete placement, including conveying and depositing.
3. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.

a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.11 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 03 30 00

22 05 01 BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 Special Note

A. All provisions of the Bidding Requirements, General Conditions, Supplementary Conditions including Divisions 00 and 01, apply to work specified in this Division.

B. The scope of the Division 22 work includes furnishing, installing, testing and warranty of all work and complete Plumbing systems as shown on the P series drawings, and as specified in Division 22 and elsewhere in the project documents.

C. The project drawings and specifications define scope of work for the various divisions. Such assignments of work are not intended to restrict the Engineer in assignment of work among the contractors to accommodate trade agreements and practices or the normal conduct of the construction work. If there is a conflict of assigned work between Divisions 02 thru 33 and Divisions 00 and 01, Divisions 00 and 01 shall take precedence.

1.2 Permits and Regulations

A. Include payment of all permit and inspection fees applicable to the work in Division 22. Furnish for the Owner certificates of approval from the governing inspection agencies, as a condition for final payment.

B. Work must conform to applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawings and specifications shall govern. Install no work contrary to minimum legal standards.

1.3 Inspection of Site

A. Each bidder shall inspect the project site and the premises of the existing building. Conditions shall be compared with information shown on the drawings. Report immediately to the Architect / Engineer any significant discrepancies which may be discovered. After the contract is signed, no allowance will be made for failure to have made a thorough inspection.

1.4 Drawings and Specifications

A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word "provide", as used, shall mean "furnish and install". If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect / Engineer for approval before proceeding with the work.

B. Make all necessary field measurements to ensure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.

C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Architect / Engineer for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Having pipe and fittings fabricated and delivered in advance of making actual measurements shall not be sufficient cause to avoid making offsets and minor changes as may be necessary to install piping and equipment.

D. The Architect / Engineer shall reserve the right to make minor adjustment in locations of system runs and components where considered desirable in the interest of concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.

E. Equipment or piping shall not be installed in the dedicated electrical space above or in the working space required around electrical switchgear, motor control centers or panelboards as identified by the National Electric Code (NEC).

F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The Architect's / Engineer's decision shall be final in regard to the arrangement of equipment, piping, etc., where conflict arises.

G. Provide offsets in system runs, additional fittings, necessary drains and minor valves, traps and devices required to complete the installation, or for the proper operation of the system. Exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.

H. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect / Engineer. In such event, none of the trades or their suppliers shall assume that they are relieved of the work which is specified under their branch until instructions in writing are received from the Architect / Engineer.

1.5 Inspection

A. All work shall be subject to inspection of Federal, State and local agencies as may be appropriate, and of the Architect and Engineer.

B. Obtain final inspection certificates and turn over to the Owner.

1.6 Record Drawings

A. Maintain a separate set of prints of the contract documents and hand mark all changes or variations, in a manner to be clearly discernible, which are made during construction and the coordination process. Upon completion of the work and within 90 days of system acceptance, these drawings shall be turned over to the Architect / Engineer. This shall apply particularly to underground and concealed work, and to other systems where the installation varies to a degree which would justify recording the change.

1.7 Operating and Maintenance Manuals

A. Assemble three copies each of operating and maintenance manuals for the Plumbing work.

B. All "approved" shop drawings and installation, maintenance and operating instruction pamphlets or brochures, wiring diagrams, parts list and other information, along with warranties, shall be obtained from each manufacturer of the principal items of equipment. In addition, prepare and include a chart listing all items of equipment which are furnished under this contract, indicating the nature of maintenance required, the recommended frequency of checking these points and the type of lubricating media or replacement material required. Name and address of a qualified service agency. A complete narrative of how each system is intended to operate.

C. Pipe pressure test reports, shall also be included.

D. These shall be assembled into three-ring loose leaf binders or other appropriate binding. An index and tabbed sheets to separate the sections shall be included. These shall be submitted to the Engineer for review. Upon approval, manuals shall be turned over to the Owner.

1.8 Warranty

A. Warrant all workmanship, equipment and material entering into this contract for a period of one (1) year from date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect or Engineer. Any materials or equipment proving to be defective during this warranty period shall be made good without expense to the Owner. Use of equipment for temporary system use is not the start of the warranty period.

1. Certain items of equipment are specified to have multi-year parts and/or labor warranties. Refer to individual equipment specifications.

B. This provision is intended specifically to cover deficiencies in contract completion or performance which are not immediately discovered after systems are placed in operation. Also included shall be supplementary assistance in balancing, adjusting or providing operating instructions as the need develops, and replacing overload heater elements in starters where necessary to keep systems in operation. Heater element sizes shall not exceed the motor manufacturer's recommendations.

C. This provision shall not be construed to include maintenance items such as re-tightening or repacking glands, greasing, oiling, belt tightening and cleaning strainers after these have been done for final close-out.

D. Provisions of this warranty shall be considered supplementary to warranty provisions under Division 01 General Conditions.
1. Div. 01

PART 2 - PRODUCTS

2.1 Materials and Equipment

A. Materials and equipment furnished under this contract shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.

2.2 Listing and Labeling

All equipment and appliances shall be listed and labeled in accordance with the Plumbing Code. Testing shall be performed by an Approved Agency, with the seal or mark of the Agency affixed to each piece of equipment or appliance

2.3 Reference Standards

A. Where standards (NFPA, NEC, ASTM, UL, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the authority having jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

2.4 Equipment Selection

A. The selection of materials and equipment to be furnished shall be governed by the following:

1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specification, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturers listed.
2. Where the words "or approved equal" appear after a manufacturer's name, specific approval must be obtained from the Architect during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish quality level and standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer's approval.

B. Substitute equipment of equal quality and capacity will be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.

C. Before bidding equipment, and again in the preparation of shop drawings, verify that adequate space is available for entry and installation of the item of equipment, including associated piping and accessories. Also verify that adequate space is available for servicing of the equipment.

D. If extensive changes in pipe or equipment layout, or electrical wiring and equipment are brought about by the use of equipment which is not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in this contract.

2.5 Shop Drawings

A. Electronic copies of shop drawings and descriptive information of equipment and materials shall be furnished. Submit to the Architect and/or Engineer for review as stated in the General Conditions and Supplementary Conditions. These shall be submitted as soon as practicable and before equipment is installed and before special equipment is manufactured. Submittal information shall clearly identify the manufacturer, specific model number, approval labels, performance data, electrical characteristics, features, specified options and additional information sufficient to evidence compliance with the contract documents. Product catalogs, brochures, etc. submitted without project specific items marked as being submitted for review will be rejected and returned without review. Shop drawings for equipment, fixtures, devices and materials shall be labeled and identified same as on the Contract Documents. If compliance with the above criteria is not provided shop drawings will be subject to rejection and returned without review. Samples shall be submitted when requested or as specified here with-in.

B. The review of shop drawings by the Architect or Engineer shall not relieve the Contractor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer’s attention in a separate clearly stated notification at the time of submittal for the Engineer’s review.

C. Shop drawings of the following Plumbing equipment and materials shall be submitted:

1. Pipe, fittings and joining methods for the various systems.
2. Valves.
3. Flexible connectors.
4. Gauges.
5. Vibration isolators.

6. Fuel Oil System Components and accessories, Tanks, Pumps, etc.
7. Tank Gauging and Leak Detection System.

PART 3 - EXECUTION

3.1 Pipe Testing

A. All piping provided in this work shall be pressure tested, as specified below.

B. Pipe testing for Plumbing piping shall be:
   1. Other piping - refer to appropriate Sections.

C. Ensure that air is vented from piping when piping is hydrostatically tested.

D. Tests shall be witnessed by field representatives of the Architect or Engineer or shall be monitored by a recorder. Furnish a written record of each piping system test indicating date, system, pressure, duration and results of tests. Copies of test reports shall be included in the O&M manuals.

E. Leaks discovered during testing shall not be patched. Threaded connections shall be either tightened or replaced.

3.2 Operation and Adjustment of Equipment

A. As each piping system is put into operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing water systems, tightening packing glands, and adjusting all operating equipment.

B. Caution: Verify that all bearings are lubricated, all motors are operating in the right direction, and correct drive settings and overload heater elements are provided on all motors. Do not depend wholly on the electrician's judgment in these matters. Follow specific instructions in regard to lubrication. Do not oil or grease presealed ball bearings unless upon manufacturer's specific instructions.

C. Test relief valves, air vents and regulating valves to ensure proper operation.

3.3 Operating Demonstration and Instructions

A. Set the various systems into operation and demonstrate to the Owner that the systems function properly and that the requirements of the Contract are fulfilled.

B. Provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.

C. O&M manuals shall be submitted, reviewed and approved prior to scheduling of demonstrations.

END OF SECTION

22 05 02 AGREEMENT AND WAIVER FOR USE OF ELECTRONIC FILES

PART 1 - GENERAL

1.1 The Engineer, at their sole discretion and without obligation, makes graphic portions of the contract documents available for use by the contractor in electronic format. These electronic files are proprietary, and remain the Engineer's Instruments of Service and shall be for use solely with respect to this project, as provided in the Standard Form of Agreement between Owner/Architect and Engineer.

1.2 Electronic files shall be released only after bids have been received for the project and contracts have been signed with the contractors.

1.3 The contractor shall acknowledge receipt of electronic files in the requested format for this project. The electronic files are provided as a convenience to the User, for use in preparing shop drawings and/or coordination drawings related to the construction of only the project identified in the Agreement. The electronic files and the information contained within are the property of the Engineer and/or the Architect and/or the Owner, and may not be reproduced or used in any format except in conjunction with the project identified in the Agreement.

1.4 The User acknowledges that the information provided in the electronic files is not a substitution or replacement for the Contract Documents and does not become a Contract Document. The User acknowledges that neither the Engineer, the Architect, the Consultants, the Client or the Owner make any warrant or representation that the information contained in the electronic files reflect the Contract Documents in their entirety. The User assumes full responsibility in the use of the electronic files, including the responsibility to see that all manual modifications, addenda, bulletins, clarifications and Change Orders to the drawings executed as a part of the Contract Documents have been incorporated.

1.5 The User acknowledges that the receipt of electronic files in no way relieves the User from the responsibility for the preparation of shop drawings or other schedules as set forth in the Contract between the Contractor and the Owner.

1.6 Electronic files are available in a .DWG or .RVT format for a cost as indicated in the Agreement and Waiver Form. **Providing the documents in a .DWG version that differs from the product version that the .DWG files were initially created in will incur additional charges per sheet, as indicated in the Agreement and Waiver Form.** Charges are for the Engineer's time to prepare the documents in the format stated. They are available through the Engineer's office on a C.O.D. basis only. A sample of the format will be provided by the Engineer upon request by the contractor, for the purpose of testing the compatibility of the format to the contractor's systems.

1.7 All drawings will be in an AutoCAD file format, when requested to be .DWG format.

1.8 All project models will be furnished without views.

1.9 All electronic files shall be stripped of the Project's name and address, the Architect's / and / Engineer's / and / any consultant's name and address, and any professional licenses indicated on the contract documents, (and all dimensions, verbiage, and statistical information). Use of these electronic files is solely at the contractor's risk, and shall in no way alter the contractor's Contract for Construction.

1.10 The User agrees to indemnify, hold harmless and defend the Engineer, the Architect, the Consultants, the Owner, the Client and any of their agents from any litigation resulting from the use of (by any means of reproduction or electronic media) these files. The Engineer makes no

representation regarding fitness for any particular purpose, or suitability for use with any software or hardware, and shall not be responsible or liable for errors, defects, inexactitudes, or anomalies in the data, information, or documents (including drawings and specifications) caused by the Engineer's or its consultant's computer software or hardware defects or errors; the Engineer's or its consultant's electronic or disk transmittal of data, information or documents; or the Engineer's or its consultant's reformatting or automated conversion of data, information or documents electronically or disk transmitted from the Engineer's consultants to the Engineer.

1.11 The contractor waives all claims against the Engineer, its employees, officers and consultants for any and all damages, losses, or expenses the contractor incurs from such defects or errors in the electronic files. Furthermore, the contractor shall indemnify, defend, and hold harmless the Engineer, and its consultants together with their respective employees and officers, harmless from and against any claims, suits, demands, causes of action, losses, damages or expenses (including all attorney's fees and litigation expenses) attributed to errors or defects in data, information or documents, including drawings and specifications, resulting from the contractor's distribution of electronic files to other contractors, persons, or entities.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 Attached "Agreement" shall be submitted with accompanying payment to the Engineer prior to delivery of electronic files.

END OF SECTION

ELECTRONIC FILES
HEAPY RELEASE FORM TO CONTRACTORS

Project: RTA Bldg. 601 Tank Replacement
6012 Longworth
Dayton, Ohio 45402

Owner: Greater Dayton Regional Transit Authority

Heapy Engineering Project Number: 2022-07200

Heapy Engineering Project Manager: Don Timmer

The Provider, named below, will furnish the Recipient, named below, certain documents prepared by the Provider or its sub consultants in an electronic format. These documents are hereinafter collectively referred to as "Electronic Files". The Electronic Files are instruments of the Provider services performed solely for the Owner's benefit and to be used solely for this Project. The Provider does not represent that the information contained in the Electronic Files are suitable for use on any other project or for any other purpose. If the Electronic Files are used for any other project or purpose without the Provider's specific written permission, the risk of such use shall be assumed solely by the Recipient or other user.

Prior to the use of the Electronic Files the Provider and the Recipient agree to the following terms and conditions:

1. The Provider and Recipient fully understand that the data contained in these electronic files are part of the Provider's Instruments of Service. The Provider shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

2. The Recipient confirms their request to the Provider for Electronic Files for the Project listed above, which the Recipient understands are to be provided only in accordance with, and conditioned upon, the terms and conditions of the Agreement and Waiver for Use of Electronic Files).

3. The Provider agrees that the Recipient may use the Electronic Files for the sole purpose of preparing shop drawings and/or coordination drawings for the above Project only. Any Electronic Files provided are strictly for the use of the Recipient in regard to the Project named above, and shall not be utilized for any other purpose or provided by the Recipient to any entity other than its subcontractors for the Project named above.

4. The Recipient acknowledges that the furnishing of Electronic Files in no way relieves the Recipient from the responsibility of shop drawings or other schedules as set forth in the Contract between the Contractor and the Owner.

5. The Recipient acknowledges:

    a. That the Electronic Files do not contain all of the information of the Bid Documents or Contract Documents for the construction of the Project above.

    b. That information in the Bid Documents or Contract Documents may be revised or modified in the future.

c. The Provider does not have, and will not have, any duty or obligation to advise or give notice to the Recipient of any such revisions or modifications.

d. That the Recipient agrees that its use of the Electronic Files is at the Recipient's sole risk of liability, and that the Recipient shall make no claim or demand of any kind against the Provider arising out of Recipient's receipt or use of the Electronic Files.

6. The Provider makes no representation or warranty of any kind, express or implied, with respect to the Electronic Files and specifically makes no warranty that the Electronic Files shall be merchantable or fit for any particular purpose, or accurate or complete. Furthermore, any description of said Electronic Files shall not be deemed to create an implied or express warranty that such Electronic Files shall conform to said description.

7. Due to the unsecured nature of the Electronic Files and the inability of the Provider or the Recipient to establish controls over their use, the Provider assumes no responsibility for any consequences arising out of the use of the data. It is the sole responsibility of the Recipient to check the validity of all information contained within the Electronic Files. The Recipient shall at all times refer to the Construction Documents of the project during all phases of the project. The Recipient shall assume all risks and liabilities resulting from the use of this data, and the Recipient agree(s) to waive any and all claims and liability against the Provider and its sub consultants resulting in any way from the use of the Electronic Files.

8. Electronic Files are provided strictly as a courtesy by the Provider solely for the convenience of the Recipient, and are not part of the Bid Documents or Contract Documents for the Project. The Electronic Files do not replace or supplement the paper copies of any drawings, specifications, or other documents included in the Contract Documents for use on the project.

    a. The Recipient assumes full responsibility in the use of Electronic Files, including the responsibility to see that all manual modifications, addenda, bulletins, clarifications and Change Orders to the drawings executed as a part of the Contract Documents have been incorporated.

9. As stated herein, the possibility exists that the Electronic Files provided may differ from the Bid Documents or Contract Documents for construction of the Project. The Provider shall not be responsible, nor be held responsible, for differences between Electronic Files, the Bid Documents, and Contract Documents. The Bid Documents or Contract Documents for the Project may be modified by the Provider at any time, either before or after construction begins. The Provider has no responsibility, either before or after any such modification, to determine or to advise the Recipient whether any such modification causes Electronic Files provided to the Recipient to be out of date, inconsistent with the Bid Documents or Contract Documents, or otherwise unsuitable or unfit for use in any way.

10. The Recipient assumes all risk and liability for any losses, damages, claims, or expenses (including defense and attorney fees) resulting from its receipt, use, or possession of Electronic Files furnished by the Provider. The Provider makes no representation, warranty or guarantee that the Electronic Files:

    a. Are suitable for any other usage or purpose.

    b. Have any particular durability.

    c. Will not damage or impair the Recipient's computer or software.

    d. Contain no errors or mechanical flaws or other discrepancies that may render them unsuitable for the purpose intended by the Recipient.

11. Recipient agrees to indemnify, defend and hold harmless the Provider, agents, employees, and the Owner from, and against, any and all claims, suits, losses, damages or costs, of any kind or nature, including attorney's fees, arising from or by reason of the Recipient's use of Electronic Files provided by

the Provider, and such defense and indemnification obligation duties shall survive any use under this Agreement and Waiver for Use of Electronic Files.

12. The Recipient agrees that the Provider shall have no responsibility whatsoever for problems of any nature arising from transmitting and storing electronic files at a Recipient requested FTP or project management site or the conversion of the Electronic Files by the Recipient or others for use in non-native applications. The Provider will not provide Electronic Files in compressed formats. Recipient agrees to accept the files in the format provided by the Provider, and that Recipient's conversion or electronic file storage at the Recipient's requested site, shall be at Recipient's sole risk.

13. Recipient acknowledges:

    a. That the Electronic Files provided by the Provider are a graphical representation of the building in order to generate two-dimensional industry standard drawings.

    b. That the data contained in the Electronic Files may not be 100% accurate and should not be used for dimensional control, building layout, shop drawings, or any other similar purpose

    c. That any schedule of materials produced directly from the Electronic Files has not been checked for accuracy.

    d. That the information in the Electronic Files should be used only for comparative purposes and shall not be relied upon for accurate quantity estimates or used in establishing pricing.

14. Electronic Files provided by the Provider will only contain elements and content that the Provider deems necessary and appropriate to share. No specific Level of Development (LOD) is implied or expected. The Recipient agrees that no proprietary content, MvParts or Revit Families or any other AutoCAD MEP or Revit MEP content shall be removed from the model and/or used for any other purpose but to support this specific project.

15. The Provider, at its sole discretion, may modify the Electronic files before they are provided to the Recipient. Such modifications may include, but are not necessarily limited to, removal of certain information. The Provider, at its sole discretion, may refuse to provide some or all Electronic Files requested by Recipient.

16. The availability of Electronic Files that were not prepared by the Provider is subject to the consent of the Owner or consultant that prepared those Electronic Files. The Provider will not negotiate with the Owner or consultant or repeatedly solicit the Owner or consultant to obtain such consent. Neither this Agreement and Waiver for Use of Electronic Files nor any such separate Consultant's consent may be assigned or transferred by Recipient to any other person or entity.

    Provider (Name of Company): _____

    Recipient (Name of Company): _____

    Recipient Address: _____

    Name of authorized Recipient Representative: _____

    Title of authorized Recipient Representative: _____

    E-mail address of authorized Recipient Representative: _____

    Signature of authorized Recipient Representative: _____

Date: _____

NOTE: Select requested Electronic File Format, File Transfer Medium and complete applicable Cost Summary.

A. Electronic File Format (select one):

1. ☐ .DWG Format - List of Drawings Requested: _____

_____

2. ☐ Revit Project Model Requested (Model only, no Views included)

B. File Transfer Medium (select one):

☐ CD-ROM ☐ DVD-ROM ☐ Heapy FTP ☐ User's FTP site ☐ Flash Drive

C. Delivery of Electronic Files Cost Summary:

Available Electronic .DWG file format:
☐ 20XX DWG

If a different file version is required than the indicated available version state the requested version:

_____ .DWG
Note that an additional charge per sheet will be incurred.

Cost of Preparation of Division 22 Electronic .DWG Files:

First Drawing: $50.00 $50.00

Additional Drawings $15.00 each _____ x $15.00 = $ _____

Conversion to .DWG version different from available .DWG:
$5.00 additional/sheet _____ x $ 5.00 = $ _____

Total Cost: (Please make check payable to Heapy Engineering and include a copy of this form.) $ _____
All files will be bound together.
Available electronic Revit file format:
☐ 20XX .RVT

Cost of Preparation of Division 22 Electronic Revit Model Files:

Revit Project Model without Views $500.00

Total Cost: (Please make check payable to Heapy Engineering and include a copy of this form.) $ _____

22 05 04 BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 Construction Water

A. Refer to Division 01 - General Requirements, for information regarding construction water.

B. Each Contractor requiring water for construction purposes shall connect to wall hydrants or other connection points within the existing building.

1.2 Continuity of Services

A. Work shall be so planned and executed as to provide reasonably continuous service of existing systems throughout the construction period. Where necessary to disrupt services for short periods of time for connection, alteration or switch-over, the Owner and Engineer shall be notified in advance and outages scheduled at the Owner's reasonable convenience.

B. Submit, on request, a written step-by-step sequence of operations proposed to accomplish the work. The outline must include tentative dates, times of day for disruption, downtime and restoration of services. Submit the outline sufficiently in advance of the proposed work to allow the Architect or Engineer and Engineer to review the information with the Owner. Upon approval, final planning and the work shall be done in close coordination with the Owner.

C. Shutdown of systems and work undertaken during shutdowns shall be bid as being done during normal working hours. If the Owner should require such work be performed outside of normal working hours, reimbursement shall be made for premium time expenses only, without mark-up.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 Workmanship

A. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Architect and Engineer shall have the right to stop the work if highest quality workmanship is not maintained.

B. Plumbing work shall be performed by licensed Plumbing Contractors in accordance with requirements of the jurisdiction.

3.2 Protection

A. Each Contractor shall be entirely responsible for all material and equipment furnished in connection with their work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Architect or Engineer. All piping and tubing shall be elevated from grade for on-site storage, and all open ends shall be covered.

B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide drop cloths and visqueen or similar barriers where dust and debris is generated, to protect adjacent areas.

3.3 Cutting and Patching

A. Refer to Division 01 - General Requirements for information regarding cutting and patching.

B. Where pipes are to pass thru, above or behind existing walls, floors, roof or ceiling, cutting, patching and refinishing of same shall be provided. Core drilling and saw cutting shall be utilized where practical. Contractor to examine where floors and walls, etc. are to be cut for presence of existing utilities.

C. When cutting or core-drilling floor verify location of existing electrical, plumbing or steel reinforcement. Use X-ray method to verify existence of obstructions. Either re-route existing system, brace floor or alter location of new work to maintain existing system.

D. All sleeves and openings not used or partially used shall be closed.

E. All materials, methods and procedures used in patching and refinishing shall be in accordance with applicable provisions of specifications governing the various trades, and shall be completed by skilled workmen normally engaged in these trades. The final appearance and integrity of the patched and refinished areas must meet the approval of the Architect. Wall, floor and ceiling refinishing must extend to logical termination lines (entire ceiling of the room repainted, for instance), if an acceptable appearance cannot be attained by finishing a partial area.

3.4 Removals, Alterations and Reuse

F. Unless otherwise noted, remove all existing work which is associated with Division 22 and which will be superfluous when the new work is installed and made operational.

G. Extraneous piping which is or becomes accessible shall be removed and stubs shall be capped. Piping that is and remains inaccessible shall be disconnected from active systems and abandoned. Ends of abandoned pipe shall be capped so as to be concealed by finished surfaces. Upon completion of the work no abandoned pipe, valve or stub shall extend thru finished floors, walls or ceilings.

H. Materials and equipment which are removed shall not be reused within the scope of this project unless specifically noted to be relocated or reused. Turn over to the Owner and place where directed on the premises all removed material and equipment so designated by the Owner. All material and equipment not claimed by the Owner shall become the property of the Contractor responsible for removal and shall be removed from the premises.

I. In areas of minor work where the space is not completely vacated, temporarily move portable equipment and furnishings within the space as required to complete the work. Coordinate this activity with the Owner. Protect the Owner's property by providing dust covers and temporary plastic film barriers to contain dust. Remove barriers and return equipment and furniture upon completion of the work.

J. Refinish any surface disturbed under this work to match existing.

END OF SECTION

22 05 09 EXCAVATION, BACKFILL AND SURFACE RESTORATION

PART 1 - GENERAL

1.1 Excavate for all underground exterior piping, underground tanks and associated incidental work. Backfill to finish grade or to levels consistent with site work activity. Cut existing street, drive and parking lot paving, walks, curbs and other permanent hard surfaces which are to be encountered. Repair or restore exterior surfaces to original condition or as is consistant with site activity. All work shall comply with requirements set forth in Division 31 – Earthwork and Division 32 – Exterior Improvements.

1.2 Excavation and trench wall supporting, cribbing, sloping and stepping of excavations required for safety shall be done in accordance with OSHA and local requirements. Pumping of water from excavations and trenches which may be required during construction shall be included in this contract.

1.3 Contact the Ohio Utilities Protection Service (1-800-362-2764 or 811) / and the Oil and Gas Producers Underground Protection Service (1-800-925-0988 or 811) sufficiently in advance of the start of any excavation so that notification can be made to member utility departments and utility companies (water, sewer, gas, petroleum, electric, telephone, cable, etc.) having underground utilities in or near the project area. Also contact those companies to verify that utility lines have been located and duly marked and identified.

1.4 A utility locator service shall be provided to locate, mark and identify private lines and other utilities that are not located by the means mentioned above.

1.5 Existing utilities encountered during excavation work shall be protected in a manner acceptable to the utility owner. Any utilities that are damaged shall be repaired or replaced by this Contractor to the full satisfaction of the utility owner.

PART 2 - PRODUCTS

2.1 Refer to Division 31 Earthwork for bedding and backfill materials specifications.

2.2 Sand: ASTM C33 Standard Specification for Concrete Aggregates, fine aggregate, natural or manufactured.

2.3 Pea Gravel: Coarse Aggregate Meeting ASTM C33, Size No. 8, crushed, washed and screened to a size no less than 0.375 inch with no fines.

2.4 Satisfactory Soils: ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes. Soil Classification Groups GW, GP, GM, SW and SP or a combination of these groups; free of rock or gravel larger than 0.75 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

2.5 Compaction: ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort, compact soil materials to not less than the indicated percentages of maximum dry unit weight.

PART 3 - EXECUTION

3.1 Trenches for interior and exterior piping shall be over excavated and the pipe shall be laid on 6 inches minimum depth sand bed.

3.2 Backfilling and compaction of excavations and trenches inside the building and outside under paved or other hard surfaced areas, shall be with approved backfill materials, to prevent undue settlement. Backfill material for plastic piping shall be pea gravel or sand. Other excavations and trenches shall be backfilled with similar materials up to 18 inches above the top of the piping. The remainder shall be with similar materials or with excavated material having no large clods, stones or rocks.

3.3 Backfill shall be mechanically compacted in layers not over 6 inches deep. Water settling will not be permitted. Where excavations have not been properly filled or where settlement occurs, they shall be refilled, compacted, smoothed off, and finally made to conform to the initial requirements. Excess excavated materials shall be removed from the site or disposed of. Refer to Division 31 Earthwork for compaction requirements.

3.4 Concrete floor slabs, paving, sidewalks, curbs, sodded and other finished surfaces which have been damaged or removed in order to install the underground work shall be replaced by this Contractor equal to original conditions. Refer to Division 32 for Exterior Improvement requirements. This requirement is not applicable in areas where the General Contractor or the Site Contractor is obligated to provide new surfaces.

3.5 Excavation, backfill, surface repair and traffic control within the public right-of-way shall be in accordance with governing agency rules and regulations. Any fee for activity in the roadway shall be included so that no additional cost will accrue to the Owner.

3.6 Maintain in place adequate barricades, guards, planking, plating, signage, warning lights, etc., at and around excavations.

3.7 All exterior underground piping shall be protected against future excavation damage by placing a plastic tape warning marker in each trench during backfill. Tape shall be 6 inches wide with black letters identifying the piping service. Tape shall be equal to that manufactured by Seton. Install tape full length of the trench approximately 18 inches above and on the centerline of the pipe.

END OF SECTION

22 05 13 ELECTRICAL REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 Motors, starters, disconnects, devices, fuses, wiring and other electrical work included in Division 22 shall be factory installed, or furnished and field installed, as specified in the various specification sections and as shown on the drawings.

1.2 Equipment and devices shall comply with applicable standards of NEMA and shall be UL listed. All work shall comply with the National Electrical Code (NEC).

1.3 Electrical equipment, devices, fuses, wire, conduit and methods shall comply with applicable provisions of Division 26 - Electrical.

1.4 Refer to the project documents and verify adequacy of feeder size, sets of conductors and size, disconnecting means and other electrical requirements. Compare these to the requirements of the equipment to be furnished and report deficiencies and / or discrepancies to the Engineer in the bid period for resolution by addendum. Cost for electrical changes shall be borne by Division 22 where such issues are not properly resolved.

1.5 Equipment control panels containing power control components shall be marked with the minimum SCCR. The rating shall not be less than the available fault current. Coordinate with the Electrical drawings for the calculated available fault at the distribution panel, MCC or panelboard serving the equipment. Include confirmation of being protected from the fault current in the equipment shop drawing submittals.

PART 2 - PRODUCTS

2.1 Motors

A. General purpose motors shall be induction type NEMA Design "B" with copper windings, Class B or F insulation, and motor enclosure to suit the application. Service factor shall be 1.15 minimum.

B. Motors for other than general duty application shall be furnished to suit the application and operating environment.

C. Premium efficiency motors shall be equal to Century "E + 3", General Electric "Energy Saver Premium Efficiency", Baldor “Super E Premium Efficient” or Reliance "Premium Energy Efficient" series. Motor efficiencies shall be tested and conform to NEMA Standard Publication MG-1 and IEEE 112 Test Method B.

D. Motor sizes shown on the drawings are to be considered minimum. Motors furnished shall be sized so as to not operate in the service factor range. Motors for direct driven pumps shall be selected so as to not operate in the service factor range at any point on the curve.

E. Coordinate with electrical drawings. Compare, with the equipment suppliers, the electrical power requirements of the intended equipment with power feeders to the equipment shown on the project documents. Verify adequacy and compatibility of voltage, phase, wiring capacity, number and size of conductors (versus equipment connection points), fusing and other information on the project documents to that required for the equipment. If conflicts exist, issue a Request for Information (RFI).

2.2 Magnetic starters shall comply with provisions of Division 26 - Electrical specifications and shall be NEMA construction (IEC rated not acceptable) with thermal overload element on each phase, 115

volt control voltage and hand-off-automatic switch, where appropriate. An integral control transformer shall be incorporated in the starter for each motor of 200 volt and greater. A single control transformer is acceptable for multiple motor packaged equipment, however, when such is the manufacturer's standard. Duplex type units (pumps, compressors, etc.) are not included in this exception. A control transformer shall be provided in each starter to ensure standby operating capability.

2.3 Wire and conduit shall comply with applicable provisions of Division 26 - Electrical specifications. Control wiring lighter than No. 12 AWG is acceptable where lesser ampacity will permit. All power and control wiring shall be overcurrent protected per N.E.C.

PART 3 - EXECUTION

3.1 Motor connections of factory assembled equipment shall be made with flexible conduit except for plug-in electric cord connections.

3.2 All power wiring shall be run in conduit. Control wiring shall be run in conduit except where open wiring is specified in the various sections.

3.3 Fuses shall be furnished and installed in fuse clips of equipment and switches.

END OF SECTION

22 11 50 LIQUID FUEL DIESEL SYSTEM

PART 1 - GENERAL

1.1 Liquid fuel oil system shall be provided as shown on the drawings and as specified herein for a complete operating and approved installation. The system shall be complete with fuel oil tank, underground piping, piping to inside the building, pumps, valves, fuel management and leak detection system, tank gauging system, to supply existing fuel dispensing facilities and accessory equipment and devices.

1.2 The system and its components shall conform to EPA, federal, state and local regulations and to NFPA 30, 30A.

1.3 Refer to 22 05 07 Piping Materials and Methods, 22 05 09 Excavation Backfill and Surface Restoration, 22 05 13 Electrical Requirements for Plumbing Equipment and 22 05 53 Identification of Plumbing Piping and Equipment.

PART 2 - PRODUCTS

2.1 Underground Storage Tanks

A. Underground fuel oil tank shall be double wall containment type having fiberglass reinforced polyester inner and outer tanks, with reinforcing ribs and interstitial space. Tanks shall comply with UL 1316 and ASTM D4021. Tank shall be by Xerxes, Containment Solutions, or approved equal.

B. Tank(s) shall be constructed of materials, which are chemically inert to petroleum products and are capable of storing diesel fuel at ambient underground temperature and at temperatures not to exceed 150 degrees F.

C. Tank construction shall incorporate a safety factor of 5:1 for fiberglass tanks against general buckling when buried in the ground with 7 feet of overburden and the hole fully flooded and surface H-20 axle loading when installed in accordance with manufacturer's recommendations. Tank and interstitial space shall withstand a 5psi internal air pressure test with 5:1 safety factor.

D. Tanks shall have an annular space between the primary and secondary shell walls to allow for hydrostatic monitoring. One 4 inch access fitting shall be provided to the annular space between the tanks to monitor leakage of the inner tank.

E. Each tank shall be covered by the manufacturer's standard 30-year warranty regarding external corrosion, internal corrosion, structural failure, and material defects.

2.2 Tank Accessories

A. Tank shall be equipped with manway and pipe openings as shown on the drawings and as required for the various pipe, monitoring and gauging connections, and an additional 4 inch spare connection. Manways shall be furnished with UL listed gaskets, bolts and covers. Provide integrally mounted FRP reservoir, 4 inch riser pipe and 4 inch annular space fitting for hydrostatic monitoring. A strike plate shall be provided on the bottom of the tank under each opening.

B. Turbine enclosures and collars shall be fitted over the tank manway providing a watertight installation. The enclosures shall be 48 inches dia. (fuel oil supply enclosure) and 42 inches dia. (monitoring probe enclosures) FRP with FRP reducer, watertight push-on FRP lids and o-

ring seals. The sump shall be fitted with watertight bulkhead fittings for each pipe and conduit penetration.

C. Tank fill assembly shall be direct watertight and shall consist of a 15-gallon high density polyethylene spill container, grade cover and mounting ring, lid with lever and drain-back apparatus overfill prevention valve, fill window and riser seal. All materials shall be corrosion resistant. .

D. Fill tube shall be fitted with mechanical overfill prevention mechanism/valve.

E. Anchor straps and concrete deadman shall be furnished with and suitable for the tank.

F. Tank accessories shall be by the tank manufacturer or by Franklin Fuel Systems, Universal, EmcoWheaton, OPW, or approved equal.

G. In areas of traffic, grade lids shall be designed for surface H-20 axle loading.

H. Transition sumps shall be adjustable, ribbed polyethylene sump with fiberglass top equal to OPW FlexWORKS PST-4630. Provide concrete slab and minimum 36 inches diameter manhole frame and cover above lid.

2.3 Underground Piping

A. The piping shall be UL listed for the service intended. Use of fiberglass or flexible piping shall be limited to buried service only and at pressures not exceeding that marked on the pipe.

B. Underground piping shall be double wall (primary and secondary) piping except where single wall is specifically noted. Secondary piping shall completely contain the primary pipe from the tank sump to transition sump. Secondary pipe shall allow for complete inspection of primary pipe connections, during primary pipe hydrostatic testing, before the secondary pipe is sealed.

C. The secondary pipe shall be made from materials to have sufficient strength to withstand the maximum underground burial loads, be non-corrosive, di-electric, non-degradable, resistant to attack from microbial growth, and compatible with the products to be stored.

D. Double wall piping shall be integral fiberglass coaxial smooth bore primary piping with bell and spigot ends, porous sand layer, and fiberglass reinforced epoxy flexible wrap for secondary containment layer.

1. Primary piping shall be joined by adhesive-bonded joints.
2. Secondary piping material shall be joined by adhesive bonded clamshell fittings, compression molded for exact fit and match.
3. Piping shall be Ameron Dualoy 3000/LCX or approved equal.

E. Fiberglass pipe fittings shall be the same manufacturer as the pipe with adhesive as required by the manufacturer. Threading of fiberglass pipe shall not be permitted.

F. Vent Pipe and Fittings Below Grade

1. Vent piping shall be single wall fiberglass having bonded joints. Pipe and fittings shall be Dualoy 3000/L as manufactured by Ameron or approved equal.

G. Non-Buried Piping

1. Piping inside the building and other non-buried piping shall be Schedule 40 black steel, ASTM A-53, Types E and F, with 150 lb. seamless steel malleable iron threaded fittings and joints.
   a. Pipe thread lubricant shall be manufactured specifically for use with petroleum products. Product shall be by Permatex, Gasoila, Loctite, Rectorseal, or approved manufacturer. Use of Teflon tape is not permitted. Contractor shall follow manufacturer's requirements for cure times.
2. Shutoff valves shall be
   a. 0.25 inch to 4 inches, Ball type with three - piece bronze body, threaded ends, chrome plated bronze ball, TFE seat, and full port, blow out proof stem, handle, UL Listed for flammable liquids. Provide valve by OPW, Morrison Brothers, NIBCO, Universal, or approved manufacturer.
3. Pipe hangers, sleeves, installation methods and related items shall conform to applicable portions of 22 05 29 – Piping Materials and Methods.

2.4 Flexible Connectors

A. Flexible connectors shall be:

1. Seamless PTFE liner, high strength, and corrosion resistant stainless steel wire braid reinforcement. Fittings shall be made of ductile iron with NPT threads. Couplings shall be electrically isolated from the braid to eliminate corrosion. Swivel adaptors shall be used for connection to equipment.
2. Flexible metal hose, corrugated type with braided wire sheath covering, close-pitch annular corrugations, rated for a working pressure of at least 125 psig, 8 inches minimum live length, flanged end connections, UL listed for flammable liquid service. Metal for hose and braided wire sheath shall be ASTM 300 – series stainless steel.

B. Where flexible connectors are direct buried, adequate isolation and secondary containment sleeves or boots shall be supplied.

C. Flexible connectors are to be installed where shown on the drawings and at:

1. Tank connections to vents.
2. Tank connections to product lines within the containment sump.
3. Underground at base of vent risers.
4. Underground at changes in direction in non-flexible supply/return piping
5. Flexible connectors are to be supplied by Crane Resistoflex, Teleflex, or approved equal.

2.5 Submersible Fuel Transfer Pump(s)

A. Pumps shall be UL 79 listed, centrifugal, submersible type located in the underground storage tank as indicated on the drawings. Pump shall include ASTM A48 Class 25 gray iron discharge head and manifold assembly, thermal over-current overload protection with automatic reset, check valve, pressure relief valve, air eliminator, fluorocarbon seals, venture type siphon primer, adjustable pump length and diaphragm leak detector feature. Pump shall be manufactured by FE Petro (Franklin Fueling Systems), Red Jacket Pumps or approved equal. Pumps shall fit standard 4 inch NPT tank opening.

B. Fuel pump power and control shall be extended from the existing power and control systems.

2.6 Fuel Pump Control

1. Fuel pump control/engagement is existing to remain.

2.7 Fuel Gauging and Leak Detection System

A. The storage tank fuel gauging and leak detection system shall be automatic tank gauging which will monitor and be capable of generating the required inventory and fuel management reports, perform continuous leak detection, and overflow alarming.

B. The system shall be microprocessor-based, complete with enclosure, 8" color LCD touch screen display, graphic alarm and level indicators, integral audible and visual alarms, fuel oil storage tank overfill and low liquid level alarms, printer and RS232, RS485, USB, and Ethernet interface. The system shall be intrinsically safe for Class 1, Division 1, Group 1, hazardous locations. Front panel display shall include audible and visual alarms, user-friendly pushbutton controls, and printer.

C. Both building fuel detection systems (600 & 601) shall be Veeder-Root TLS-450 Plus, no equals permitted.

D. Building 601 shall include the following components:

1) **One 0860091-302 TLS450Plus console with 8" color touch screen display and printer**
2) **One 0333545-001 TLS450Plus application software**
3) **One 0332812-001 Universal sensor module for probes and sensors**
4) **One 0332813-001 Universal input / output module for line leak detector**
5) **One 0332972-006 Continuous statistical tank leak detection software**
6) **One 0332972-008 Risk management line leak software**
7) **Two 0846397-1XX 0.1 GPH mag plus tank probe (will need to specify probe length based upon new tank diameters)**
8) **One 0846397-601 inventory only probe for 4' diameter aboveground tank**
9) **One 0846400-001 4" diesel probe float kit**
10) **Two 0846400-002 4" oil probe float kit**
11) **Four 0794380-208 sump sensor**
12) **Two 0794390-409 interstitial sensor**
13) **One 0859080-001 digital line leak detector without swift-check**
14) **One 0790091-001 overfill alarm box**
15) **One 0790095-001 alarm box acknowledgement switch**

E. Building 600 shall include the following components:

1) **One 0860091-302 TLS450Plus console with 8" color touch screen display and printer**
2) **One 0333545-001 TLS450Plus application software**
3) **Two 0332812-001 Universal sensor module for probes and sensors**
4) **One 0332813-001 Universal input / output module for future line leak detector**
5) **One 0332972-006 Continuous statistical tank leak detection software**
6) **One 0332972-008 Risk management line leak software for future line leak detection**
7) **One 0790091-001 overfill alarm box**
8) **One 0790095-001 alarm box acknowledgement switch**

F. Monitoring of the tank interstitial space shall be by hydrostatic level monitoring. Hydrostatic monitoring of the interstitial space between the primary and secondary tank shall be by UL approved compatible solutions within the tank annular space. Solution shall have a contrasting color. Dual float reservoir switch sensor shall be equal to Pneumercator #RSU800-2.using electric-optic sensor. Monitor of the manway-piping sumps shall be by with UL listed

containment collar float switch sensors (equal to Pneumercator #LS600-LD). Sensors shall be compatible with the monitoring system and shall be supplied by Veeder-Root.

2.8 Miscellaneous Specialties

A. Oil safety closing valves, access covers for pump and probe manway, observation wells, float vent valve-extractor assemblies, tight-fill adapters and caps, spill containers and vapor vents are specified on the drawings by manufacturers name and number. Specialties having comparable features and of equal quality by other manufacturers will be acceptable.

B. Fittings, manways, fill and observation wells shall be provided with locking capability.

PART 2 - EXECUTION

3.1 Installation

A. Tank installation shall be in strict accordance with the manufacturer's recommendations and standard practices and procedures relating to handling, pre-installation testing, setting, in-place testing, piping and backfilling and in accordance with API RP 1615 – Installation of Underground Petroleum Storage Tanks.

B. Tank backfill material shall be clean and dry, well-graded pea gravel (rounded particles) having a minimum diameter of 0.125 inch and a maximum diameter of 0.75 inch. Fill material must be dry and free of ice and snow. Do not use sand or other backfill material.

C. A 12 inch inch thick pea gravel bedding shall be placed before setting the tanks. Backfill shall then be placed around the tank(s) in 12 inch layers. The layers shall be carefully hand-tamped until the backfill reaches the springline of the tank. Care shall be taken to avoid leaving voids under or around the tank(s). Do not strike the tanks with the tamping bar. The remainder of the backfill is not required to be hand-tamped.

D. Backfilling to the top of the tanks shall be accomplished as soon as possible after the tanks have been set in place. Tanks will be filled with product (at Owner's expense) as soon as possible after the aforementioned backfill is in place. Tanks must be adequately vented during the "fill" operation. Accessibility by the tanker truck must be ensured by the Contractor.

E. Piping shall have a slope toward the tank of not less than 0.125 inch per ft. Pea gravel shall be used for bedding and backfill as previously specified.

F. Provide unions in pipes 2 inches and smaller, adjacent to each valve, and at connections near each piece of equipment to facilitate equipment removal.

G. Provide detectable underground warning tape above all underground pipe. Tape shall be for utility involved, with warning and identification imprinted continuously and repeatedly over entire tape length. Warning and identification shall read “CAUTION BURIED PIPING BELOW” or similar wording. Provide tape with printed side up at a depth of 12 inches below top surface of earth or top surface of sub grade under pavements.

H. Installation of fiberglass pipe and fittings shall be in strict accordance with the pipe manufacturer’s recommendations and standards.

I. Thoroughly flush piping before final connections to end use equipment are made. Flush piping, including any branch piping, at a minimum velocity of 8 feet per second. Furnish temporary pump and hose with strainer having not less than 40-mesh screen at the end of piping system

for flushing. Flush piping with same type of fuel intended for use in system until out flowing fuel is free of sediment and has no cloud or haze.

J. Provide wiring and conduit, control wiring and interlocking between the fuel gauging system, underground storage tank, and over fill alarm panel.

K. A fuel system trained representative shall be provided for installation supervision, startup and testing services, and operation and maintenance personnel training services. The representative shall make a minimum of two visits, minimum 4-hours on-site, for each visit. The first visit shall be for assistance in the installation of the equipment. Subsequent visits shall be for checking the completed installation, startup and training. The representative shall test operate the system. The representative shall revisit the site as often as necessary until all trouble is corrected and the installation is entirely satisfactory.

L. After equipment is fully operational, and before the Owner will assume responsibility for the operation of equipment, the representative shall instruct the Owner's operating personnel in the care, maintenance and proper operation of the equipment. One training session shall be required. The session shall consist of 4-hours devoted to maintenance training.

M. Manufacturer's installation reports shall be included in the project O & M manuals and shall include field testing reports, description of installation deficiencies not resolved to the Owner's satisfaction, description of problems or potential problems, names of the Owner's personnel who attended the operations and maintenance training sessions, and a record copy of materials used for the training sessions including an outline summary of the course.

3.2 Testing

A. Tanks (primary and secondary on double wall tanks) shall withstand 5-psi air pressure test with 5 to 1 safety factor. Contractor shall individually test tanks for leakage prior to installation. Maximum test pressure is 5-psi.

B. Pipe Testing
   1. For field fabricated systems, primary piping must be tested before installation of the secondary piping. Piping shall be tested in accordance with API RP 1100 – Pressure Testing of Liquid Petroleum Pipelines.
   2. For field fabricated systems, secondary piping must be tested upon completion of installation with a minimum 5-psi air-pressure/soap test to confirm the secondary containment integrity. This testing shall be in compliance with the manufacturer's published installation instructions.

END OF SECTION

22 11 52 UNDERGROUND FUEL OIL STORAGE SYSTEM REMOVAL

PART 1 - GENERAL

1.1 Removal of underground fuel oil storage tanks, related piping and accessories shall be as shown on the drawings and as specified.

1.2 Underground fuel storage system removal work must be supervised by a certified UST Contractor. The work shall be performed in accordance with current EPA and State of Ohio Regulations and local Fire Department rules. Certification shall be furnished to the Owner prior to performing work on this project. In addition, submit, with the bid documents, evidence establishing the capability to perform this type of work. Documentation should indicate number of years in business (as current company), previous experience, key personnel and their experience, equipment available to perform work, list of Owners and similar projects completed in this geographic area, and other information pertinent to qualifications. The evidence shall include a list of projects by the Contractor in the last five (5) years, along with a name and telephone number of a "contact" at each project location.

1.3 The certified UST Contractor shall obtain, and pay for, a permit from the local authority having jurisdiction or the State Fire Marshal prior to performing any work. The Certified UST Contractor shall obtain, and pay for, the required dewatering permit(s) from the local EPA authority prior to performing any dewatering work.

1.4 Cleaning, removal and safety requirements shall be conducted in compliance with the American Petroleum Institute Recommended Practice 1604 – Removal and disposal of used underground petroleum storage tanks, American Petroleum Institute Publication 2015 Safe Entry and Cleaning Petroleum Storage Tanks and the National Institute of Occupational Safety and Health; Criteria for a Recommended Standard: Working in Confined Space.

1.5 The handling, transportation and disposal of regulated substances removed from the UST, regulated soil, backfill material, ground water, wash water or other similar materials at the site shall be managed in accordance with all applicable federal, state and local regulations.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 Excavation and Backfill

A. Excavation may be made with the use of suitably sized power equipment for the upper level of the excavation. Hand excavation shall be required around buried tank structures, piping and accessories, to prevent damage.

B. Provide bracing, shoring, sheeting, etc. as necessary to ensure a safe and stable excavation. Provide all details and construction procedures used for excavation. Provide all bracing, shoring, sheeting, etc. as may be required.

C. The Contractor shall furnish and install safety barrier fencing around the excavation during periods of work stoppage and off hours.

D. After testing and the soil is deemed clean, excavated material shall be directly loaded into trucks and disposed of on-site as directed by owner and BUSTR representative. No more than 12 inches of native soil shall be removed from the side walls and bottom of tank cavity excavations. Piping trenches, dispensing unit areas and remote fill pipe trenches.

E. Provide dewatering equipment to maintain a dry excavation. Clean water removed shall be discharged as directed by the permitting authority and/or local utility.

F. The water shall be considered as contaminated with hydrocarbons if any free product or sheen is observed on the surface of the water or if adjacent soils are considered as contaminated.

G. Halt excavation work or dewatering activity if visual or other sensory signs of fuel or hydrocarbon are discovered in the soils or groundwater within the excavation area.

H. Existing utilities encountered during excavation work shall be protected in a manner acceptable to the Owner. Any utilities that are damaged shall be repaired or replaced to the full satisfaction of the Owner.

I. Backfilling of excavations and trenches under paved or other hard surfaced areas, shall be with graded gravel, graded coarse sand or crushed limestone, 0.75 inch maximum size, to prevent undue settlement. Other excavations and trenches shall be backfilled with similar materials or with excavated material having no large clods, stones or rocks.

J. Backfill shall be mechanically compacted in layers not over 12 inches deep. Under hard surfaces backfill shall be compacted to 98 percent Proctor and Compaction and, shall be certified by a soils Engineer. Water settling will not be permitted. Where excavations have not been properly filled or where settlement occurs, they shall be refilled, compacted, smoothed off, and finally made to conform to the initial requirements. Excess excavated materials shall be removed from the site or disposed of as directed by the Owner.

K. The contract price for soil removal and backfill required in conjunction with the tank work shall be predicated on the premise that the soil has not been contaminated.

L. List on the bid form unit pricing for:

1. Contaminated soil, gravel, and other backfill materials - removal, disposal and replacement, per cubic yard.
2. Fuel and sludge - removal and disposal, per gallon.
3. Contaminated water (from dewatering) removal and disposal, per gallon.
4. Additional samples and testing to determine contamination.

3.2 Excavation Area (Closure) Assessment

A. Inform the Owner of any visual or other sensory signs of fuel or hydrocarbon releases to the soils or groundwater adjacent to the tanks or piping and halt further work or dewatering activity upon such detection. This visual assessment shall also identify past or present operational problems, which will be used to biase soil sample collection areas.

B. Do not disturb the excavation area after discovery of any fuel oil or hydrocarbons in the excavation area and do not proceed with work which might cause disturbance of the excavation until given a Notice to Proceed by the Owner and Trihydro representative.

C. Notify the Owner, and governing authorities at least three (3) working days prior to excavation to allow the these parties to be present during excavation and initial site assessment.

D. Collect soil samples around and beneath tank(s), and along pipe runs in the number and distribution as required by the code, and as appropriate for the type, size and number being removed.

E. Package all soil samples for field screening and laboratory analysis. Soil samples, in the required distribution and number, shall be delivered to an Owner approved testing lab. Cost of making the analysis to be included in contract.

F. The Owner shall conduct a site (closure) assessment of the soils and groundwater in the excavation area. Soil and groundwater samples will be collected by the Owner and analyzed thru field testing and at a laboratory for presence of hydrocarbons. Upon receipt of laboratory results, the Owner will decide if corrective action is necessary.

G. Assist with collection of soil or groundwater samples such as providing a backhoe for bottomhole sampling, ventilation of the excavation, means of safe entry to and egress from the excavation, etc. if requested by the Owner.

H. If corrective action (i.e. contaminated material removal, transportation and disposal) is not necessary, a Notice to Proceed will be given and further work in the excavation zone shall resume promptly.

I. Secure the excavation during the closure assessment period. Provide a security fence around the excavation. An earth berm shall be constructed around the excavation perimeter to prevent surface intrusion.

3.3 Contaminated Soils Removal

A. Contaminated soils shall be transported and disposed of in accordance with Ohio Environmental Protection Agency's (OEPA) Rules and Regulations and all other applicable rules and regulations.

B. Secure all permits, generator numbers, manifests, chemical analyses, etc. required by all applicable laws and regulations for transportation and disposal of contaminated soil prior to transportation of the material.

C. Contaminated soil which is removed from the excavation and temporarily stored at the site (maximum 120 days) awaiting permanent disposal shall be placed within bunker boxes. Soil shall be protected from precipitation infiltration. Sufficient room may not be available for on-site storage of all excavated soil. Make provisions for either immediate disposal or a temporary off-site storage facility complying with all state and federal requirements. Any temporary off-site storage may require compliance with OEPA manifesting regulations.

3.4 Tank Removal and Disposal

A. Existing steel and/or fiberglass underground storage tanks related piping, sumps, accessories shall be removed.

B. Extreme caution shall be exercised in the removal process which shall be in accordance with all standards, rules and regulations of the authority (or authorities) having jurisdiction. Tank(s), sump(s) and piping shall be regularly monitored to ensure that an accumulation of exposure vapors does not occur. The process shall involve not less than the following steps:

1. Remove as much product as possible from the tanks. Transfer any usable product as directed by the Owner.
2. Completely disconnect, at the source, all electrical power to the components being removed.
3. Carefully expose the underground piping and tank and sump tops.

4. With due consideration for type of system (suction or pressure product lines), relieve vacuum and/or checks to allow all product in the lines to drain into the tank. Use hand pump if necessary to ensure that all lines have been evacuated.
5. Manually remove remaining product (and sludge, if present) from tanks. Containment and disposal shall be in accordance with approved methods.
6. Tanks shall be rendered "vapor-free" by an approved method such as placing solid carbon dioxide (dry ice) in the tank or by forced-air ventilation of the tank. Dry ice, if used, shall be provided at the rated of 1.5 lbs. per 100 gallons of tank capacity. The dry ice should be crushed and spread evenly in the tank. If the forced ventilation method is used, any exhaust fans used to withdraw vapors must be of explosion-proof construction.
7. After the tanks have been tested (per applicable NFPA standards) and found to be "vapor-free", the top of the tank shall be forcibly opened to allow full uninhibited ventilation.
8. Backfill shall be removed and tanks shall be removed from the excavation. Do not depend on the tanks lifting lugs. Lift cables should encircle the tanks for maximum safety. Depending on soil conditions, appropriate provisions shall be made to protect the workers in or near the excavation as well as adjacent structures, pads and drives.
9. Tanks shall then be crushed, sectioned or perforated, and disposed of in an approved manner.

C. Certify, in writing to the Owner, that the tanks have been crushed, sectioned or perforated and have been disposed of in conformance with all applicable federal, state and local codes, rules and regulations.

D. All system accessories (piping, vents, etc.) as shown on the drawing shall also be removed. Disposal of these items shall be as directed by the Owner and/or Trihydro representative. Items that become the property of the Contractor shall be removed from the premise as soon as possible.

END OF SECTION

26 05 01 BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 Special Note

A. All provisions of the Bidding Requirements, General Conditions and Supplementary Conditions, including Division 00 and Division 01, apply to work specified in this Division.

B. The scope of the Division 26 work includes furnishing, installing, testing and warranty of all Division 26, work and complete systems as shown on the Division 26, drawings and as specified in Division 26, and elsewhere in the project documents.

C. The project drawings and specifications define scope of work for the various divisions. Such assignments of work are not intended to restrict the Construction Manager in assignment of work among the contractors to accommodate trade agreements and practices or the normal conduct of the construction work. If there is a conflict of assigned work between Divisions 02 thru 33 and Divisions 00 and 01, Divisions 00 and 01 shall take precedence.

1.2 Permits and Regulations

A. Include payment of all permit and inspection fees applicable to the work in this Division. Furnish for the Owner certificates of approval from the governing inspection agencies, as a condition for final payment.

B. Work must conform to the National Electrical Code, National Electrical Safety Code and other applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawings and specifications shall govern. Install no work contrary to minimum legal standards.

C. All electrical work shall be inspected and approved by the local jurisdictional authority.

1.3 Inspection of Site

A. Inspect the project site and the premises of the existing building. Conditions shall be compared with information shown on the drawings. Report immediately to the Architect / Construction Manager any significant discrepancies which may be discovered. After the contract is signed, no allowance will be made for failure to have made a thorough inspection.

1.4 Drawings and Specifications

A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word "provide", as used, shall mean "furnish and install". If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect / Construction Manager for approval before proceeding with the work.

B. Make all necessary field measurements to ensure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.

C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Architect / Construction Manager for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to

show every vertical or horizontal offset which may be necessary to complete the systems. Having bus duct, wireways and fittings fabricated and delivered in advance of making actual measurements shall not be sufficient cause to avoid making offsets and minor changes as may be necessary to install bus duct, wireways, fittings and equipment.

D. The Architect / Construction Manager shall reserve the right to make minor adjustment in locations of system runs and components where they consider such adjustments desirable in the interest of protecting and concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.

E. Equipment, ductwork and piping shall not be installed in the dedicated electrical space above or in the working space required around electrical switchgear, motor control centers or panelboards as identified by NEC 110.26 Spaces about Electrical Equipment – 600 Volts Nominal or Less. For equipment rated over 600 volts nominal – 110.32 Work Space About Equipment – 110.33 Entrance to Enclosures and Access to Work Space – 110.34 Work Space and Guarding. Caution other trades to comply with this stipulation.

F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The Architect's / Construction Manager's decision shall be final in regard to the arrangement of bus duct, conduit, etc., where conflict arises.

G. Provide offsets in system runs, additional fittings, necessary conduit, pull boxes, conductors, switches and devices required to complete the installation, or for the proper operation of the system. Exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.

H. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect / Construction Manager. In such event, none of the trades or their suppliers shall assume that they are relieved of the work which is specified under their branch until instructions in writing are received from the Architect / Construction Manager.

1.5 Asbestos Materials

A. Abatement, removal or encapsulation of existing materials containing asbestos is not included in the Division 26 Contract. Necessary work of this nature will be arranged by the Owner to be done outside of this construction and remodeling project by a company regularly engaged in asbestos abatement. Such work will be scheduled and performed in advance of work in the construction and remodeling project.

B. If, in the performance of the work, materials are observed which are suspected to contain asbestos, the Contractor shall immediately inform the Architect / Construction Manager who in turn will notify the Owner. Work that would expose workers to the inhalation of asbestos particles shall be terminated. Work may be resumed only after a determination has been made and unsafe materials have been removed or encapsulated and the area declared safe.

1.6 Inspection

A. All work shall be subject to inspection of Federal, State and local agencies as may be appropriate, and of the Architect and Engineer.

B. Obtain final inspection certificates and turn over to the Owner.

1.7 Record Drawings

A. Maintain a separate set of field prints of the contract documents and hand mark all changes or variations, in a manner to be clearly discernible, which are made during construction. Upon completion of the work and within 90 days of system acceptance, these hand marked drawings shall be turned over to the Architect / Construction Manager. This shall apply particularly to underground and concealed work, and to other systems where the installation varies to a degree which would justify recording the change.

1.8 Operating and Maintenance Manuals

A. Assemble three copies each of operating and maintenance manuals for the Electrical work.

B. All “approved” shop drawings and installation, maintenance and operating instruction pamphlets or brochures, wiring diagrams, parts list, and other information, along with warranties, shall be obtained from each manufacturer of the principal items of equipment. In addition, prepare and include a chart listing all items of equipment which are furnished under this contract, indicating the nature of maintenance required, the recommended frequency of checking these points and the type of lubricating media or replacement material required. Name and address of a qualified service agency. A complete narrative of how each system is intended to operate. Major items of equipment shall consist of not less than the following:

1. Motor controllers and motor control centers.
2. Specialty equipment.

C. Standard NEMA publications on the operation and care of equipment may be furnished in lieu of manufacturer's data where the manufacturer's instructions are not available.

D. Original purchase order number; date of purchase; name, address, and phone number of the vendor; warranty information.

E. Copy of required test reports.

F. These shall be assembled into three-ring loose leaf binders or other appropriate binding. An index and tabbed sheets to separate the sections shall be included. These shall be submitted to the Engineer and Construction Manager for review. Upon approval and within 90 days of system acceptance, manuals shall be turned over to the Owner.

1.9 Final Inspection and Punch List

A. As the time of work completion approaches, survey and inspect Division 26 work and develop a punch list to confirm that it is complete and finished. Then notify the Architect / Construction Manager and request that a final inspection be made. It shall not be considered the Architect's or Engineer's obligation to perform a final inspection until the Contractor has inspected the work and so states at the time of the request for the final inspection.

B. Requests to the Architect, Engineer for final inspection may be accompanied by a limited list of known deficiencies in completion, with appropriate explanation and schedule for completing these; this is in the interest of expediting acceptance for beneficial occupancy.

C. The Architect and/or Engineer will inspect the work and prepare a punch list of items requiring correction, completion or verification. Corrective action shall be taken by the Contractor to the satisfaction of Architect and Engineer within 30 days of receipt of the Architect/Engineer's punch list.

1.10 Warranty

A. Warrant all workmanship, equipment and material entering into this contract for a period of one (1) year from date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect or Construction Manager. Any materials or equipment proving to be defective during the warranty period shall be made good without expense to the Owner. Use of equipment for temporary electric is not the start of the warranty period.

B. This provision is intended specifically to cover deficiencies in contract completion or performance which are not immediately discovered after systems are placed in operation. These items include, but are not limited to, motor controller malfunction, heater element changes required for motor controller, fuse replacement where fuses blow due to abnormal shorts, adjustments and/or replacement of malfunctioning equipment and adjusting special equipment and communication systems to obtain optimum performance.

C. This provision shall not be construed to include maintenance items such as making normally anticipated adjustments or correcting adjustment errors on the part of the Owner's personnel.

D. Provisions of this warranty shall be considered supplementary to warranty provisions under Division 01 General Conditions.

PART 2 - PRODUCTS

2.1 Materials and Equipment

A. Materials and equipment furnished shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.

B. All electrical equipment and wiring shall bear the Underwriters Laboratories, Inc. label where UL labeled items are available, and shall comply with NEC (NFPA-70) and NFPA requirements.

2.2 Reference Standards

A. Where standards (NFPA, NEC, ASTM, UL, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the Authority Having Jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

2.3 Equipment Selection

A. The selection of materials and equipment to be furnished shall be governed by the following:

1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specification, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturers listed.
2. Where the words "or approved equal" appear after a manufacturer's name, specific approval must be obtained from the Engineer during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish quality level and

standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer's approval.

B. Substitute equipment of equal quality and capacity will only be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.

C. Before bidding equipment, and again in the preparation of shop drawings, verify that adequate space is available for entry and installation of the item of equipment, including associated accessories. Also verify that adequate space is available for servicing of the equipment and that required NEC clearances are met.

D. If extensive changes in conduit, equipment layout or electrical wiring and equipment are brought about by the use of equipment which is not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in this contract.

2.4 Shop Drawings

A. Electronic copies of shop drawings and descriptive information of equipment and materials shall be furnished. Submit to the Architect and/or Engineer for review as stated in the General Conditions and Supplementary Conditions. These shall be submitted as soon as practicable and before equipment is installed and before special equipment is manufactured. Submittal information shall clearly identify the manufacturer, specific model number, approval labels, performance data, electrical characteristics, features, specified options and additional information sufficient to evidence compliance with the contract documents. Product catalogs, brochures, etc. submitted without project specific items marked as being submitted for review will be rejected and returned without review. Shop drawings for equipment, fixtures, devices and materials shall be labeled and identified same as on the Contract Documents. If compliance with the above criteria is not provided shop drawings will be subject to rejection and returned without review. Samples shall be submitted when requested or as specified here with-in.

B. The review of shop drawings by the Architect or Engineer shall not relieve the Contractor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.

C. Shop drawings of the following equipment and materials shall be submitted:

1. Wireway.
2. firestopping.
3. Miscellaneous cabinets.
4. Wiring devices and coverplates.
5. enclosures.
6. Fuses.
7. Motor controllers, control centers and disconnects.

PART 3 - EXECUTION

3.1 Testing

A. As each wiring system is completed, it shall be tested for continuity and freedom from grounds.

B. As each electrically operated system is energized, it shall be tested for function.

C. On all electric services including change-outs, backfeeds, etc. the Contractor shall verify phase rotation and voltage readings to ensure the final installation is proper. Submit to the Engineer in writing a record of voltage readings and current readings taken at no-load and fully loaded conditions.

D. The Contractor shall perform megger and resistance tests and special tests on any circuits or equipment when an authorized inspection agency suspects the system's integrity or when requested by the Architect or Engineer.

E. All signaling and communications systems shall be inspected and tested by a qualified representative of the manufacturer or equipment vendor. Submit four (4) copies of reports indicating results.

F. Tests shall be witnessed by field representatives of the Architect or Engineer or shall be monitored by a recorder. Furnish a written record of each system test indicating date, system, test conditions, duration and results of tests. Copies of all test reports shall be included in the O&M manuals.

G. Instruments required for tests shall be furnished by the Contractor.

3.2 Equipment Cleaning

A. Before placing each system in operation, the equipment shall be thoroughly cleaned; cleaning shall be performed in accordance with equipment manufacturer's recommendations.

B. Refer to appropriate Sections for cleaning of other equipment and systems for normal operation.

3.3 Operation and Adjustment of Equipment

A. As each system is put into operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing and adjusting voltages and currents; verifying phase rotation; setting breakers, ground fault and other relays, controllers, meters and timers; and adjusting all operating equipment.

B. Caution: Verify that all bearings of equipment furnished are lubricated, all motors are operating in the right direction, and correct drive settings and overload heater elements are provided on all motors. Do not depend wholly on the other trades judgment in these matters. Follow specific instructions in regard to lubrication of equipment furnished under this Contract.

3.4 Operating Demonstration and Instructions

A. Set the various systems into operation and demonstrate to the Owner and Architect/ Construction Manager that the systems function properly and that the requirements of the Contract are fulfilled.

B. Provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.

C. O & M manuals shall be submitted, reviewed and approved prior to scheduling of demonstrations.

D. A minimum of 4 hours shall be allowed for instructions to personnel selected by the Owner. Instructions shall include not less than the following:

1. Show location of items of equipment and their purpose.
2. Review binder containing instructions and equipment and systems data.
3. Coordinate written and verbal instructions so that each is understood by personnel.
4. Separate instructions shall be given by manufacturer's representatives for the various special and communications systems.

E. A minimum of 48 hours continuous trouble-free operating time shall be acceptable to prove that the systems function properly.

END OF SECTION

26 05 02 AGREEMENT AND WAIVER FOR USE OF ELECTRONIC FILES

PART 1 - GENERAL

1.1 The Engineer, at their sole discretion and without obligation, makes graphic portions of the contract documents available for use by the contractor in electronic format. These electronic files are proprietary, and remain the Engineer's Instruments of Service and shall be for use solely with respect to this project, as provided in the Standard Form of Agreement between Owner/Architect and Engineer.

1.2 Electronic files shall be released only after bids have been received for the project and contracts have been signed with the contractors.

1.3 The contractor shall acknowledge receipt of electronic files in the requested format for this project. The electronic files are provided as a convenience to the User, for use in preparing shop drawings and/or coordination drawings related to the construction of only the project identified in the Agreement. The electronic files and the information contained within are the property of the Engineer and/or the Architect and/or the Owner, and may not be reproduced or used in any format except in conjunction with the project identified in the Agreement.

1.4 The User acknowledges that the information provided in the electronic files is not a substitution or replacement for the Contract Documents and does not become a Contract Document. The User acknowledges that neither the Engineer, the Architect, the Consultants, the Client or the Owner make any warrant or representation that the information contained in the electronic files reflect the Contract Documents in their entirety. The User assumes full responsibility in the use of the electronic files, including the responsibility to see that all manual modifications, addenda, bulletins, clarifications and Change Orders to the drawings executed as a part of the Contract Documents have been incorporated.

1.5 The User acknowledges that the receipt of electronic files in no way relieves the User from the responsibility for the preparation of shop drawings or other schedules as set forth in the Contract between the Contractor and the Owner.

1.6 Electronic files are available in a .DWG or .RVT format for a cost as indicated in the Agreement and Waiver Form. A sample of the format will be provided by the Engineer upon request by the contractor, for the purpose of testing the compatibility of the format to the contractor's systems.

1.7 All drawings will be in an AutoCAD file format, when requested to be .DWG format.

1.8 All project models will be furnished without views.

1.9 All electronic files shall be stripped of the Project's name and address, the Architect's / and / Engineer's / and / any consultant's name and address, and any professional licenses indicated on the contract documents, (and all dimensions, verbiage, and statistical information). Use of these electronic files is solely at the contractor's risk, and shall in no way alter the contractor's Contract for Construction.

1.10 The User agrees to indemnify, hold harmless and defend the Engineer, the Architect, the Consultants, the Owner, the Client and any of their agents from any litigation resulting from the use of (by any means of reproduction or electronic media) these files. The Engineer makes no representation regarding fitness for any particular purpose, or suitability for use with any software or hardware, and shall not be responsible or liable for errors, defects, inexactitudes, or anomalies in the data, information, or documents (including drawings and specifications)

caused by the Engineer's or its consultant's computer software or hardware defects or errors; the Engineer's or its consultant's electronic or disk transmittal of data, information or documents; or the Engineer's or its consultant's reformatting or automated conversion of data, information or documents electronically or disk transmitted from the Engineer's consultants to the Engineer.

1.11 The contractor waives all claims against the Engineer, its employees, officers and consultants for any and all damages, losses, or expenses the contractor incurs from such defects or errors in the electronic files. Furthermore, the contractor shall indemnify, defend, and hold harmless the Engineer, and its consultants together with their respective employees and officers, harmless from and against any claims, suits, demands, causes of action, losses, damages or expenses (including all attorney's fees and litigation expenses) attributed to errors or defects in data, information or documents, including drawings and specifications, resulting from the contractor's distribution of electronic files to other contractors, persons, or entities.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 Attached "Agreement" shall be submitted with accompanying payment to the Engineer prior to delivery of electronic files.

END OF SECTION

ELECTRONIC FILES
HEAPY RELEASE FORM TO CONTRACTORS

Project: RTA Bldg. 601 Tank Replacement
6012 Longworth
Dayton, Ohio 45402

Owner: Greater Dayton Regional Transit Authority

Heapy Engineering Project Number: 2022-07200

Heapy Engineering Project Manager: Don Timmer

The Provider, named below, will furnish the Recipient, named below, certain documents prepared by the Provider or its sub consultants in an electronic format. These documents are hereinafter collectively referred to as "Electronic Files". The Electronic Files are instruments of the Provider services performed solely for the Owner's benefit and to be used solely for this Project. The Provider does not represent that the information contained in the Electronic Files are suitable for use on any other project or for any other purpose. If the Electronic Files are used for any other project or purpose without the Provider's specific written permission, the risk of such use shall be assumed solely by the Recipient or other user.

Prior to the use of the Electronic Files the Provider and the Recipient agree to the following terms and conditions:

1. The Provider and Recipient fully understand that the data contained in these electronic files are part of the Provider's Instruments of Service. The Provider shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

2. The Recipient confirms their request to the Provider for Electronic Files for the Project listed above, which the Recipient understands are to be provided only in accordance with, and conditioned upon, the terms and conditions of the Agreement and Waiver for Use of Electronic Files).

3. The Provider agrees that the Recipient may use the Electronic Files for the sole purpose of preparing shop drawings and/or coordination drawings for the above Project only. Any Electronic Files provided are strictly for the use of the Recipient in regard to the Project named above, and shall not be utilized for any other purpose or provided by the Recipient to any entity other than its subcontractors for the Project named above.

4. The Recipient acknowledges that the furnishing of Electronic Files in no way relieves the Recipient from the responsibility of shop drawings or other schedules as set forth in the Contract between the Contractor and the Owner.

5. The Recipient acknowledges:

    a. That the Electronic Files do not contain all of the information of the Bid Documents or Contract Documents for the construction of the Project above.

    b. That information in the Bid Documents or Contract Documents may be revised or modified in the future.

c. The Provider does not have, and will not have, any duty or obligation to advise or give notice to the Recipient of any such revisions or modifications.

d. That the Recipient agrees that its use of the Electronic Files is at the Recipient's sole risk of liability, and that the Recipient shall make no claim or demand of any kind against the Provider arising out of Recipient's receipt or use of the Electronic Files.

6. The Provider makes no representation or warranty of any kind, express or implied, with respect to the Electronic Files and specifically makes no warranty that the Electronic Files shall be merchantable or fit for any particular purpose, or accurate or complete. Furthermore, any description of said Electronic Files shall not be deemed to create an implied or express warranty that such Electronic Files shall conform to said description.

7. Due to the unsecured nature of the Electronic Files and the inability of the Provider or the Recipient to establish controls over their use, the Provider assumes no responsibility for any consequences arising out of the use of the data. It is the sole responsibility of the Recipient to check the validity of all information contained within the Electronic Files. The Recipient shall at all times refer to the Construction Documents of the project during all phases of the project. The Recipient shall assume all risks and liabilities resulting from the use of this data, and the Recipient agree(s) to waive any and all claims and liability against the Provider and its sub consultants resulting in any way from the use of the Electronic Files.

8. Electronic Files are provided strictly as a courtesy by the Provider solely for the convenience of the Recipient, and are not part of the Bid Documents or Contract Documents for the Project. The Electronic Files do not replace or supplement the paper copies of any drawings, specifications, or other documents included in the Contract Documents for use on the project.

   a. The Recipient assumes full responsibility in the use of Electronic Files, including the responsibility to see that all manual modifications, addenda, bulletins, clarifications and Change Orders to the drawings executed as a part of the Contract Documents have been incorporated.

9. As stated herein, the possibility exists that the Electronic Files provided may differ from the Bid Documents or Contract Documents for construction of the Project. The Provider shall not be responsible, nor be held responsible, for differences between Electronic Files, the Bid Documents, and Contract Documents. The Bid Documents or Contract Documents for the Project may be modified by the Provider at any time, either before or after construction begins. The Provider has no responsibility, either before or after any such modification, to determine or to advise the Recipient whether any such modification causes Electronic Files provided to the Recipient to be out of date, inconsistent with the Bid Documents or Contract Documents, or otherwise unsuitable or unfit for use in any way.

10. The Recipient assumes all risk and liability for any losses, damages, claims, or expenses (including defense and attorney fees) resulting from its receipt, use, or possession of Electronic Files furnished by the Provider. The Provider makes no representation, warranty or guarantee that the Electronic Files:

    a. Are suitable for any other usage or purpose.

    b. Have any particular durability.

    c. Will not damage or impair the Recipient's computer or software.

    d. Contain no errors or mechanical flaws or other discrepancies that may render them unsuitable for the purpose intended by the Recipient.

11. Recipient agrees to indemnify, defend and hold harmless the Provider, agents, employees, and the Owner from, and against, any and all claims, suits, losses, damages or costs, of any kind or nature, including attorney's fees, arising from or by reason of the Recipient's use of Electronic Files provided by

the Provider, and such defense and indemnification obligation duties shall survive any use under this Agreement and Waiver for Use of Electronic Files.

12. The Recipient agrees that the Provider shall have no responsibility whatsoever for problems of any nature arising from transmitting and storing electronic files at a Recipient requested FTP or project management site or the conversion of the Electronic Files by the Recipient or others for use in non-native applications. The Provider will not provide Electronic Files in compressed formats. Recipient agrees to accept the files in the format provided by the Provider, and that Recipient's conversion or electronic file storage at the Recipient's requested site, shall be at Recipient's sole risk.

13. Recipient acknowledges:

    a. That the Electronic Files provided by the Provider are a graphical representation of the building in order to generate two-dimensional industry standard drawings.

    b. That the data contained in the Electronic Files may not be 100% accurate and should not be used for dimensional control, building layout, shop drawings, or any other similar purpose

    c. That any schedule of materials produced directly from the Electronic Files has not been checked for accuracy.

    d. That the information in the Electronic Files should be used only for comparative purposes and shall not be relied upon for accurate quantity estimates or used in establishing pricing.

14. Electronic Files provided by the Provider will only contain elements and content that the Provider deems necessary and appropriate to share. No specific Level of Development (LOD) is implied or expected. The Recipient agrees that no proprietary content, MvParts or Revit Families or any other AutoCAD MEP or Revit MEP content shall be removed from the model and/or used for any other purpose but to support this specific project.

15. The Provider, at its sole discretion, may modify the Electronic files before they are provided to the Recipient. Such modifications may include, but are not necessarily limited to, removal of certain information. The Provider, at its sole discretion, may refuse to provide some or all Electronic Files requested by Recipient.

16. The availability of Electronic Files that were not prepared by the Provider is subject to the consent of the Owner or consultant that prepared those Electronic Files. The Provider will not negotiate with the Owner or consultant or repeatedly solicit the Owner or consultant to obtain such consent. Neither this Agreement and Waiver for Use of Electronic Files nor any such separate Consultant's consent may be assigned or transferred by Recipient to any other person or entity.

    Provider (Name of Company): _____

    Recipient (Name of Company): _____

    Recipient Address: _____

    Name of authorized Recipient Representative: _____

    Title of authorized Recipient Representative: _____

    E-mail address of authorized Recipient Representative: _____

    Signature of authorized Recipient Representative: _____

Date: _____

NOTE: Select requested Electronic File Format, File Transfer Medium and complete applicable Summary.

A. Electronic File Format (select one):

1. ☐ .DWG Format - List of Drawings Requested: _____

_____

2. ☐ Revit Project Model Requested (Model only, no Views included)

B. File Transfer Medium (select one):

☐ CD-ROM ☐ DVD-ROM ☐ Heapy FTP ☐ User's FTP site ☐ Flash Drive

C. Delivery of Electronic Files Summary:

Available Electronic .DWG file format:
☐ 2013 DWG

If a different file version is required than the indicated available version state the requested version:

_____ .DWG

26 05 04 BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 Temporary Electric Services

A. Contractors requiring extension cords shall provide their own cords and plugs up to capacity of 20 amperes. For services to larger items of equipment and welders, this Contractor shall extend proper feeders as requested at the expense of the Contractors requiring the service.

B. The Contractor shall maintain the temporary light and power system for the duration of the work and shall remove it from the site when directed or no longer required as coordinated with the construction team. Temporary wiring and equipment shall remain the property of the Contractor.

C. The use of the permanent electrical system for temporary services during stages of construction shall be allowed. Expedite completion of system as practicable to this end. Maintain the system during this period.

D. Warranty periods on equipment, materials and systems shall commence upon Owner acceptance of the building or systems. Temporary use shall not jeopardize or alter warranty requirements.

1.2 Continuity of Service

A. Work shall be so planned and executed as to provide reasonable continuous service of existing systems throughout the construction period. Where necessary to disrupt services for short periods of time for connection, alteration or switch over, the Owner shall be notified in advance and outages scheduled at the Owner's reasonable convenience.

B. Submit, on request, a written step-by-step sequence of operations proposed to accomplish the work. The outline must include tentative dates, times of day for disruption, downtime and restoration of services. Submit the outline sufficiently in advance of the proposed work to allow the Architect or Engineer and Construction Manager to review the information with the Owner. Upon approval, final planning and the work shall be done in close coordination with the Owner.

C. Shutdown of systems and work undertaken during shutdown shall be bid as being done outside of normal working hours.

PART 2 - PRODUCTS

2.1 None Listed.

PART 3 - EXECUTION

3.1 Workmanship

A. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Architect and Engineer shall have the right to stop the work if highest quality workmanship is not maintained.

B. Electrical work shall be performed by a licensed Contractor in accordance with requirements of the jurisdiction.

3.2 Protection

A. The Contractor shall be entirely responsible for all material and equipment furnished in connection with their work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Architect, or Construction Manager.

B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide drop cloths and visqueen or similar barriers where dust and debris is generated, to protect adjacent areas.

3.3 Cutting and Patching

A. Refer to Division 01 - General Requirements for information regarding cutting and patching.

B. Plan the work well ahead of the general construction. Where conduits, cable trays, bus ducts and wireways are to pass thru new walls, partitions, floors, roof or ceilings, place sleeves in these elements or arrange with the General Contractor to provide openings where sleeves are not practical. Where sleeves or openings have not been installed, cut holes and patch as required for the installation of this work, or pay other trades for doing this work when so directed by the Architect or Construction Manager. Any damage caused to the building shall be repaired or rectified.

C. Where conduits, cable trays, bus ducts and wireways are to pass thru, above or behind existing walls, partitions, floors, roof or ceiling, cutting, patching, refinishing and painting of same shall be included in this contract. Core drilling and saw cutting shall be utilized where practical. Contractor to examine where floors and walls etc. are to be cut for presence of existing utilities.

D. When cutting or core-drilling floor verify location of existing electrical, plumbing or steel reinforcement. Use X-ray method to verify existence of obstructions. Either re-route existing system brace floor or alter location of new work to maintain existing system.

E. All sleeves and openings not used or partially used shall be closed to prevent passage of fire or smoke.

F. All materials, methods and procedures used in patching and refinishing shall be in accordance with applicable provisions of specifications governing the various trades, and shall be completed by skilled workmen normally engaged in these trades. The final appearance and integrity of the patched and refinished areas must meet the approval of the Architect. Wall, floor and ceiling refinishing must extend to logical termination lines (entire ceiling of the room repainted, for instance), if an acceptable appearance cannot be attained by finishing a partial area.

G. Provide steel angle or channel lintels to span openings which are cut in existing jointed masonry walls where the opening span exceeds 16 inches. Provide framing around roof openings for required support of the roof deck.

H. Engage a Roofing Contractor on a subcontract basis for roofing and roof insulation work necessitated by the Electrical work. The Roofing Sub-Contractor shall be certified for installation and repair of the roofing system so as to maintain the existing roofing warranty.

3.4 Removals, Alterations and Reuse

A. Refer to the drawings for the scope of remodeling in the existing building.

B. Cooperate with the General Contractor and Construction Manager regarding all removal and remodeling work. The Contractor shall remove existing work which is associated with their trade, and which will be superfluous when the new system is installed and made operational. Void unused conduit behind walls or below floors as necessary or as directed. No wire or conduit shall be removed which will impair the functioning of the remaining work unless first replaced with a rerouted section of wire or conduit to ensure continuity. Remove inactive wiring back to the last active junction box, panelboard or piece of equipment.

C. Upon completion, no unused conduit or stub shall extend thru floors, walls or ceilings in finished areas. Abandoned conduit where remaining in place shall have any unused wiring removed. All accessible unused conduit shall be removed.

D. When it is necessary to reroute a section of an active circuit, the rerouted section shall be installed before removing the existing in order to minimize system down time. Rerouted sections shall be installed as required for new work.

E. Materials and equipment which are removed shall not be reused within the scope of this project unless specifically noted to be relocated or reused. Turn over to the Owner and place where directed on the premises all removed material and equipment so designated by the Owner. All material and equipment not claimed by the Owner after a reasonable time frame shall become the property of the Contractor responsible for removal and shall be removed from the premises.

F. Protect the Owner's property by providing dust covers and temporary plastic film barriers to contain dust. Remove barriers and return equipment and furniture upon completion of the work.

G. Refinish any surface disturbed under this work to match existing, except where refinishing of that surface is included under the General Contract.

3.5 Painting

A. In addition to any painting specified for various individual items of equipment, the following painting shall be included in Division 26:

1. Ferrous metal which is not factory or shop painted or galvanized and which remains exposed to view in the building including finished areas, mechanical rooms, storage rooms, and other unfinished areas shall be given a prime coat of paint and two finish coats of paint.
2. Ferrous metal installed outside the building which is not factory or shop painted or galvanized shall be given a prime coat of paint and two finish coats of paint.
3. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated, shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch up.
4. Apply Z.R.C. Galvilite cold galvanizing compound, or approved equal, for touch-up and repair of previously galvanized surfaces.
5. Each backboard shall be painted with a minimum of two coats of flame retardant paint, all sides; gray enamel primer with gray matte enamel finish.

B. Paint, surface preparation and application shall conform to applicable portions of the Painting section of Division 09 of the Specifications. All rust must be removed before application of paint.

C. Finish painting is included in the General Contract.

3.6 Backboards

A. Where shown on the drawings, backboards shall be provided for wall mounting of disconnect switches, devices and communications equipment. The Contractor may opt to mount additional groups of disconnect switches on backboards.

B. General

1. Backboard shall be 0.75 inch thick waterproof flame retardant plywood secured to structure.

2. Each board shall be painted.

3. Telephone backboards shall be normally 4 ft. x 8 ft. mounted 6 inches above floor where located on drawings. Where other sizes are required, they will be noted on the drawings.

C. Each terminal cabinet for communication systems, relays, etc., shall be fitted with a full size 0.50 inch thick backboard for mounting terminal strips, equipment, etc.

END OF SECTION

26 05 05 FIRESTOPPING

PART 1 - GENERAL

1.1 Firestopping assemblies shall be provided at penetrations of conduits, bus ducts, cables, cable trays and other electrical items thru fire rated floors, fire rated floor-ceiling and roof ceiling assemblies, fire rated walls and partitions and fire rated shaft walls and partitions and smoke barriers. In addition, firestopping assemblies shall be provided at penetrations thru 0-hour rated floors. Refer to the drawings for fire rated building elements.

1.2 Firestopping assemblies shall be tested and rated in accordance with ASTM E814, E119 and listed in accordance with ANSI / UL 1479, as published in the UL Fire Resistance Directory. Firestopping shall provide a fire rating equal to that of the construction being penetrated.

1.3 Firestopping materials, assemblies and installation shall conform to requirements of the OBC / Chapter 1, Section 106 and Chapter 7, Section 714 / and the Authority Having Jurisdiction.

1.4 For those firestopping applications that exist for which no UL tested system is available through any manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests shall be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

1.5 Shop drawings shall be prepared and submitted for review and approval. Submittals shall include manufacturer's specifications and technical data of each material, documentation of U.L. firestopping assemblies and installation instructions. Submittals shall include all information required in OBC Chapter 1, Section 106 and Chapter 7, Section 714 /

PART 2 - PRODUCTS

2.1 Firestopping materials shall be manufactured and/or supplied by Hilti, 3M, Tremco, or Specified Technologies Inc (STI).

2.2 Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. These shall be installed in conjunction with sleeves and materials for fill and damming.

2.3 Combination pre-set floor sleeve and firestopping assemblies shall be equal to Hilti CP 680.

PART 3 - EXECUTION

3.1 Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.

3.2 Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.

3.3 Refer to 26 05 33 Raceway and Boxes for Electrical Systems for sleeve requirements and treatment of penetrations not requiring firestopping.

END OF SECTION

26 05 09 EXCAVATION, BACKFILL AND SURFACE RESTORATION

PART 1 - GENERAL

1.1 Excavate for all in-grade in grade raceways and incidental work fuel delivery pumps and fuel monitoring raceways which are included in the Electrical contract. Backfill to finish grade or to levels consistent with the General Contractor's and the Site Contractor's activities. Cut existing street, drive and parking lot paving, walks, curbs and other permanent hard surfaces which are to be encountered. Repair or restore exterior surfaces to original condition where such are not affected by Division 31 – Earthwork or Division 32 Exterior Improvements. Cut existing floor slabs and replace slabs in conformance with 26 05 04 Basic Electrical Materials and Methods. All work shall comply with requirements set forth in Division 31 and 32.

1.2 Excavation and trench wall supporting, cribbing, sloping and stepping of excavations required for safety shall be done in accordance with OSHA and local requirements. Pumping of water from excavations and trenches which may be required during construction shall be included in the contract.

1.3 Contact the Ohio Utilities Protection Service 8-1-1 or (1 800 362 2764) / and the Oil and Gas Producers Underground Protection Service (1-800-925-0988) sufficiently in advance of the start of any excavation so that notification can be made to member utility departments and utility companies (water, sewer, gas, petroleum, electric, telephone, cable, etc.) having underground utilities in or near the project area. Also contact those companies to verify that utility lines have been located and duly marked and identified.

1.4 A utility locator service shall be engaged to locate, mark and identify private lines and other utilities that are not located by the means mentioned above.

1.5 Existing utilities encountered during excavation work shall be protected in a manner acceptable to the utility owner. Any utilities that are damaged shall be repaired or replaced by this Contractor to the full satisfaction of the utility owner.

PART 2 - PRODUCTS

2.1 Refer to Division 31, Earthwork for bedding and backfill materials specifications.

PART 3 - EXECUTION

3.1 Interior and exterior trenches shall be over excavated and the duct, conductor or conduit shall be laid on 4 inches minimum depth sand bed. Where ductbank is concrete encased, excavate to required depth, if fill or backfill needed under ductbank use washed pea gravel or crushed limestone and compactt.

3.2 Backfilling of excavations and trenches inside the building and outside under paved or other hard surfaced areas, shall be with graded pea gravel, graded coarse sand or crushed limestone 0.75 inch maximum size, to prevent undue settlement. Backfill material for non-metallic conduit shall be pea gravel or sand. Other excavations and trenches shall be backfilled with similar materials or with excavated material up to 18 inches above the top of the conduit. The remainder shall be with similar materials or with excavated material having no large clots, stones or rocks.

3.3 Backfill shall be mechanically compacted in layers not over 6 inches deep. Water settling will not be permitted. Where excavations have not been properly filled or where settlement occurs, they shall be refilled, compacted, smoothed off, and finally made to conform to the initial requirements. Excess excavated materials shall be removed from the site or disposed of as directed by the General Contractor. Refer to Division 31 Earthwork for compaction requirements.

3.4 Fuel storage tanks shall be specified and installed under the division 22 portion of the project.

3.5 Concrete floor slabs, paving, sidewalks, curbs, sodded and other finished surfaces which have been damaged or removed in order to install the underground work shall be replaced by this Contractor equal to original conditions. Refer to Division 31 and 32 for Surface Restoration Requirements. This requirement is not applicable in areas where the General Contractor or the Site Contractor is obligated to provide new surfaces.

3.6 Excavation, backfill, surface repair and traffic control within the public right-of-way shall be in accordance with governing agency rules and regulations. Any fee for activity in the roadway shall be included in this contract so that no additional cost will accrue to the Owner.

3.7 Maintain in place adequate barricades, guards, planking, plating, signage, warning lights, etc., at and around excavations.

3.8 All exterior underground conduit, concrete encased ducts, and direct buried conductors shall be protected against future excavation damage by placing a plastic tape warning marker in each trench during backfill. Tape shall be 6 inches wide with black letters identifying the type of service. Tape shall be equal to that manufactured by Seton. Install tape full length of the trench approximately 18 inches above and on the centerline of the conduit, duct or conductor.

END OF SECTION

26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS COPPER

PART 1 - GENERAL

1.1 This section pertains to the use of copper conductors, 600V insulation class.

PART 2 - PRODUCTS

2.1 All conductors shall be copper: conductors shall be insulated for 600 volts.

2.2 Insulation types referenced are those of NEC. All conductors shall be UL labeled and shall be marked for size and type at regular intervals on its length. Conductors #8 and larger shall be stranded; #10 and smaller may be stranded provided approved terminations are used.

2.3 Types of conductor insulation for general use may be any of the following, subject to limitations listed, in addition to those in the NEC:

A. Type THHN - restrictions - do not use for conductors in slab. Do not use in wet locations.

B. Type THWN - no restrictions.

C. Type XHHW - no restrictions.

2.4 Use shielded VFD cables for feeds from VFD to motor where conductor length is longer than 25 feet. VFD cable shall be 3 conductor XHHW low capacitance copper, full size insulated copper ground, 1.5 mil AL foil and 85 percent tinned copper woven braid shield with PVC oil and sunlight resistant jacket. UL TC-ER, 90 degrees C., 600V wet/dry. Manufactured by Belden, AWC, Lutze or equal.

2.5 Use only Type XHHW for isolated ungrounded branch circuit wiring such as monitored wiring in hospital operating and special procedures and X ray rooms. Refer to Section "Hospital Specialty Equipment".

2.6 Use Type THHN or XHHW, (90 degrees C. rated) types for connecting luminaires and for running thru fixture housings.

2.7 Use conductors such as type FEP with high temperature insulation as identified in the NEC for connections to resistance heating elements or in other areas subject to temperature exceeding the rating of THWN, XHHW or THHN.

2.8 Color Coding – The use of colored commercial building wire is encouraged.

A. On 208/120 volt, three phase and 240/120 volt, single phase grounded systems, wires colored black, red and blue shall be used for phase conductors. Neutral wires on these systems shall be white. If conductors No. 4 AWG or larger are not available in white or white stripes, the neutral may be a black wire identified with white tape, minimum size 0.50 inch wrapped twice around at the following points:

1. At each terminal.
2. At each conduit entrance.
3. At intervals not more than 12 inches apart in all accessible enclosures.

B. On 480/277 volt, three phase system, wires colored brown, orange and yellow shall be used for phase conductors. Neutral wires on these systems shall be gray or other NEC acceptable means for distinguishing each system grounded conductor from another. If conductors No. 4

AWG or larger are not available in the proper colors, black wire may be used with 0.50 inch tape bands of the proper color at the following points:

1. At each terminal.
2. At each conduit entrance.
3. At intervals not more than 12 inches apart in all accessible enclosures.

C. Equipment grounding conductors shall be green, or for 4 AWG and larger may be completely taped green, at all accessible points.

D. All control circuits shall be red with individual wire identification on each conductor.

E. Where existing wiring systems (remodel work or building additions) have different color coding, consult the Engineer concerning matching existing wire color coding and phasing.

2.9 Wire size ampacity shall equal or exceed its overload protective device. Where wire sizes shown on the drawings are greater than the apparent ampacity requirements, the size shown shall prevail to compensate for voltage drop. In no instance shall conductors be installed that are less than required by N.E.C. Minimum conductor size shall be No. 12 AWG except No. 14 AWG may be used only for control wiring or where otherwise specifically shown.

2.10 When necessary to use a lubricant for pulling wires, lubricant must be listed by Underwriters' Laboratories, Inc. Only cable lubricants approved for the type of jacket material or insulation shall be used, and must be of such consistency that it will dry completely when exposed to air. Lubricant must leave no obstruction or tackiness that will prevent pulling out old wires or pulling in new wires or additional wires, and, after drying, must leave a film of lubrication which will promote easy movement of the wires. The lubricant shall contain no waxes, greases, silicones, or polyalkylene glycol oils or waxes. Lubricant shall be Ideal "Yellow 190", 3M “WL”” Wire Pulling Lubricant, or approved equal.

2.11 Splices No. 10 AWG and smaller shall be made using the following:

A. Preinsulated spring pressure connectors as follows: ITT Holub "Freespring", with metal grip threads 3M "Scotch-Lok", Ideal "Wingnut", Thomas and Betts Type "PT", or Buchanan "B Cap". Other hard insulated wire connectors which have bakelite or ceramic insulation are prohibited. (Non-metallic thread connectors shall not be used.)

2.12 Splices No. 8 AWG and larger shall be made using the following:

A. Approved crimp type connectors with special crimping tool; T&B, Burndy, Buchanan or approved equal. Joints and free ends shall be covered with tape or approved moistureproof insulating kits. Applied insulation shall exceed 150 percent of conductor insulation voltage rating.

B. For two or more taps use Power Distribution Blocks by Square D, Gould, Taylor, Ilsco or Connectron.

2.13 Wiring in vertical raceways shall be supported with strain relief devices; Kellem's grips or approved equal.

2.14 Connections to equipment shall be made with pressure type terminals. On stranded wire, use spade type terminals or terminals approved for use with stranded wire. Connections shall contain only single conductors unless approved for multiples.

A. For conductors No. 10 AWG and smaller, applied crimp type terminals shall be T&B "Sta Kon" or approved equal.

B. For No. 8 AWG and larger conductors, applied crimp type terminals shall be Burndy, T&B or approved equal.

2.15 Where tape is applied over wires and connectors on 600 volt or lower voltage applications, it shall consist of a minimum of two (2) half lapped layers of Scotch "88" or Plymouth No. 4240 for both indoor and outdoor applications, except Scotch 33 Plus or Plymouth No. 4453 is acceptable for use indoors.

2.16 Where fireproofing of cables is noted on the drawings or required by Code, each cable shall be arc and fireproofed with one (1) half lapped layer of Scotch Brand 77 Electric Arc and Fireproofing Tape. Tape shall be secured with a 2 layer band of Scotch Brand 69 Glass Electrical Tape over the last wrap. Installation shall comply with manufacturer's recommendation.

2.17 Where installed underground, splices and terminations shall be listed and approved for waterproof application. Utilize kits approved for the application.

PART 3 - EXECUTION

3.1 Branch circuit conductor identification means shall be permanently posted at each panelboard and switchboard. This identification shall be installed on the inside of the door and shall identify conductor colors for each voltage system in the building. Provide identification at all new panelboards and existing panelboards utilized within this project.

3.2 Conduit systems shall be clear and clean before pulling wire. Branch circuit conductors shall be pulled without resorting to levers or heavy pulling devices.

3.3 Cable pulling tensions shall not exceed recommended values.

3.4 Group ungrounded and grounded circuit conductors for each multiwire branch circuit by cable ties in panelboards and tap boxes.

3.5 Each branch circuit or multiwire branch circuit shall have its own dedicated neutral. Group neutral conductors with phase conductors by wire ties in each enclosure where multiple neutrals provided.

3.6 Shielded VFD cables shall be provided for VFD to motor conductors length longer than 25 feet. VFD motor feed cables shall be terminated per VFD manufacturer’s direction.

3.7 Control conductors shall not be run in same raceway with branch circuit or motor circuit conductors.

3.8 Unless noted otherwise on the drawings, a maximum of 8 conductors shall be installed in a branch circuit conduit. This maximum is a count of all phase and neutral conductors only, ground conductors are not counted when determining maximum fill for this purpose.

3.9 Wire tags shall be provided on all main and feeder conductors in all pull boxes, wireways and panelboard and switchboard wiring gutters. Tags shall identify wire or cable number and/or equipment served. Tags shall be of flame resisting adhesive material, T&B Type WSL or approved equal.

3.10 Perform meggar tests on all feeders and motor branch circuit conductors prior to energization of circuits. Provide documentation in standard NETA format to the Engineer for review. Do not run meggar check on solid state equipment.

END OF SECTION

26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 Work includes grounding and bonding of system neutral, equipment and conduit systems to conform to requirements of NEC and as detailed on the plans and in the specifications.

PART 2 - PRODUCTS

2.1 Grounding rods shall be copper clad, molten-welded copper to steel; unless otherwise designated, 0.625 inch diameter x 10 ft. long.

2.2 Clamps and continuity devices shall be non-ferrous material, UL approved. Connections to ground rods and all underground connections shall be "Thermoweld" or "Cadweld".

2.3 Ground conductors shall be insulated, identified by green insulation or by painting or taping green at all accessible locations and shall be connected with approved connectors and terminators to boxes, devices, equipment, etc. and to ground bars in panels.

PART 3 - EXECUTION

3.1 Wiring devices shall be connected with grounding jumper from ground pole on device to grounding screw in the outlet box. Branch circuit to be connected to grounding screw in the outlet box.

3.2 The complete metal conduit system shall be used for the equipment grounding system. Conduit systems and associated fittings and terminations shall be made mechanically tight to provide a continuous electrical path to ground and shall be safely grounded at all equipment by bonding all metallic conduit to the equipment enclosures with locknuts cutting thru paint or enclosures. Bond all conduits entering primary switchgear, pad-mount transformers, unit substations, emergency generator control panel and main breaker panel, and secondary service entrance switchboard / switchgear / panelboard with a ground wire connecting the grounding type bushings to the equipment ground bar. Conductors shall be sized per NEC Tables 250.66, 250.102 and 250.122. Bond all communications conduit systems to ground.

3.3 In addition to using the conduit system for grounding, a complete auxiliary green wire equipment grounding system shall be installed, continuous from main ground, thru distribution and branch circuit panelboards and paralleling all feeders and branch circuit wiring. Grounding conductor sizes shall comply with NEC Table 250.122, minimum size shall be #12 copper except #14 on control circuits. This shall apply to all circuits rated 100 volts or more above ground potential.

A. Connect ground terminal on wiring devices to auxiliary green wire equipment grounding system.

3.4 Ground neutral of all transformers for separately derived systems. Grounding electrode conductor shall be to the street side of the main water service plus a bond ground ran to nearest structural steel in area or to other NEC approved electrodes. A common grounding electrode size #3/0 may be used for multiple separately derived systems. Conductors shall be sized per NEC Table 250.66.

3.5 Motor frames shall be bonded to the equipment grounding system by an independent green insulated copper wire, sized to match equipment grounding conductor. Motors with VFD shall be bonded with flat braided tinned copper straps in lieu of wire.

3.6 Equipment mounted on vibration isolation hanger and supports shall be bonded so bond does not transmit vibration. Size bond to match equipment ground conductor.

3.7 A green grounding conductor shall be installed in each non-metallic conduit and all flexible conduits, including exterior underground conduits.

3.8 System neutral connections shall be insulated from metal enclosures except at the neutral of the service entrance equipment and on the neutral of a separately derived system.

3.9 The building neutral shall be identified throughout with white conductors. Where there are neutral conductors from a separately derived system (such as 120/208 volt, 3 phase, 4 wire where the main building service is 277/480 volt, 3 phase, 4 wire) the neutrals of the two systems shall be separately identifiable per NEC Article 200.

3.10 Where metal covers on pull boxes and junction boxes are used, they shall comply with the grounding and bonding requirements of NEC Article 250.

END OF SECTION

26 05 33 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 This specification section covers common conduit systems, boxes, firestopping and sleeves. Where other methods are specified under separate sections for specific applications, the specific application requirements shall govern.

1.2 Refer to Section 26 05 05 Firestopping and Division 07 for firestopping requirements.

PART 2 - PRODUCTS

2.1 Conduit Type - Application (Use only conduit types listed)

A. Conduit - Rigid or Intermediate Grade Galvanized Threaded.
Application - restrictions - (Not to be used in):

1. Direct buried in corrosive soils.
2. Corrosive atmospheres.

B. Conduit - Thinwall EMT.
Application - restrictions - (Not to be used in):

1. Poured concrete.
2. Exposed to weather.
3. Underground.
4. Exposed in mechanical equipment or other equipment/process rooms below 48 inches.
5. Hazardous or corrosive atmospheres.

C. Conduit - PVC Type 40 (Schedule 40) rigid, conforming to ANSI, NEMA specifications and each length UL labeled.
Application - use limited to:

1. In or under concrete slabs on grade where permitted by electric legend on the drawings.
2. Exterior use when encased in 3 inch concrete.
3. Direct buried, underground when indicated on drawings.

D. Conduit - PVC, NEMA Type TC 6, rigid, conforming to ANSI, NEMA specifications and each length UL labeled.
Application - use limited to:

1. Exterior use when encased in 3 inch concrete, for duct bank use only.

E. Conduit - Flexible Metal (Greenfield type), galvanized steel or aluminum.
Application - use limited to:

1. Connection to lighting fixtures; not over 6 ft. in length.
2. Narrow movable partitions where other raceways are not practicable, when approved by the Architect or Engineer.
3. Connections to transformers, dynamic equipment and for motors only when in air streams or plenums.
4. In existing walls for remodel projects, vertical drops to outlets and switches; no more than 3 ft. out the top of the wall.

F. Conduit - Liquidtight Flexible Metal.

Application - use and limitations:

1. Connections to all motors, except in air stream or plenum.
2. Connections to controls on dynamic equipment, transformers, etc., outdoors and indoors in wet locations.
3. Use not permitted underground or where subject to physical damage.

2.2 Conduit sizes

G. Conduits shall be 0.75 inch minimum size except 0.50 inch size may be used for switch legs and flexible connections to lighting fixtures.

2.3 Conduit Fittings

A. Fittings and workmanship shall ensure electrical continuity. All conduit systems in poured concrete shall be concrete tight.

B. Application of bushings, locknuts and insulated fittings shall comply with NEC requirements.

C. Use conduit fittings as manufactured by Efcor, Steel City, Raco, Midwest, Appleton, ETP / O-Z / Gedney, American Fitting Corporation or T&B, equal to the following catalog numbers:

1. Rigid and intermediate conduit
   - all fittings, couplings and connectors shall be threaded type.
   - grounding bushings, malleable iron; insulated; Steel City BG-801; Midwest Series GLL.
2. EMT
   - fittings shall be all steel, set screw or compression type, concrete tight.
   - set-screw type couplings; Midwest Series 460; Steel City TK 121; Appleton TW 50S.
   - compression type couplings; Midwest series 660S; Steel City TK111; Appleton TWC50CS.
   - set-screw type connectors; Midwest Series 450; Steel City TC 121; Appleton TWC 50S.
   - compression type connectors; Midwest Series 650; Steel City TC111; Appleton TW50CS.
3. Flexible metal conduit
   - malleable iron, "squeeze" type, non-insulated; Midwest series 1708; Steel City XC 901; Appleton 7481V. (For lighting fixture whips only - all steel or die cast screw in connector; Midwest 771; Steel City XC 241; Appleton SGC 50DC).
4. Liquid tight conduit
   - steel or malleable iron; Midwest Series LT; Steel City LT 100; Appleton ST.
5. PVC Type 40 and Type TC-6
   - couplings and fittings socket type solvent weld, coupling and solvent by same manufacturer as conduit.
6. RTRC
   - Coupling and fittings socket type adhesive jointing. Coupling and adhesive by same manufacturer as conduit. Gasketed jointing system may be used underground where encased in conduit.

2.4 Boxes

A. Junction boxes and pull boxes shall be code gauge galvanized steel with multiple screw fasteners and galvanized steel covers.

B. Outlet boxes all steel construction with galvanized or plated finish or otherwise all metal, by Steel City, Appleton, Crouse Hinds, R&S or Raco.
   1. Lighting fixture outlet boxes 4 inches square or octagonal, 2.125 inches deep, with 0.375 inch fixture studs. Equal to Steel City Series 54171; Series 52171 with FE 421 stud. Fixtures weighing more than 50 lbs. shall be supported independently of the outlet box.
   2. Flush mounted device outlet boxes shall be minimum 4 inches square. Provide extension rings as required. Use Erico Caddy No. H2-3 mounting support plate where metal studs are used.
   3. Device rings in finished masonry or tile walls shall be square corner masonry type with no extended ears, to allow flush mounting of plates.
   4. Surface mounted device boxes shall be cast "FS" type or special surface mounted boxes for use with surface raceway systems.

C. Floor boxes shall be UL listed for its application as manufactured by Hubbell, Steel City, Walker, Raco or Wiremold. Drawings identify material type.

D. Provide water tight boxes, slip expansions and bonding jumpers where dictated by construction conditions.

E. Terminations at boxes shall be secured by locknuts or approved bushings.

2.5 Surface Metal Raceways

A. Snap on cover types by Mono-Systems, Panduit or Wiremold / Walkermold with prime gray finish (enamel finish coat to match room finishes in remodel areas). Application - permitted only when specifically shown on the drawings.

   1. Fittings, boxes and extension rings: Furnish manufacturer’s standard accessories; match finish of raceway.

2.6 Sleeves and Openings

A. Sleeves and formed openings shall be placed in walls, partitions, floor slabs and poured concrete roof decks for the passage of conduit, cable, wireway, cable tray and bus duct. Sleeves and formed openings are not required:

   1. Where conduit is installed before the wall, partition or slab is constructed.
   2. Openings are cut for conduit passage and patched with equal or comparable material to close the space around the conduit.
   3. In stud and gypsum board or plaster walls and partitions which are not fire rated.
   4. For conduit passing thru masonry walls and partitions and stud and gypsum board or plaster walls and partitions. Sleeves are required however, for which expansion, contraction and other movement can be expected.
   5. In core drilled openings in solid concrete not requiring water protection. Sleeves are required, however, at core drilling thru hollow pre-cast slabs and concrete block walls, to facilitate containment of required firestopping material.
   6. In large floor openings for multiple pipe and duct risers which are within a fire rated shaft, unless the opening is to be closed off with concrete or other material after conduits are set.

7. Sleeves for passage of conduit and cables shall be schedule 40 black steel pipe or galvanized rigid conduit. Rectangular sleeves for cables, wireway, cable tray and bus duct shall be 18 gauge galvanized steel in poured concrete floors, walls and roof decks; 26 gauge galvanized sheet steel in other than poured concrete.
8. Sleeves shall be sized to afford 0.25 inch to 0.75 inch clearance space.

2.7 In areas having special membrane waterproofing in or on the floor slab, a Josam 26420, or equal approved by the Architect, riser sleeve with clamping ring and auxiliary conduit sleeve extending 4 inches above finished floor or 8 inches above finished roof shall be used. Waterproofing membrane for roof and construction shall be secured by the clamping ring. These are to be used in areas having special membrane water-proofing in or on the floor slab and at roof decks.

2.8 Escutcheon plates shall be split-ring chromium plated pressed steel. Plates shall be sized to cover the surface penetration and sleeve. Plates shall be installed on exposed piping in finished rooms and areas where conduits penetrate walls, floors, ceilings or overhead structure.

2.9 Anchors and Fasteners

A. Anchors and fasteners shall be of a type designed and intended for use in the base material to which the material support is to be attached and shall be capable of supporting the intended load and withstanding any associated stresses and vibrations.

B. In general, screws shall be used in wood, masonry anchors on concrete or brick, toggle bolts in hollow walls, and machine screws, bolts or welded studs on steel.

C. Nails shall not be used except for temporary support or for light loads in wood frame construction.

D. In outdoor locations or other corrosive atmospheres, the anchors and fasteners shall be non-corrosive or have suitable corrosion resisting coatings.

PART 3 - EXECUTION

3.1 Conduit shall be run concealed in all finished areas of new construction and elsewhere unless specifically indicated or upon specific permission by the Architect. All conduit shall parallel building lines.

3.2 Conduit shall be run overhead and shall not be run in or below concrete slabs unless specifically indicated on the drawings and in the legend on the drawings.

3.3 Where feeders are permitted to be run below floor slab on grade, they shall be installed in non-metallic conduit encased in 3 inch concrete using galvanized rigid steel or RTRC (equal to Champion Fiberglass) elbows with all necessary fittings and couplers. (NOTE: Where not required to be run overhead, branch circuits may be installed in 1 inch or smaller Schedule 40 PVC conduit below the vapor barrier, shall have a minimum of 6-inch fill over the conduit below the vapor barrier without concrete encasing the PVC.

3.4 All conduits installed below concrete slab on grade shall have a minimum of 6-inches fill over the conduits in order to prevent accidental damage to conduits should the floor be saw-cut in the future.

3.5 Conduits shall not be installed above the vapor barrier in concrete floors poured on grade.

3.6 Conduit crossing building expansion joints shall have expansion provisions with grounding continuity; use special expansion fittings or other NEC approved method. Refer to the Architectural and Structural floor plans and details for locations of expansion joints.

3.7 Do not install wall-mounted boxes back-to-back in opposite sides of wall; in stud walls, boxes shall be on opposite side of studs. In acoustic rated and fire rated walls boxes shall be separated a minimum of 24 inches.

3.8 Boxes not otherwise accessible in ceilings and walls shall be made accessible by installation of hinged door access panels. Refer to Section 26 05 04 - Basic Electrical Materials and Methods.

3.9 Use cast floor boxes for installation in slab on grade; formed steel boxes are acceptable for other installations.

3.10 Work shall be so planned as to:

A. Minimize the number of offsets and junction boxes. For feeder conduits, use all long radius conduit bends or accessibly located large junction boxes with screw covers.

B. Generally run conduit and conductors as high as practicable against underside of floor slab in concrete construction or immediately below the top chord of bar joist construction unless otherwise shown. This high level zone shall be used for running electrical raceways. Running conduits promiscuously at various levels and directions will not be acceptable. Runs at bottom chord level or ceiling grid level will not be acceptable.

C. Where spray on fireproofing is used, coordinate with the General Contractor about installing supports, panel feeders and larger conduits before fireproofing is applied. Branch circuit conduits and smaller size conduits may be run as high as possible on stud walls that go all the way up to the structure; this will minimize damage to spray on fireproofing. Patch and repair damaged spray on fireproofing caused by electrical installation; conduits shall not be fully covered with fireproofing.

D. Coordinate activity in advance to avoid interference with other trades.

E. Provide access to all junction and pull boxes.

F. Maintain 6 inches from conduit to paralleled hot water piping and 4 inches from cross piping and 12 inches from generator exhaust piping.

3.11 Secure feeder conduit to basic structural elements with galvanized strap hangers and clamps; use of trapeze type hangers is encouraged for multiple conduits where space will permit. Galvanized metal clamps and screws may be used for attaching and supporting branch circuit conduit. Non-metallic fasteners shall not be used except plastic inserts may be used in concrete for small conduits. Vertical conduits shall be supported at each floor by clamps.

3.12 Surface mounted horizontal and vertical conduit supports on walls up to a height of 7 feet-0 inches above the floor shall be one or two hole sheet metal pipe straps. Pinch type hangers similar to Minerallac type may only be used at heights greater than 8 feet-0 inches. The use of pinch type hangers similar to Minerallac type are expressly prohibited on ductwork, air handling units and other mechanical equipment below 8 feet-0 inches.

3.13 During construction temporarily cap open ends of conduit. Caution trades to take special care of runs in concrete slabs during pouring.

3.14 Empty conduit installed for communications use or for future systems shall have an insulated pull wire or heavy nylon cord inserted for use in pulling wires.

3.15 Pull mandrel or large swab thru conduit to ensure freedom from debris before pulling wires. Use pulling lubricants sparingly.

3.16 Sleeves for passage of conduit, cables, wireway, cable tray and bus duct shall be placed in the initial stages of construction before concrete, masonry and other general construction activity. Means shall be taken to ensure that the sleeve will not move during or after construction. Beams, columns and other structural members shall not be sleeved except upon approval of the Architect.

3.17 Length of wall sleeves shall be such that the sleeve ends are substantially flush with both sides of the wall or partition. Floor sleeves shall be flush with the bottom and top of the floor slab except, in mechanical rooms and other areas which might have water on the floor, sleeves shall project a minimum of 1 inch above finished floor.

3.18 Refer to 26 05 05 Firestopping. Sleeves which are a part of firestopping assemblies shall conform to the requirements of the assembly with particular emphasis regarding size, annular space, length, passage or non-passage of insulation and the installation of the sleeves.

3.19 Where firestopping is not required, the annular space between the sleeve, core drilling or opening and the conduit, cable, cable tray, bus duct and raceway shall be closed with caulking to retard the passage of smoke.

3.20 Where permitted by OBC Section 712 Penetrations, metallic conduits requiring no pipe sleeves in passing thru concrete floors or concrete or masonry walls and partitions, the annular space shall be closed full depth of the penetration with materials and methods compatible with the floor, wall or partition material (concrete, grout or mortar).

3.21 Conduits, wire and cables entering from outside the building shall be sealed water and moisture tight. Seal between conduit and sleeves, conduits and core drilled holes and around conductors inside conduits.

3.22 Conduits extending through the roof shall be made watertight by means compatible with the roofing system and as directed by the Roofing Contractor (the company who presently holds the warranty on the roof) and approved by the Architect.

3.23 Conduit, wire and cable, where exposed to different temperatures, shall have raceway or sleeve filled with approved material to prevent circulation of warm air to cold.

3.24 Power actuated fasteners of any type are prohibited in occupied buildings. This includes anchors which are driven into place by any device which produces an impact force by use of a powder charge, compressed air, gas or any other propellant.

3.25 Provide four (4) 1 inch diameter spare conduits for each flush mounted branch circuit panelboard; extend from top of panelboard to above an accessible ceiling for future use.

3.26 All conduit terminations to be equipped with locknuts and bushings. Conduits 1-1/2 inches and larger shall have insulating bushings, grounding lug and shall have locknuts inside and outside the enclosure.

3.27 Outlet Box Installation

A. Set box square and true with finished building surfaces and trim.

B. Secure boxes firmly to building structure.

C. Verify location of outlets and switches in finished rooms with Architectural Drawings of interior details and finish. In centering outlets and locating boxes, allow for overhead pipes, ducts and mechanical equipment, variations in fireproofing and plastering, window and like, and correct any inaccuracy from failure to do so without expense to the Owner.

D. Maintain symmetry of all outlets as closely as possible contained within Architectural Elevation. For example, the Contractor shall center light fixture over doorway or receptacle in section of masonry wall, if shown in that approximate position. If receptacle is shown in same location as counter or bench, determine countertop height and set receptacle to clear top and trim of counter and render outlet easily accessible.

E. In the event of conflict between locations of electrical outlets as shown on the Electrical Drawings and on the Architectural Drawings, outlets shall be installed in accordance with the latter.

F. Locate light switches on latch side of door and verify door hinge location in field prior to switch outlet installation.

G. The Owner reserves the right to relocate any device as much as 10 feet-0 inches (measured horizontally) from its indicated location at no additional cost, provided the contractor is notified prior to roughing that device in.

3.28 Contractor shall record carefully on a set of "as built" prints the exact location of all feeder conduits.

3.29 Unless noted otherwise on the drawings, a maximum of 8 conductors shall be installed in a branch circuit conduit. This maximum is a count of all phase and neutral conductors only - ground conductors are not counted when determining maximum fill for this purpose.

END OF SECTION

26 05 43 PULLBOXES, HANDHOLES, UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEM

PART 1 - GENERAL

1.1 Work includes manholes, pullboxes, handholes and underground duct banks complete as shown, including excavation, backfill and accessories.

PART 2 - PRODUCTS

2.1 Pullboxes

A. Precast pullboxes including moving and setting installation requirement shall be submitted for approval.

B. Refer to the drawings for number and sizes of pullboxes required.

C. Furnish ground rod for each pullbox and bond all exposed metal parts, including the ring for the manhole cover, to rod with minimum #8 copper conductor.

D. The use of precast concrete manholes is encouraged. Acceptable manufacturers: Oldcastle Infrastructure, Mack Industries, Norwalk Concrete Industries, E. G. Babbert or approved equal.

E. Cover shall have bolt down provisions and have "ELECTRIC" or "TELEPHONE" cast in top. Covers weighing less than 100 pounds shall have bolted fastening provided.

F. Provide pulling rings on each side of pullbox.

2.2 Handholes

A. Constructed of polymer concrete reinforced with fiberglass. Cover to be bolted with stainless steel pentahead bolts. Manufactured by Quazite, Oldcastle, or MacLean Highline.

B. Enclosures, boxes and cover are required to conform to all test provisions of ANSI/SCTE 77 “Specifications For Underground Enclosure Integrity” for Tier 15 (unless marked otherwise on drawing) applications. When multiple Tiers are specified the boxes must physically accommodate and structurally support compatible covers while possessing the highest Tier rating. In no assembly can the cover design load exceed the design load of the box.

C. All components in an assembly (box and cover) are manufactured using matched surface tooling. All covers are required to have a minimum coefficient of friction of 0.05 in accordance with ASTM C1028 and the corresponding Tier level embossed on the top surface.

D. Independent third party verification or test reports stamped by a registered Professional Engineer certifying that all test provisions of this specification have been met are required with each submittal.

2.3 Duct Banks

A. Duct material, where concrete encased, shall be concrete encasement type PVC with 3 inches envelope of 3,000 psi concrete. Fittings shall be fully compatible for the duct material, assembled with recommended sealants to form a watertight joint. All bends shall be long sweep type; use proper adapters between PVC duct and galvanized rigid steel.

B. Ducts shall be carefully placed, aligned and tied to avoid disruption during pouring using plastic spacers.

C. Duct runs shall pitch slightly toward manholes to provide drainage; pitch away from building entrance.

D. Pull a mandrel or swab through each completed duct run; leave a No. 10 THW copper or equivalent, pull wire in all unused duct runs: plug ends of all unused duct runs.

E. Use rigid galvanized steel conduit at all bends and within five (5) ft. of the building wall.

F. Provide taper end bells at all pull in points.

G. Mark the top of all underground duct runs with one of the following methods:

1. Concentrated red dye or powder on top.
2. 6 inches wide yellow plastic tape, with black letters; place approximately 18 inches above on the centerline of the duct bank.

EXECUTION

3.1 Installation

A. Refer to Section 26 05 09 for excavation and backfill.

B. Pullboxes, handholes and ducts shall be placed only on firm soil, carefully graded. Tamped sand or gravel shall be used to compensate for over excavation.

C. Use saw cuts where existing paving, walks or curbs are cut. Replace all surfaces to near original condition as practicable.

D. Coordinate duct bank, pullbox, handhole and manhole locations with underground utilities and piping.

E. Duct runs shall be covered only after inspection and approval by the Engineer or the Architect.

F. Where concrete encased ductbanks meet building walls and manhole walls, drill and set a minimum of four size 6 reinforcing bars into manhole wall and builder walls and extend bars parallel to conduits 5 feet beyond the area excavated for manhole. Also provide size 3 cross-ties (top and bottom) 12 inches on center. Where ductbank crosses road also place rebars to extend under roadbed and 5 feet beyond.

G. Handhole installation over excavate hole by 6” to 8”, provide minimum 6” bedding of compacted crushed stone with 6” to 12” extension beyond sides of box. Fill and compact with crushed stone around sides of box. Top of box shall be flush with finish grade.

3.2 Grounding Underground Distribution System Components

A. Grounding handholes, pullboxes: Install a driven ground rod through floor, close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before structure is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into handhole through a waterproof sleeve in handhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or

heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.

B. Grounding Connections to Handhole, Pullbox and Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

END OF SECTION

26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 Equipment Identification

A. Identify all the following items with laminated plates:

1. Secondary distribution switchgear, and switchboards, including all subassembly switches.
2. Every motor, lighting and equipment controller and disconnect switch.
3. Panelboards.
4. Motor control centers and motor controller panelboards and individual motor starters within panelboards.
5. Transformers.
6. Automatic transfer switches.

B. Nameplate on motor controllers, disconnect switches, automatic transfer switches, switchgear, switchboards, panelboards and transformers shall indicate source, voltage, disconnect location, and load served.

C. Equipment on the emergency systems shall be identified with nameplates having a red background. Outlets on the emergency systems shall be identified red. This shall be accomplished by using red devices or by providing a coverplate with "EMERGENCY" engraved on the face; fill engraving with red paint or equal.

D. Branch circuit panelboards:

1. Identify panel designation on directory card within the panel.
2. Fill out branch circuit directory indicating circuit number and area served, rooms, group of rooms, lighting, convenience outlets, motors, etc. Card index shall be neatly typed. Provide electronic file for card using Excel.
3. Update or replace branch circuit directory in existing panelboards in areas of alteration.
4. Branch circuit phase conductor color format shall be permanently identified inside each panelboard.

E. Wire identification:

1. Identify communications and signaling system wiring and branch circuit wiring by circuit number in panels and motor control center wiring gutters by means of permanent durable wire markers wrapped around or fastened to conductors. This shall be done concurrently with pulling of conductors.
2. Wiring or fiber cabling installed by Contractor for termination by Owner's vendor such as for telephone or data systems shall be identified at both ends utilizing the alpha/numerical identification schedule established by the system vendor.

F. For disconnecting means where power can be backfed (like tie breaker) provide permanent sign at disconnecting means saying: 'DANGER – CONTACTS ON EITHER SIDE OF THIS DEVICE MAY BE ENERGIZED BY BACKFEED.' Also, provide a single-line showing local switching arrangement on permanent sign.

PART 2 - PRODUCTS

2.1 Nameplates

A. Nameplates shall be laminated phenolic with black surface (red surface for emergency) and white core. Use 0.0625 inch thick material for plates up to 2 inches x 4 inches and 0.125 inch thick for larger sizes. The lettering shall be Condensed Gothic with space between the lines equal to the width of the letters. Use 0.25 inch minimum height letters on the small plates increasing the size proportionately to plate size.

B. The lettering on the plate shall indicate the name of equipment, the specific unit number, voltage, phases, which panel, switchboard or motor control center the equipment is served from, and any other reference data pertinent to the operation. Names and numbers shall coincide with those listed on the drawings. Sample: Panel 3A; 277/480 V, 3 phase, 4 wire, served from unit substation USI.

PART 3 - EXECUTION

3.1 Nameplates shall be secured with screws, one on each end.

END OF SECTION

26 05 65 SPECIFIC WIRING APPLICATIONS

PART 1 - GENERAL

1.1 Specific wiring applications are identified. Refer to applicable sections of the specifications.

PART 2 - PRODUCTS

2.1 Materials and equipment shall be as indicated on the drawings and in the specifications.

PART 3 - EXECUTION

3.1 Final connections to fixture pigtails shall be made with approved pressure connectors such as 3M "Scotchlok".

3.2 Miscellaneous Equipment Connections

A. Various items of equipment such as a Veeder-Root etc. will be furnished by other trades. This Contractor shall furnish power wiring to these various items of equipment and connect them up complete and ready for operation.

B. Where disconnect switches are indicated or where otherwise required, these shall be mounted.

3.3 Miscellaneous Wiring and Interlocks

A. Various items of work in connection with interlocking motor and starter operations and providing wiring to serve equipment which is furnished by other trades.

B. Interlocks between fuel pump motors, controllers, and fuel emergency stop for purposes of accomplishing sequence control and operation of fuel delivery motors are all to be included by the Contractor. These interlocks consist of auxiliary contacts on the starter of the lead motor wired in, according to standard diagrams of the motor starter manufacturer to energize the holding coil of the starter for the motor. These interlocks shall be thru the "automatic" position only of the starter where HOA switches are supplied. This Contractor shall inquire of the Engineer during bidding, or at the earliest practical date, regarding any questions which may arise regarding the intention and scope of this work. This Contractor shall furnish extra contacts for their starters where required, in lieu of which they may furnish externally mounted relays to accomplish the specified function.

C. The following is a list of equipment and systems requiring wiring. Note that these are in addition to standard interlocks which are scheduled on the drawings.

1. Fuel Overfill - Interconnect existing fuel system overfill alarm lighting and audible alarm located at buildings exterior.
2. Raceways, sealoffs, cabling and termination for all Veeder-root probes, monitoring devices and outputs to devices.
3. High Water Alarm. Furnish a floor water alarm switch where shown and wire up through a 4 inch diameter alarm bell. Switch shall be "Water Alert" by Dorlen Products.

3.4 Wiring in Hazardous Locations

A. The areas serving the fuel tanks, fuel dispensing system and fuel islands where required by Code are to be considered hazardous locations. All work in these areas shall comply with

NEC 514, and any Veeder-Root fuel monitoring system requirements for installation, cabling types, system monitoring and system outputs.

B. All switches, outlet devices, fixtures and wiring to be installed in these areas shall comply with special requirements of the National Electric Code Article 500, 501, Class I, Division 1. Explosion proof devices shall be used throughout.

C. To avoid expense and to minimize the hazards, electrical work shall be so laid out and installed as to require only a minimum of wiring and outlets.

END OF SECTION

26 27 16 ELECTRICAL CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 Work includes all special cabinets and enclosures; equipment shall conform to requirements of N.E.C. and shall be UL labeled.

PART 2 - PRODUCTS

2.1 Indoor Cabinets - NEMA 1

A. Cabinets shall be galvanized code gauge steel, finished gray enamel or manufacturer's standard equivalent finish, of sizes shown with flush painted hinged door and master keyed cylinder locks keyed to match panelboard locks. Cabinets in finished areas shall be designed for flush mounting with separable front overlapping flange. Cabinets in concealed areas shall be surface mounted types.

B. Each cabinet shall be equipped with a 0.75 inch thick waterproof fir plywood backboard painted gray.

2.2 Outdoor Enclosure - Single Door - Small

A. The enclosure shall meet or exceed the requirements of a NEMA 3R or 4X rating and shall be UL listed.

B. The cabinet and door shall be constructed from 5052-H32 sheet aluminum alloy; 0.125 inch thick. The door opening shall be double flanged on all four sides.

C. The cabinet door shall be a minimum of 80 percent of the front surface area and shall be gasketed (UL 508 table 21.1) with weather tight seal between the cabinet and door.

D. The hinges shall be continuous and made of 0.063 inch stainless steel with 0.120 inch diameter stainless steel hinge pins.

E. The latching mechanism shall be a slam type with Corbin #R357SGS, or equal lock with keyhole cover for NEMA 3R enclosure; for NEMA Type 4X enclosure, the latch shall be weather tight quarter turn type. Furnish 2 keys with each lock.

F. Provide aluminum back panel 0.125 inch thick complete with all mounting hardware.

G. Cabinet finish shall be natural aluminum finish.

H. Cabinet mounting plates shall be located at bottom and top of enclosure for either in wall mounting or surface mounting.

PART 3 - EXECUTION

3.1 Mount the cabinets and enclosures as indicated on the drawings and in accordance with manufacturer's instructions.

3.2 Mount top of wall mounted cabinets 6 feet-0 inches above floor. Coordinate location of recessed cabinets so they are accessible and to avoid interference with other equipment and trades.

3.3 Refer to "Identification for Electrical System" Section for nameplate requirements.

END OF SECTION

26 27 26 WIRING DEVICES AND COVERPLATES

PART 1 - GENERAL

1.1 Wiring devices are identified on the drawings per legend symbols or as specifically noted. Receptacles are identified in the legend by NEMA configuration numbers only. Catalog numbers from acceptable manufacturers for the common wiring devices shall be as listed herein. Catalog numbers are not listed for all devices. Other devices, such as clock hanger outlets, etc. shall be furnished by one of the manufacturers listed and shall be equal in quality to the device series listed.

1.2 When shop drawings are required for wiring devices and coverplates, the submittal shall be comprehensive for all wiring device configurations listed in the legend and for devices specifically noted on the drawings.

PART 2 - PRODUCTS

2.1 Standard specification grade receptacles shall be listed by Underwriters Laboratories, Inc. and shall be minimum 20-ampere, 125 volt, NEMA configuration 5 20R and ivory (select color) in color unless noted otherwise. Where identified on drawing that receptacle is controlled a device of same design to be furnished but with controlled symbol marking.

Acceptable Manufacturer	Single	Duplex	Ground Fault	Isolated Ground	WR GFI	Tamper Resistant
Eaton	5351	5352	SGF20	IG5362	WRSGF20	TR5362
Bryant	5351	5352	GFRST20	BRY5362IG	GFWRST20	CBRS20TR
Hubbell	HBL5361	5352A	GFRST20	IG5352	GFFIWRST20	HBL5362TR
Leviton	T5020	5842	G5362WT	5362IG	G5362WT	TD63
Legrand	5351	CRB5362	2095	IG6300	2095TRWR	TR63

2.2 Receptacles installed in a damp or wet location shall be a listed weather-resistant (WR) type.

A. Receptacle shall be installed in a listed weatherproof enclosure, whether or not the attachable plug cap is inserted.

2.3 Provide GFCI devices as shown on drawings and in compliance with NEC 210.8 for type and location. Where GFCI receptacle devices not available at rating required a GFCI protection device to be provided. Bender Lifeguard series.

2.4 Provide a device plate to suit each particular application. Cover all empty outlet boxes with a blank plate. Coverplates shall be manufactured by Pass and Seymour, Hubbell, Cooper, Bryant, Leviton or Mulberry; Taymac is an acceptable manufacturer for weatherproof non-metallic coverplates Multi-Mac Series, “While-In-Use” type, 3.5 inches depth, ‘Extra Duty’, opaque grey, locking tab. Provide jumbo size plates for outlets installed in masonry walls.

2.5 In finished spaces, wall plates shall be nominal .032 inch thick, made of 302 high nickel stainless steel with brushed satin finish and beveled edges. Screws shall be metal with countersunk heads and finished to match plates. Sectional plates will not be permitted.

PART 3 - EXECUTION

3.1 Locate devices as shown on the drawings, coordinate exact location with other trades, to avoid interference. Check for potential interference from door swings, cabinets, heating equipment and other wall mounted devices.

3.2 Clean debris from outlet boxes.

3.3 Install receptacles with grounding pole on bottom.

3.4 Verify each receptacle device is energized and test each device for proper polarity.

3.5 Adjust devices and wall plates to be flush and level.

END OF SECTION

26 28 13 FUSES

PART 1 - GENERAL

1.1 Safety switches and other fusible protective devices provided under this contract shall be complete with fuses properly sized to protect the feeders and equipment served.

1.2 Fuses shall not be shipped installed in switches in electrical equipment nor shall they be shipped to the job site until the equipment is ready to be energized. Fuses shall be of the same manufacturer to retain selectivity as designed.

PART 2 - PRODUCTS

2.1 Manufacturers shall be Bussmann, Mersen, Littelfuse or Edison.

2.2 Fuses shall be current limiting with 200,000 amperes interrupting capacity, all shall be UL labeled.

2.3 Fuses, 601 ampere to 6,000 ampere (bolt type dimensions) shall be UL Class "L" fuses. The size and type is indicated on drawings; Bussmann HI CAP time delay fuse KRP C shall be used.

2.4 Fuses with ampere ratings 1 ampere to 600 ampere (standard dimensions) shall be UL Class RK 1. The size and type is indicated on drawings. Bussmann LOW PEAK Time Delay fuse LPN RK (250 volts) or LPS RK (600 volts).

2.5 H.I.D. ballasts shall be individually fused with type GLR fuses in an HLR fuseholder or Type KTK fuses in HEB waterproof fuse holder sized and installed by the fixture manufacturer, in addition to any internal ballast thermal protection. When ballast primary is phase to phase, both shall be fused.

2.6 Where Bussmann specific fuse types are indicated above or on the drawings, acceptable fuses by cross reference of manufacturers are:

Voltage UL Class	Ratings	Bussmann	Mersen	Littel Fuse	Edison
L	600 V	HI CAP KRP C	AMP TRAP A4BQ( )	POWR-PRO KLPC	LCL
RK 1		Low Peak	AMP TRAP II	POWR-PRO	
	250V	LPN RK	A2D ( ) R	LLN-RK	LEN-RK
	600V	LPS RK	A6D ( ) R	LLS-RK	LES-RK
J (Time Delay)	600V	LPJ ( )	AJT ( )	JTD ( )	JDL ( )

PART 3 - EXECUTION

3.1 Place a fuse identification label showing type and size inside door of each switch. Use fuse reducers where fuse gaps are larger than fuse dimension.

3.2 Verify fuse types before installation for proper application by voltage and ampere ratings; fuses protecting motors shall not exceed 150 percent of motor nameplate amps. (Applies to fuses in sizes 600 amps and below.)

3.3 Furnish the Owner with a minimum of 25 percent of quantity of each size installed, but not less than one complete set of three spare fuses for each size of fuse furnished.

END OF SECTION

26 28 16 DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 Provide disconnect switches, fused and non-fused, where indicated on the drawings and in the specifications, and where required by the NEC.

PART 2 - PRODUCTS

2.1 Disconnect switches shall be listed by Underwriter's Laboratories and shall be manufactured by Square D, Siemens, G.E. or Eaton. All starters and disconnect switches shall be of the same manufacturer unless otherwise approved.

2.2 Switches shall be Heavy-Duty Type, NEMA 1 enclosures, non-fused except where fuses are specified or required to protect wiring from overload; provide raintight NEMA 3R type enclosures for outdoor applications unless otherwise noted.

2.3 Disconnect switches shall be quick-make, quick-break, externally operated with door interlocked with operating handle. Provide solid neutral and ground bars where indicated or where required by the application.

2.4 Disconnect switches shall have multiple padlock provisions in the off position.

2.5 The fuse holders shall be designed for Class "R" rejection type fuses.

2.6 Refer to "Identification for Electrical Systems" Section for nameplate requirements.

PART 3 - EXECUTION

3.1 Mount top of wall mounted disconnect switch 6 ft.-0 inches above floor where space permits.

3.2 Coordinate location of disconnect switches to avoid interference with other equipment and trades and allow access for safe operation.

END OF SECTION

26 29 13 MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 Schedules on the drawings list motors with disconnect and starter requirements and associated controls. Motor starters and disconnects shall be furnished under this Contract except where specifically shown or specified to be furnished by other trades. Motor starters and disconnects shall be manufactured and rated in accordance with NEMA, UL and IEEE standards. IEC RATED CONTACTORS AND OVERLOADS ARE NOT ACCEPTABLE.

1.2 Refer to "Disconnect Switches" Section for switch requirements.

1.3 All motor starters shall be rated for the available fault current at the point of application.

PART 2 - PRODUCTS

2.1 Manufacturer Allen Bradley, whose catalog numbers are used herein as a standard, or equivalent by Square D Type S (Class 8536), G.E. Series CR306, Eaton Class AN16 or Siemens "U.S. Series". All starters and disconnect switches shall be of the same manufacturer unless otherwise approved.

2.2 Where new motor starters and disconnect switches are to be installed in existing motor control centers they shall match existing units.

2.3 Magnetic starters shall be line voltage suitable for the service listed on the drawings. Each starter shall have one extra auxiliary contact for future control purposes, a 3-leg melting alloy thermal overload relay on a single block, a manual reset mechanism, a 120-volt control coil, Bulletin 509. Contractor shall have the option of installing Bulletin 512 combination starters in place of separately mounted switches and starters. Disconnects shall be fused type unless otherwise specifically indicated or required by NEC.

2.4 A HAND-OFF-AUTO selector switch shall be mounted in the face of each starter enclosure. The selector switch shall be so wired that when it is in the HAND or AUTO position, all SAFETY controls are wired in series with the selector switch; all CONTROL DEVICES shall be wired in the AUTO position only.

2.5 Each starter enclosure shall have a suitable 120-volt secondary control transformer fused separately on each phase of the primary and secondary, and grounded on the secondary.

2.6 Each starter shall have a red LED pilot light mounted in the face of the starter enclosure. The LED shall be wired so it will be on when the motor is energized.

2.7 Magnetic starters shall be furnished for motors, one horsepower and greater or any 3-phase motor, unless indicated otherwise on plan.

2.8 Manual starters with thermal overload protection shall be furnished for fractional horsepower, single phase motors unless otherwise noted and shall be Bulletin 600 with a pilot light, flush mounted in finished areas.

2.9 Two speed starters shall be separate winding (two winding); Bulletin 715 with adjustable time delay on high to low speed. Contractor shall verify that starter being provided is proper for motor being furnished.

2.10 Unless otherwise noted or required by Code, safety switches shall be Heavy Duty Type, NEMA 1 enclosures, fused except where fuses are specified or required to protect wiring from overload.

Switches shall be quick make, quick break, externally operated with door interlocked with operating handle and padlock provisions in OFF position. Provide solid neutral and ground bars where required. Switches located outside shall be raintight NEMA 3R, unless otherwise noted.

PART 3 - EXECUTION

3.1 Check full load ampere and service factor rating of each motor after installed and furnish the proper size overload heater elements to protect the motor.

3.2 Those portions of interlock and control wiring which are required but not prewired, shall be done in the field.

3.3 Motor starters and disconnect switches shall be conveniently accessible; all NEC minimum clearances from walls, pipes, ducts, equipment, etc., shall be maintained. Locate as inconspicuously as possible in finished spaces.

3.4 Refer to "Identification for Electrical Systems" section for nameplate requirements.

3.5 Place label in each motor starter door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, voltage / phase, OL type and OL size.

END OF SECTION

SECTION 312000
EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, and pavements.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks and pavements.
6. Subbase course and base course for asphalt paving.
7. Subsurface drainage backfill for walls and trenches.
8. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:
1. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

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

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

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

1.4 PREINSTALLATION MEETINGS

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

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:

    a. Personnel and equipment needed to make progress and avoid delays.
    b. Coordination of Work with utility locator service.
    c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
    d. Extent of trenching by hand or with air spade.
    e. Field quality control.

1.5 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

1.6 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.7 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify Ohio 811**"**Call Before You Dig" for area where Project is located before beginning earth-moving operations.

D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

C. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294**/**D 2940M 0; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

D. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and zero to 5 percent passing a No. 8 (2.36-mm) sieve.

G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and zero to 5 percent passing a No. 4 (4.75-mm) sieve.

H. Sand: ASTM C 33/C 33M; fine aggregate.

I. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

2. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

    a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: **12 inches (300 mm) each side of pipe or conduit**.

C. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade **below the building slabs and pavements** with a pneumatic-tired **and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes)** to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction**, repeating proof-rolling in direction perpendicular to first direction**. Limit vehicle speed to 3 mph (5 km/h).
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

C. Place backfill around fuel tanks in accordance with manufacturers specifications.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill voids with satisfactory soil while removing shoring and bracing.

D. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of **satisfactory soil**, free of particles larger than **1 inch (25 mm)** in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

    a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Warning Tape: Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.

5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than **8 inches (200 mm)** in loose depth for material compacted by heavy compaction equipment and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to **ASTM D 1557**:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at **98** percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at **95** percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at **85** percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at **95** percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus **1 inch (25 mm)**.

2. Walks: Plus or minus **1 inch (25 mm)**.
3. Pavements: Plus or minus **1/2 inch (13 mm)**.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course[**and base course**] on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course **and base course** under pavements and walks as follows:
1. Place base course material over subbase course under hot-mix asphalt pavement.
2. Shape subbase course and base course to required crown elevations and cross-slope grades.
3. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
4. Place subbase course **and base course** that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
5. Compact subbase course **and base course** at optimum moisture content to required grades, lines, cross sections, and thickness to not less than [**95**] percent of maximum dry unit weight according to **ASTM D 1557**.

3.18 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
1. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
2. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
3. Compact each layer of drainage course to required cross sections and thicknesses to not less than **95** percent of maximum dry unit weight according to ASTM D 698.

3.19 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

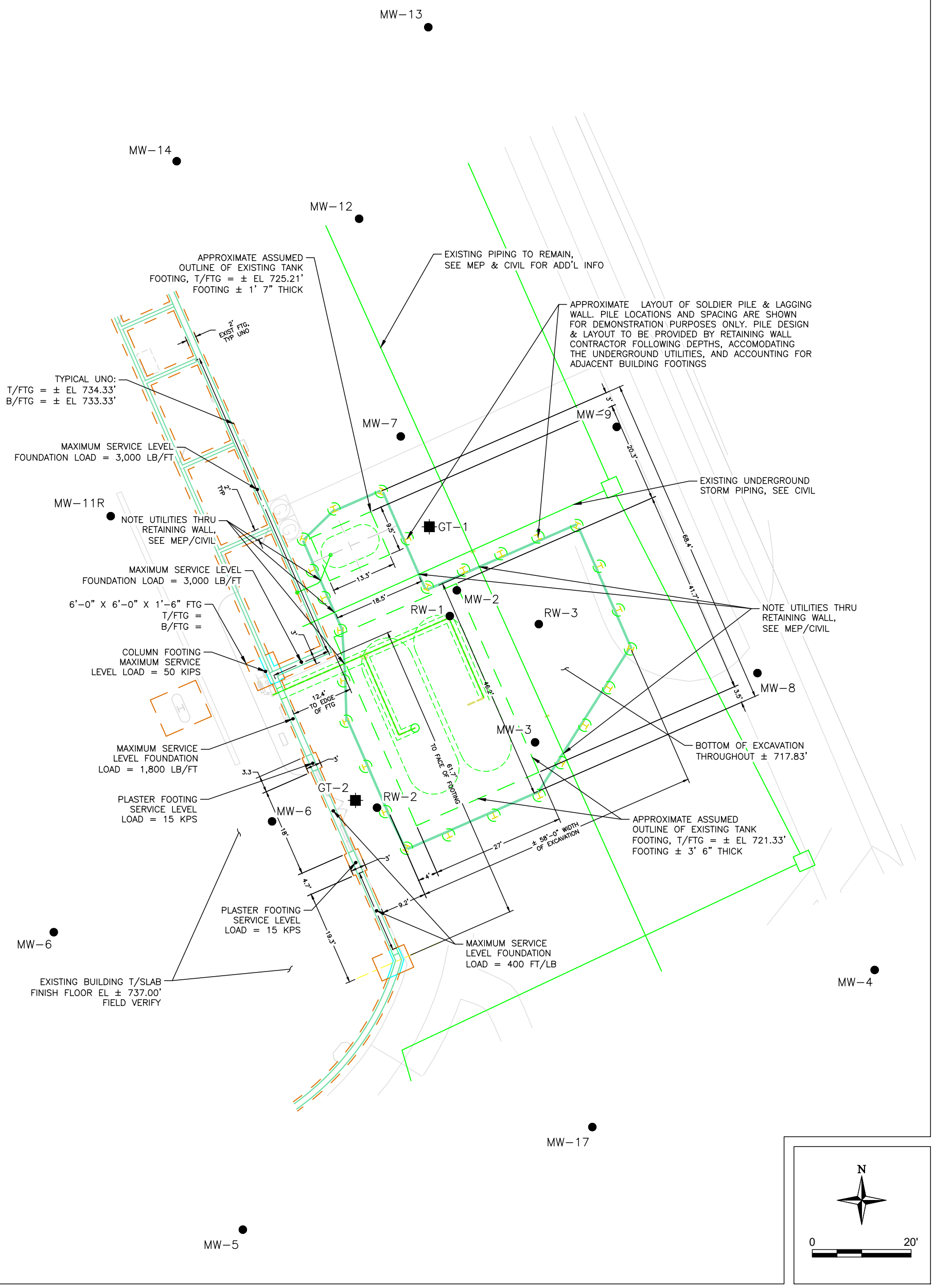
1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000



EXPLANATION

- ● MW–5 — MONITORING WELL AND DESIGNATION
- ■ SB–1 — GEOTECHNICAL BORING LOCATION

NOTE:

LOCATIONS AND SIZES OF EXISTING FEATURES HAVE BEEN DETERMINED FROM A REVIEW OF EXISTING DRAWINGS. REFER TO ENLARGED PLANS ON SHEET P100 FOR FURTHER DETAILS.

Trihydro CORPORATION
1252 Commerce Drive
Laramie, Wyoming 82070
www.trihydro.com
(P) 307/745.7474 (F) 307/745.7729

FIGURE 1

SITE MAP

GREATER DAYTON RTA BUS GARAGE
601 LONGWORTH STREET, DAYTON, OHIO

Drawn By: PME	Checked By: KB	Scale: 1" = 20'	Date: 5/13/22	File: 45D-601LWR_SITEPLAN

ECS Midwest, LLC
1125 Valley Belt Road
Brooklyn Heights, OH 44131
2167417007
2167417011

LETTER OF TRANSMITTAL

October 8, 2023

Trihydro Corporation

Cincinnati, OH 45241

ATTN: Kelly Birkenhauer, PG, CP

RE: **Trihydro - 601 Longworth RAP, Dayton, OH**
ECS Job # **67:3183**

Permits:
Location: **1125 Valley Belt Road**
Brooklyn Heights, OH 44131

X Field Reports X For your use X As requested

CC:

ENCL:

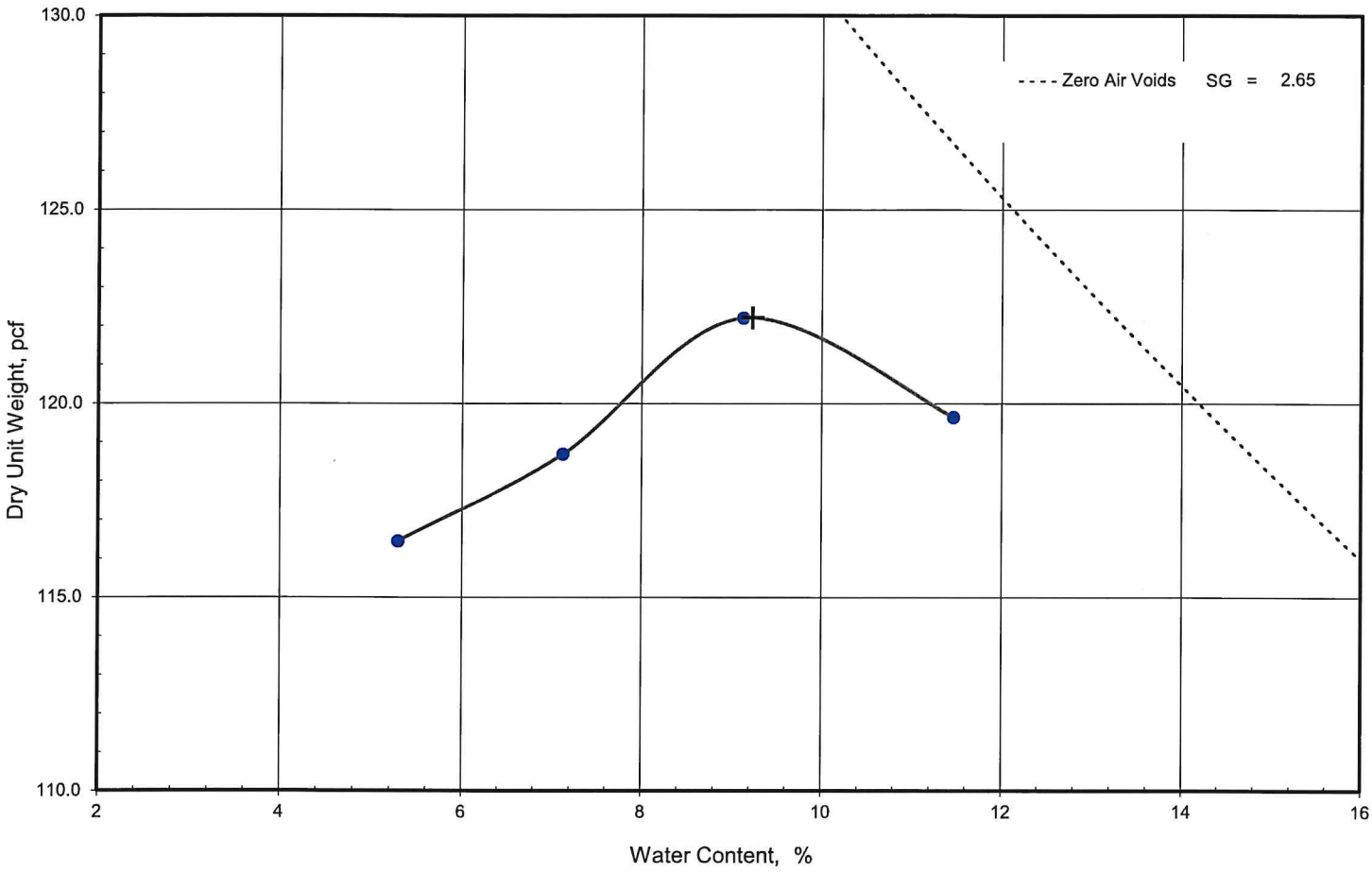
This is an automated report generated when Soils lab tests were approved for the current project's below-listed lab tests:

Sampled from GT-1 (3-5') / Sample D4S-1: Standard Proctor
Sampled from GT-1 (15-17') / Sample D4S-2: Standard Proctor
Sampled from GT-2 (3-5') / Sample D4S-3: Standard Proctor
Sampled from GT-2 (15-17') / Sample D4S-4: Standard Proctor

David Potoma, P.E.
Construction Materials Dept. Manager

Nicholas Jackson
CMT Project Coordinator

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content		**9.2**	%
Maximum Dry Unit Weight		**122.2**	pcf
Cumulative material retained on:	3/4 in. sieve	2.3	%
	3/8 in. sieve		%
	#4 sieve		%

Preparation		
Type of rammer		
Test Specfication / Method	ASTM D698-12e2-method B	
Specific gravity - D854 water pycnometer	2.65	Historical
Coarse Aggregate Specific Gravity -	2.61	Historical

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
Brown Sand, little gravel, trace silt.						

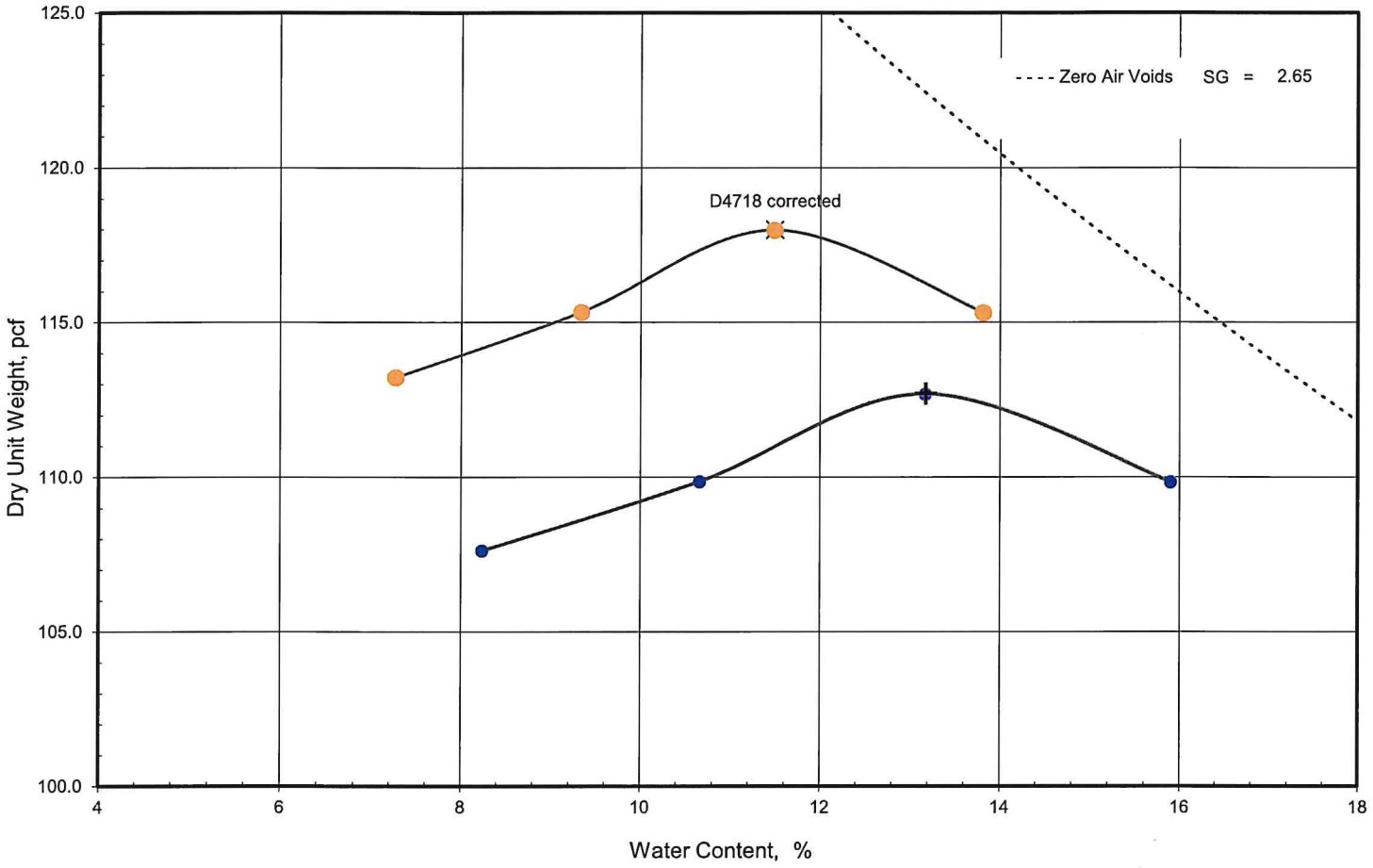
Project: Trihydro - 601 Longworth RAP, Dayton, OH
Client: Trihydro Corporation
Sample / Source GT-1 (15-17')
Test Reference/No.:

Project No.: 67:3183
Depth (ft.): 15 - 17
Sample No.: D4S-2
Date Reported: 10/6/2023

Office / Lab	Address	Office Number / Fax
ECS Midwest LLC - Cleveland	1125 Valley Belt Road Brooklyn Heights, OH 44131	(216)741-7007 (216)741-7011

Tested by	Checked by	Approved by	Date Received	Remarks
nmilkovich	nmilkovich	nmilkovich		

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content		**13.2**	%
Maximum Dry Unit Weight		**112.7**	pcf
Corrected Opt. Moisture Content		11.5	%
Corrected Max. Dry Density		118.0	pcf
Cumulative material retained on:	3/4 in. sieve	9.8	%
	3/8 in. sieve	14.8	%
	#4 sieve		%

14.76 % retained on 3/8 in. sieve.

Preparation		
Type of rammer		
Test Specfication / Method	ASTM D698-12e2-method B	
Specific gravity - D854 water pycnometer	2.65	Historical
Coarse Aggregate Specific Gravity -	2.61	Historical

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
Brown Silty Sand, little gravel, trace concrete, slag, brick, glass, organics.						

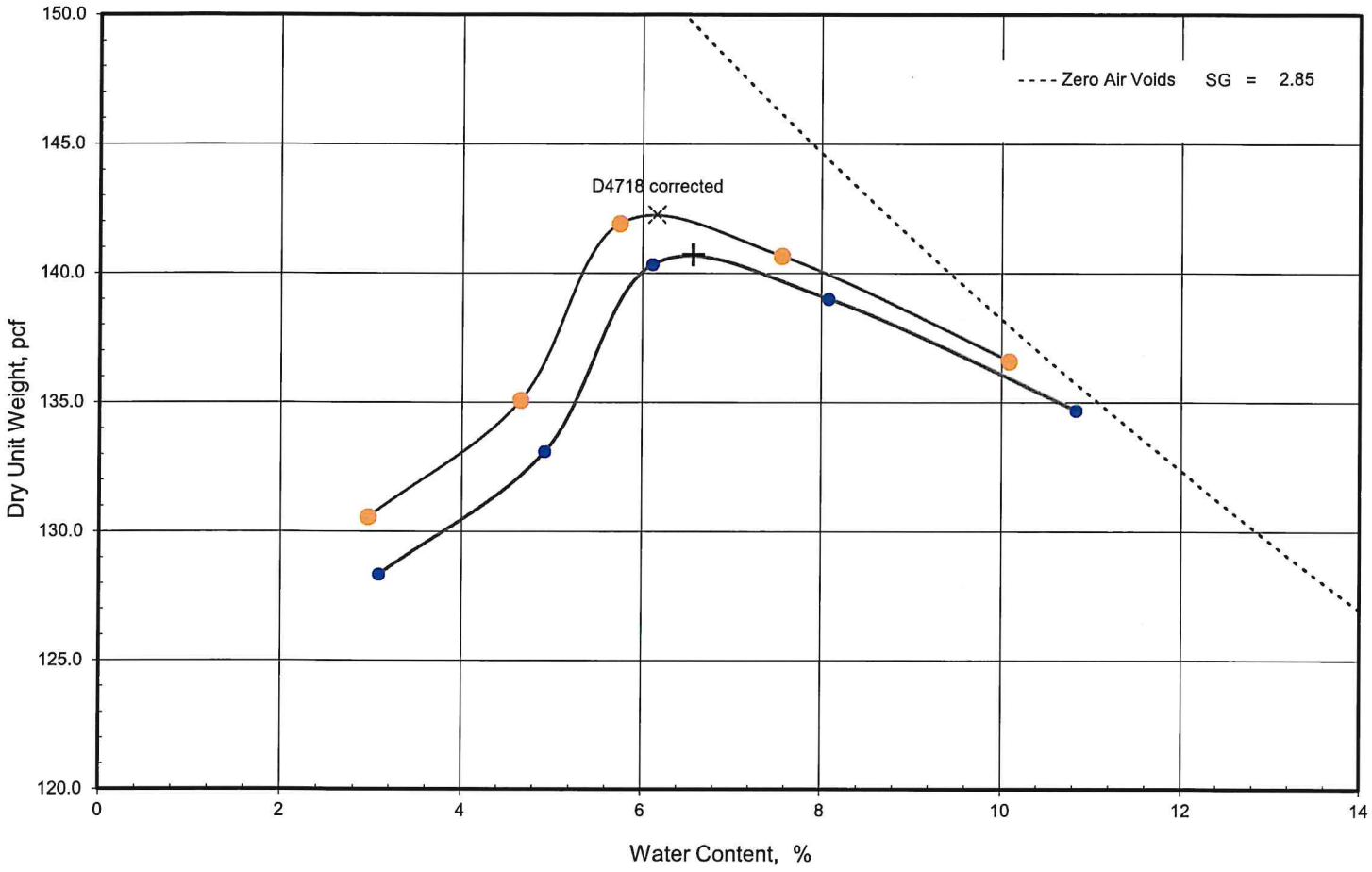
Project: Trihydro - 601 Longworth RAP, Dayton, OH
Client: Trihydro Corporation
Sample / Source GT-1 (3-5')
Test Reference/No.:

Project No.: 67:3183
Depth (ft.): 3 - 5
Sample No.: D4S-1
Date Reported: 10/6/2023

Office / Lab	Address	Office Number / Fax
ECS Midwest LLC - Cleveland	1125 Valley Belt Road Brooklyn Heights, OH 44131	(216)741-7007 (216)741-7011

Tested by	Checked by	Approved by	Date Received	Remarks
nmilkovich	nmilkovich	nmilkovich		

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content		**6.6**	%
Maximum Dry Unit Weight		**140.7**	pcf
Corrected Opt. Moisture Content		6.2	%
Corrected Max. Dry Density		142.3	pcf
Cumulative material retained on:	3/4 in. sieve	8.2	%
	3/8 in. sieve		%
	#4 sieve		%

8.17 % retained on 3/4 in. sieve.

Preparation		
Type of rammer		
Test Specfication / Method	ASTM D698-12e2-method C	
Specific gravity - D854 water pycnometer	2.85	Historical
Coarse Aggregate Specific Gravity -	2.61	Measured

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
Brown Gravelly Sand, trace silt.						

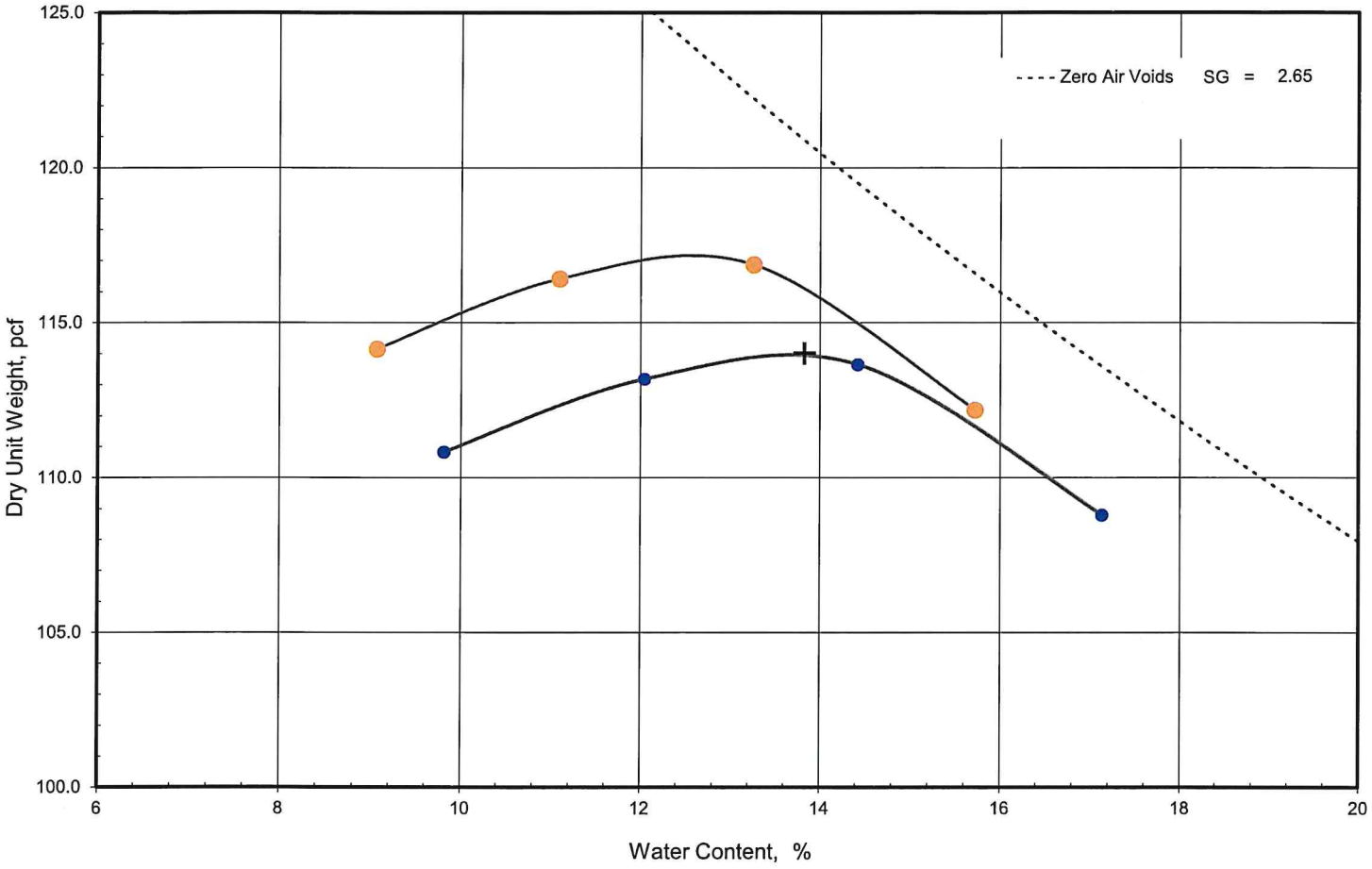
Project: Trihydro - 601 Longworth RAP, Dayton, OH
Client: Trihydro Corporation
Sample / Source GT-2 (15-17')
Test Reference/No.:

Project No.: 67:3183
Depth (ft.): 15 - 17
Sample No.: D4S-4
Date Reported: 10/6/2023

Office / Lab	Address	Office Number / Fax
ECS Midwest LLC - Cleveland	1125 Valley Belt Road Brooklyn Heights, OH 44131	(216)741-7007 (216)741-7011

Tested by	Checked by	Approved by	Date Received	Remarks
nmilkovich	nmilkovich	nmilkovich		

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content		**13.8**	%
Maximum Dry Unit Weight		**114.0**	pcf
		12.7	
		117.2	
Cumulative material retained on:	3/4 in. sieve	4.2	%
	3/8 in. sieve	9.2	%
	#4 sieve		%

9.22 % retained on 3/8 in. sieve.

Preparation		
Type of rammer		
Test Specfication / Method	ASTM D698-12e2-method B	
Specific gravity - D854 water pycnometer	2.65	Historical
Coarse Aggregate Specific Gravity -	2.61	Historical

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
Brown Silty Sand, little gravel, trace concrete, slag, brick.						

Project: Trihydro - 601 Longworth RAP, Dayton, OH
Client: Trihydro Corporation
Sample / Source GT-2 (3-5')
Test Reference/No.:

Project No.: 67:3183
Depth (ft.): 3 - 5
Sample No.: D4S-3
Date Reported: 10/6/2023

Office / Lab	Address	Office Number / Fax
ECS Midwest LLC - Cleveland	1125 Valley Belt Road Brooklyn Heights, OH 44131	(216)741-7007 (216)741-7011

Tested by	Checked by	Approved by	Date Received	Remarks
nmilkovich	nmilkovich	nmilkovich		

ECS Midwest, LLC
1125 Valley Belt Road
Brooklyn Heights, OH 44131
2167417007
2167417011

LETTER OF TRANSMITTAL

October 9, 2023

Trihydro Corporation

Cincinnati, OH 45241

ATTN: Kelly Birkenhauer, PG, CP

RE: **Trihydro - 601 Longworth RAP, Dayton, OH**
ECS Job # **67:3183**

Permits:
Location: **1125 Valley Belt Road**
Brooklyn Heights, OH 44131

X	Field Reports	**X**	For your use	**X**	As requested

CC:

ENCL: Field Report # 2 10/9/2023 Material Analysis

David Potoma, P.E.
Construction Materials Dept. Manager

Anthony Kichurchak
Assistant Office Manager

ECS Midwest, LLC
1125 Valley Belt Road
Brooklyn Heights, OH 44131
(216) 741-7007 [Phone]
(216) 741-7011 [Fax]

FIELD REPORT

Project No.	**67:3183**
Report No.	**2**
Day & Date	**Monday 10/9/2023**
Weather	**°/**
On-Site Time	**0.00**
Lab Time	**0.00**
Travel Time*	**0.00**
Total	**0.00**
Re Obs Time	**0.00**

Project	**Trihydro - 601 Longworth RAP, Dayton, OH**
Location	**Brooklyn Heights, OH**
Client	**Trihydro Corporation**
Contractor	**None Listed**

Remarks **Material Analysis**

Trip Charges*	Tolls/Parking*	Mileage*	Time of	Arrival	Departure
Chargeable Items				**8:00A**	**8:00A**

* Travel time and mileage will be billed in accordance with the contract.

Summary of Services Performed (field test data, locations, elevations & depths are estimates) & Individuals Contacted.

Please see the attached Material Analysis report of 4 soils samples that were delivered to ECS's lab on 09-27-2023.

By 1805

MATERIAL ANALYSIS

PROJECT:	TRIHYDRO – 601 LONGWORTH RAP – DAYTON, OH	**PROJECT NO.:**	3183
CLIENT:	TRIHYDRO CORPORATION 2702 EAST KEMPER ROAD CINCINNATI, OH 45241	**DATE:**	10/8/23

On September 27, 2023, four soil samples were delivered to our laboratory for material analyses. Following are the test results:

Sample	% Moisture (ASTM D1140)	Dry Density (pcf) (ASTM D7263)	Liquid Limit (ASTM D4318)	Plastic Limit (ASTM D4318)	Plasticity Index (ASTM D4318)
GT-1 3'-5'	31.9	79.5			Non-plastic
GT-1 15'-17'	9.2	120.5			Non-plastic
GT-2 3'-5'	18.8	109.3	26	19	7
GT-2 15'-17'	5.0	122.3			Non-plastic

If you have any questions, please do not hesitate to contact our office.

TECHNICIAN: DONALD HOLLENBAUGH