DEPARTMENT OF PUBLIC WORKS

DIVISION OF CIVIL ENGINEERING

INVITATION TO BID

MIAMI WELL FIELD EXPANSION PHASE 2
(5% MBE PARTICIPATION GOAL)

Electronic bids will be received by the Director, Department of Public Works, City of Dayton, Ohio until 12:00 o'clock NOON, Dayton time, **THURSDAY, JANUARY 22, 2026** for the following improvement in accord with the bidding documents available for download at www.questcdn.com using the QuestCDN eBidDoc Number for this project **#10000834**. Bids will **ONLY** be received and accepted via the online electronic bid service through www.QuestCDN.com. Bid results will be published and can be viewed on the QuestCDN project page using the project number listed above, shortly after the bids are received. Bid results will also be available on the City of Dayton website at www.daytonohio.gov/bids.aspx.

A pre-bid conference, for all Prime Contractors, will be held virtually at 11:00 o'clock am, Dayton time, Tuesday, January 13, 2026 . All meeting information for the virtual pre-bid will be available at www.questcdn.com using the QuestCDN eBidDoc Number for this project, **#10000834**.

Minority Business Enterprise (MBE) subcontract bidders on this project must be certified with the City of Dayton Human Relations Council as such.

The City of Dayton encourages all bidders to review the list of certified companies in our Procurement Enhancement Program at https://citybots.com/Home/Links (click the "Certification List" link under Procurement Enhancement Program). This Project is being bid with a **5% MBE** participation goal. A company must be certified as **MBE for the MBE goal** at the time of the bid opening and must be pre-qualified to perform the proposed subcontracted work. You are advised to obtain a copy of the company's certification letter and to review the Certification List. The participation must be submitted with your bid on the **"PEP-Certified MBE Participation Form (for the MBE goal)** provided by the City of Dayton Human Relations Council (HRC). Participation Forms must be completely filled out in accordance with the instructions listed on the forms. Any total or partial request for waiver of the **MBE** goal must be submitted on the enclosed **"PEP Participation Commitment and/or Waiver Request Form."**

CHANGES TO THE BID EVALUATION PROCESS

Each Bidder must submit an executed "PEP Participation Commitment and/or Waiver Request Form" to summarize the Bidder's overall PEP participation plan and/or to request a full or partial waiver of a PEP participation goal. For each PEP firm whose participation is being counted toward a goal, a Bidder must also submit one (1) executed "PEP-Certified SBE/MBE/WBE/DLSB Participation Form" describing the PEP firm's participation on the Base Bid and on Alternates. Participation will be evaluated based on the Base Bid plus Alternates as selected by the awarding department.

If unable to meet the project's PEP participation goal(s), a Bidder must submit a waiver request with its Bid. A Bidder must maintain supporting documentation of its Good Faith Efforts to meet the participation goal(s). If requesting a waiver, documentation of Good Faith Efforts must be submitted to the HRC within two (2) business days of the Bid Opening date. Bidders will receive no further reminders about this deadline.

A waiver will be granted based on a Bidder's Good Faith Efforts, and only when the HRC determines that a Bidder has completed all of the following activities:

1. **Solicited the interest of all PEP-Certified Firms having the capability to perform the work of the contract. The Bidder must solicit this interest at least ten (10) business days before the Bid Opening Date in order to allow the PEP-Certified Firm sufficient time to respond to the solicitation. Electronic communication will not be deemed as sufficient Good Faith Efforts, if it is the sole method of communication used.**

2. **Divided contract work items into economically feasible units to facilitate PEP participation, even when the Bidder/Proposer might otherwise prefer to perform these work items with its own forces.**
3. **Negotiated in good faith with PEP-Certified Firms and considered the firms' prices and capabilities as well as the contract goals. Rejected PEP-Certified Firms as being unqualified only for reasons based on a diligent investigation of their capabilities. The Bidder's standing within its industry; membership in specific groups, organizations, or associations; and political or social affiliations (for example, union vs. non-union employee status) are not legitimate causes to reject or not solicit bids from particular PEP-Certified Firms.**
4. **Provided interested PEP-Certified Firms with plans and specifications at no cost, or directed them to the Greater Dayton Minority Business Assistance Center (Dayton MBAC) for information about the project's plans, specifications, and requirements at least ten (10) business days prior to the Bid Opening Date in order to assist them in responding to a solicitation.**
5. **Sought the Dayton MBAC's assistance or used the services of community organizations; contractors' groups; local, state or federal business assistance offices; or similar organizations to find PEP-Certified Firms. Contacting the HRC for a list of certified companies will not be deemed as sufficient Good Faith Efforts.**

NOTE: In determining whether a Bidder has made Good Faith Efforts, the HRC may take into account the performance of other Bidders in meeting the goal(s). For example, when the apparent low bidder fails to meet a participation goal but others meet it, the HRC may reasonably raise the question of whether, with additional reasonable efforts, the apparent low bidder could have met the goal.

If you have questions regarding PEP participation or the waiver request process, please contact the Human Relations Council at (937) 333-1403.

Description of Improvement

Construction of four (4) infiltration ponds and associated piping, installation of water level monitoring equipment and valves, and the installation of any associated electrical, instrumentation, mechanical items.

Location

MIAMI WELL FIELD EXPANSION PHASE 2 (5% MBE PARTICIPATION GOAL)

Completion Date

December 31, 2027

CHARGE FOR PLANS & SPECIFICATIONS: $70.00
(NON-REFUNDABLE)

LEGAL NOTICE NO. 1

Electronic bids will be received by the Director of Public Works of the City of Dayton, State of Ohio, until 12:00 Noon, **THURSDAY, JANUARY 22, 2026** for the following improvement:

MIAMI WELL FIELD EXPANSION PHASE 2
(5% MBE PARTICIPATION GOAL)

Information and instructions to bidders may be obtained at the City Engineer's Office. Prospective bidders must be on the plan holders list through QuestCDN for bids to be accepted. Bidding documents for this project may be examined online or downloaded at: www.questcdn.com. The QuestCDN eBidDoc Number for this project is #**10000834**. There is a non-refundable fee of $70 for each set of bidding documents.

A pre-bid conference, for all Prime Contractors, will be held virtually at 11:00 o'clock am, Dayton time, Tuesday, January 13, 2026 . All meeting information for the virtual pre-bid will be available at www.questcdn.com using the QuestCDN eBidDoc Number for this project, **#10000834**.

Minority Business Enterprise (MBE) subcontract bidders on this project must be certified with the City of Dayton Human Relations Council as such.

The City of Dayton encourages all bidders to review the list of certified companies in our Procurement Enhancement Program at https://citybots.com/Home/Links (click the "Certification List" link under Procurement Enhancement Program). This Project is being bid with a **5% MBE** participation goal. A company must be certified as **MBE for the MBE goal** at the time of the bid opening and must be pre-qualified to perform the proposed subcontracted work. You are advised to obtain a copy of the company's certification letter and to review the Certification List. The participation must be submitted with your bid on the **"PEP-Certified MBE Participation Form (for the MBE goal)"** provided by the City of Dayton Human Relations Council (HRC). Participation Forms must be completely filled out in accordance with the instructions listed on the forms. Any total or partial request for waiver of the **MBE** goal must be submitted on the **enclosed "PEP Participation Commitment and/or Waiver Request Form."**

Thomas J. Ritchie, Jr., Director
Department of Public Works

Published in the Dayton Daily News on January 5, 2026 and January 12, 2026.

INSTRUCTIONS

Instructions for submitting a Bid are contained in the Invitation to Bid; the City of Dayton Construction and Material Specifications dated October 1, 2008, sections 103.01-103.43 and related modifications; the Amendments to the City of Dayton General Provisions; and any Addendum.

Electronic bids for the **MIAMI WELL FIELD EXPANSION PHASE 2 (5% MBE PARTICIPATION GOAL)** project will be received by the Director, Department of Public Works, until 12:00 o'clock NOON, Dayton time, on **THURSDAY, JANUARY 22, 2026**. Each bid shall be submitted using the QuestCDN vBid portal. Bidders must download the project bid document file from QuestCDN, which will add Bidders to the plan holders list and give Bidders access to vBid Online Bidding. No paper bids will be accepted for this project. There is a non-refundable fee of $70 to download the bid package and submit an electronic bid. Minority Business Enterprise (MBE) subcontract bidders on this project must be certified with the City of Dayton Human Relations Council as such.

A pre-bid conference, for all Prime Contractors, will be held virtually at 11:00 o'clock am, Dayton time, Tuesday, January 13, 2026 . All meeting information for the virtual pre-bid will be available at www.questcdn.com using the QuestCDN eBidDoc Number for this project, **#10000834**.

This project is being funded by the Bipartisan Infrastructure Law (BIL) through the Ohio EPA Water Supply Revolving Loan Account (WSRLA). This source of funding requires modifications to the Specifications and multiple forms to be submitted with the bid proposal. The requirements and forms are included within the Supplemental Specifications. The Ohio EPA has provided the document 'Construction-Contract-Guidance' for complete details and guidance. The document can be found here: **https://epa.ohio.gov/static/Portals/29/documents/ofa/Construction-Contract-Guidance.pdf.**

Minority Business Enterprise (MBE) subcontract bidders on this project must be certified with the City of Dayton Human Relations Council as such.

The City of Dayton encourages all bidders to review the list of certified companies in our Procurement Enhancement Program at https://citybots.com/Home/Links (click the "Certification List" link under Procurement Enhancement Program). This Project is being bid with a **5% MBE** participation goal. A company must be certified as **MBE for the MBE goal** at the time of the bid opening and must be pre-qualified to perform the proposed subcontracted work. You are advised to obtain a copy of the company's certification letter and to review the Certification List. The participation must be submitted with your bid on the **"PEP-Certified MBE Participation Form (for the MBE goal)"** provided by the City of Dayton Human Relations Council (HRC). Participation Forms must be completely filled out in accordance with the instructions listed on the forms. Any total or partial request for waiver of the **MBE** goal must be submitted on the enclosed **"PEP Participation Commitment and/or Waiver Request Form."**

CHANGES TO THE BID EVALUATION PROCESS

Each Bidder must submit an executed "PEP Participation Commitment and/or Waiver Request Form" to summarize the Bidder's overall PEP participation plan and/or to request a full or partial waiver of a PEP participation goal. For each PEP firm whose participation is being counted toward a goal, a Bidder must also submit one (1) executed "PEP-Certified SBE/MBE/WBE/DLSB Participation Form" describing the PEP firm's participation on the Base Bid and on Alternates. Participation will be evaluated based on the Base Bid plus Alternates as selected by the awarding department.

If unable to meet the project's PEP participation goal(s), a Bidder must submit a waiver request with its Bid. A Bidder must maintain supporting documentation of its Good Faith Efforts to meet the participation goal(s). If requesting a waiver, documentation of Good Faith Efforts must be submitted to the HRC within two (2) business days of the Bid Opening date. Bidders will receive no further reminders about this deadline.

The time of completion is December 31, 2027.

Please direct all technical questions to:

Liz Zelinski
Department of Water
Phone (937) 333-6134
Fax (937) 333-1826
E-mail liz.zelinski@daytonohio.gov

Each Bid shall be accompanied by a bond executed by a surety company authorized to do business in the State of Ohio for an amount of **at least ten percent (10%) of the amount of the bid submitted, including Alternates**, as a guarantee that if the bid is accepted, a Contract will be entered into and its performance properly secured.

NOTE: THIS PROJECT IS STATE OF OHIO SALES TAX EXEMPT
THIS PROJECT IS FEDERAL PREVAILING WAGE (DAVIS-BACON)

CITY OF DAYTON CMS MODIFICATIONS FOR ONLINE BIDDING

The City of Dayton Construction and Material Specifications are hereby modified by this Contract as follows:

100 GENERAL PROVISIONS

ITEM 101 ABBREVIATIONS

101 Abbreviations. The following abbreviations, when used in the Contract Documents, shall have the respective meaning shown below:

ANLA	American Nursery and Landscape Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
APWA	American Public Works Association
AREA	American Railway Engineering Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
AWG	American Wire Gauge
AWP	American Wood Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
CMS	Construction and Material Specifications of the Ohio Department of Transportation
DCE	District Construction Engineer
DDD	District Deputy Director
DET	District Engineer of Tests
DMA	Declaration Regarding Material Assistance/Non-Assistance to a Terrorist Organization
DNR	Department of Natural Resources
EEI	Edison Electric Institute
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration, Department of Transportation
FSS	Federal Specifications and Standards, General Services Administration
HRC	The Human Relations Council of the City of Dayton
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IMSA	International Municipal Signal Association
IPCEA	Insulated Power Cable Engineers Association
ISSA	International Slurry Seal Association
ITE	Institute of Transportation Engineers
JMF	Job Mix Formula
MSDS	Material Safety Data Sheet(s)

NCHRP	National Cooperative Highway Research Program
NEMA	National Electrical Manufacturers Association
NISTN	National Institute of Standards and Technology
NPDES	National Pollutant Discharge Elimination System
OAC	Ohio Administrative Code
ODOT	Ohio Department of Transportation
OMUTCD	Ohio Manual of Uniform Traffic Control Devices
ORC	Ohio Revised Code
ORDC	Ohio Rail Development Commission
OSHA	Occupational Safety and Health Administration
PCC	Portland Cement Concrete
RCGO	City of Dayton Revised Code of General Ordinances
REA	Rural Electrification Administration
SSP	Steel Structures Painting Council
STAR	State Treasurer's Asset Reserve
UL	Underwriters’ Laboratories, Inc.

ITEM 102 DEFINITIONS

102 Definitions. The following words or terms, when used in the Contract Documents, are defined to mean as follows:

Addendum or Addenda A written or graphic instruction issued prior to the Bid Deadline which clarifies, amends or interprets the Contract Documents.

Alternate A proposed change in the work described in the Contract Documents providing the City with an option to select between alternative materials, products or systems, or to add or delete portions of the Work.

Alternative Dispute Resolution A method of resolving disputes other than arbitration or litigation.

Approved Equal Article, device, material, Equipment, form of construction or other item proposed by the Bidder and approved by the Engineer for incorporation or use in the Work as being equivalent to essential attributes of a standard specified in the Contract Documents.

As-built Drawings Drawings or computer files revised and submitted by the Contractor to show changes made during the construction process.

Authorized Representative Unless otherwise specified in the Contract Documents, the City Manager of the City or any of the City Manager's duly authorized assistants or designees.

Base Bid The amount of money stated in a Bid as the sum for which the Bidder offers to perform the Work described in the Contract Documents, exclusive of adjustments for Alternates.

Bid The offer of a Bidder to perform the Work for the amount or amounts quoted, as applicable.

Bidder A Person who submits a Bid for a Contract with the City.

Bid Deadline The date and time established as the deadline for submission of Bids, either through the Electronic Bidding Service or as otherwise provided by the City, subject to modification by Addendum.

Bid Guaranty Bid Bond or other instrument of security furnished by the Bidder to provide assurance that the Bidder will execute the Contract Form.

Board of Review Committee consisting of the City Manager, City Attorney and Director of the Department of Public Works or any of their respective authorized assistants or designees.

Borrow Area A location from which natural materials are to be removed for use in the Work.

Bridge A Structure, including supports, erected over a depression or an obstruction, as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads and having a length measured along the center of the roadway of more than 10 feet between undercopings of abutments or extreme limits of openings for multiple boxes.

Length. The length of a Bridge Structure is the over all length measured along the center line of Roadway of the surface of the Roadway.

Roadway width. The clear width measured at right angles to the longitudinal centerline of the Bridge between the bottom of curbs or guard timbers or, in the case of multiple heights of curbs, between the bottoms of the lower risers. For curb widths of 1 foot or less, the Roadway width shall be measured between the parapets or railings.

Building Department The City's Department of Building Services.

Bulletin A document issued by the Engineer after the execution of the Contract Form requesting a Proposal from the Contractor which, if approved as provided in the Contract Documents, will cause the execution of a Change Order to modify, amend or alter the Contract Documents. The Bulletin becomes a part of the Contract Documents when a Change Order related to the Bulletin is executed by all applicable Persons.

Certificate of Contract Completion A document signed by the Contractor and the Engineer certifying that Contract Completion has occurred.

Certificate of Partial Occupancy or Use A document signed by the Contractor and the Engineer certifying that City has chosen to occupy or utilize the Project or a designated portion thereof in accordance with 105.03.

Certified Test Data A test report from a manufacturer's Laboratory or an independent Laboratory approved by the City listing actual test results of samples tested for compliance with specified City requirements. The City will accept Certified Test Data from a manufacturer's Laboratory if its products have been used satisfactorily on prior City Contracts and its test data has been confirmed. The Contractor shall include a statement that the test data furnished is representative of the material furnished to a City Project or to a supplier. The report shall contain a characteristic number or date and shall identify the City Project or supplier to which the material is shipped. All reports shall be signed by an individual having legal authority to act for the manufacturer's Laboratory or independent Laboratory, as applicable.

Change Order A document issued by the City after execution of the Contract Form, which authorizes a change in the Work or an adjustment or alteration in the Contract price or the time for Contract Completion. A Change Order which requires only use of contingency funds (a "Field Change Order") may be approved by the Engineer. A Change Order which increases the Contract price must be approved by the City Manager and/or City Commission.

City The City of Dayton, an Ohio municipal corporation.

Claim Affidavit A sworn document containing a claim on funds that are due to a Contractor, created by statute in favor of a Person supplying labor, materials or services for the value of labor, materials or services supplied.

Conduit Any pipe or similar passageway for electricity, gas, water, Sewer or other utility.

Construction Schedule The schedule for the construction of the Work showing the time for completion of the Work, the planned sequence for performing the Work, the Contractor's resource loading curve and the interrelationship of the Contractor's activities with the activities of other Contractors, if any, the Engineer, and the City.

Contingency Fund Moneys reserved by the City within the contract to pay costs resulting from Change Orders, unanticipated conditions, compliance with rulings on building or other codes, incompleteness or inaccuracy of Contract Documents and settlements on judgments related to the Project.

Contract The agreement between the City and the Contractor as set forth in the Contract Documents.

Contract Bond Performance and payment bond or bonds, as applicable, furnished by the Contractor and the Contractor's Surety to provide assurance that the Contractor will perform the Contract and make required payments.

Contract Completion The date upon which all deficiencies noted in the Punch List have been corrected, the Contractor's Work is one hundred percent complete, the as-built drawings have been approved by the Engineer, and the Contractor has complied with all conditions precedent to final payment and release of retainage. When the Contract Documents specify a date for Contract Completion, Contract Completion shall occur on or before the specified date, even if the specified date is a Saturday, Sunday or legal holiday. When the Contract Documents provide that Final Acceptance shall occur a specified number of consecutive days after the date for commencement of Work set forth in the Notice to Proceed, that period of time shall be the time for Contract Completion.

Contract Cost Breakdown A statement furnished by the Contractor to the City reflecting the portions of the Contract price allocated to the various portions of the Work and used as the basis for reviewing the Contractor's Payment Requests.

Contract Documents Collectively, the Plans, plan notes, standard construction Drawings identified in Plans, Specifications, supplemental Specifications, Addenda, definitions,

Legal Notice, instructions to Bidders, equal opportunity requirements, electronic Bid, Bidder's affidavit, non-collusion affidavit, Bid guaranty, Substitution sheet, Contract Form, Contract Bond or Bonds, as applicable, wage rates and Special Provisions, Change Orders and approved Working Drawings, if any.

Contract Form The form furnished by the City that, when completed and signed by the Contractor and the City, evidences the entry into the Contract.

Contractor A Person with whom the City has entered into a Contract for the performance of Work on the Project in cooperation with other Persons and in accordance with the Contract Documents.

Culvert Any Structure not classified as a Bridge that provides an opening under a Roadway.

Day Calendar day, i.e., every day of the year, unless otherwise expressly specified to mean a business day. A business day is any day other than a Saturday, Sunday or legal holiday.

Defective When modifying the word Work, refers to Work that does not conform to the Contract Documents, or does not meet the requirements of any applicable statute, rule or regulation, policy, inspection, reference standard, test or approval, or has been damaged prior to Final Acceptance, unless responsibility for the protection thereof has been expressly assumed by the City, or that is not free from defects in workmanship, material or Equipment during the period of a Guarantee.

Director The Director of the City Department under which the Project is being performed, or the duly authorized designee of the applicable Director.

Drawings See Plans.

Electronic Bidding Service The electronic service used by the City to disseminate bidding information and documents to Bidders and to receive Bids and related documents from Bidders.

Engineer Unless otherwise specified in the Contract Documents, the Engineer of the Department of Public Works, the Water Engineering Manager of the Department of Water of the City of Dayton or the Planning and Engineering Manager of the Department of Aviation under which the Project is being performed, or the duly authorized designee of the Engineer or Manager, as applicable.

Engineer's Estimate An estimate of cost for a Project or a Contract for a Project prepared by the Engineer prior to Bid Deadline.

Equipment All machinery and Equipment, together with the necessary supplies for upkeep and maintenance, tools and apparatus necessary for the construction of the Work.

Fabricator The Subcontractor that fabricates structural metals or prestressed concrete members.

Final Acceptance The City's acceptance of the Work from the Contractor upon approval by the Authorized Representative of the Certificate of Contract Completion.

Final Inspection Final review of the Work of the Contractor by the Engineer to determine whether certification of Contract Completion is appropriate.

Guarantee Legally enforceable assurance, for a period after Contract Completion, of quality or performance of the Contractor's workmanship, material and Equipment.

Inspector A Person assigned by the Engineer to make detailed inspections of the Work.

Laboratory The testing Laboratory designated by the City or determined in accordance with the Contract Documents.

Legal Notice The public announcement inviting Bids for Work.

Liquidated Damages The sum established in the Contract Documents as the predetermined measure of damages to be paid to the City due to the Contractor's failure to complete the Work, or portions thereof, within a stipulated time.

Maintenance Bond A bond furnished by the Contractor and the Contractor's Surety to provide assurance that the Contractor will perform the Guarantee.

Materials Any substances, supplies, products or other items specified or reasonably intended for use in the construction of the Project and its appurtenances.

Material Supplier A Person who furnishes materials for Work on the Project, in any tier.

Mathematically Unbalanced The lump sum amount or Unit Price in a Bid that does not include reasonably sufficient amounts for labor, material, Equipment, overhead and other applicable costs and profit.

Notice of Commencement The notice prepared by the City identifying the Project, the Contractor, the Surety for the Contractor and the name of the Person upon whom a Claim Affidavit may be served.

Notice of Intent to Award The notice provided to the apparently successful Bidder stating that upon satisfactory compliance with all conditions precedent for execution of the Contract Form, within the time specified, the City intends to execute a Contract Form with the Bidder.

Notice to Proceed A notice provided by the Engineer to the Contractor authorizing the Contractor to proceed with the Work and establishing the date for commencement of the Work.

Or Equal See Approved Equal.

Owner See City.

Partial Occupancy or Use The stage in the progress of the Work when the Project, or a designated portion thereof, is sufficiently complete in accordance with the Contract Documents so the City can occupy or utilize the Project, or the designated portion thereof, for its intended use, if the City chooses.

Payment Request The form furnished by the City that is to be used by the Contractor in requesting progress payments and which when signed by the Contractor shall serve as an affidavit that payment requests are in proportion to the Work completed as shown by the Contract Cost Breakdown and that payments previously paid by the City have been applied by the Contractor to discharge in full all of Contractor's obligations incurred in connection with the Work covered by all prior Payment Requests.

Pedestrian Bridge A Bridge designed and constructed to provide means of traverse for pedestrian traffic only; also known as a foot Bridge.

Permittee Any Person issued a permit by the City to perform Work in accordance with these Specifications in a street, alley, Public Way or place, but not having a Contract with the City.

Person An individual, corporation, business trust, estate, limited liability company, partnership, association or other entity, public or private.

Plans The graphic and pictorial portions of the Contract Documents, showing the design, type of construction, location, dimension and character of the Work to be provided by the Contractor, generally including Drawings, elevations, sections, details, schedules, diagrams, notes, and Specifications, in whole or in part.

Profile Grade The trace of a vertical plane intersecting the top surface of the proposed wearing surface, usually along the longitudinal center line of a Roadbed. Profile Grade means either elevation or gradient of such trace according to the context.

Project The improvement to be constructed, of which the Work performed under the Contract Documents may be the whole or a part.

Project Schedule The schedule for the construction of the Project showing the time for completing the Work, the planned sequence for performing the Work, the Contractor's resource loading curve and the interrelationship between the activities of the Contractor, other Contractors, the Engineer, and the City.

Proposal The offer of the Contractor to complete the Work set forth in a Bulletin.

Proposed Equal Article, device, material, Equipment, form of construction or other item proposed by the Bidder for incorporation or use in the Work as being equivalent to essential attributes of a standard specified in the Contract Documents.

Public Way (or Place) A street, road, walk, alley or path used for public travel.

Punch List A list of items of Work to be completed or corrected by the Contractor as a condition precedent to Contract Completion.

Record Drawings Drawings or computer files revised by the Engineer to show the changes made during the construction process, based on the As-built Drawings furnished by the Contractor to the Engineer.

Request for Information Written request from the Contractor to the Engineer seeking an interpretation or clarification of the Contract Documents.

Right-of-Way Land, property, or interest therein, usually in a strip, acquired for or devoted to a road and includes the Roadway, Shoulders or berm, ditch and slopes extending to the Right-of-Way limits under control of the City.

Road A Public Way for purposes of vehicular travel, including the entire area within the Right-of-Way.

Roadbed The graded portion of a road within top and slide slopes, prepared as foundation for the pavement Structure and Shoulder.

Roadside The areas between the outside edges of the Shoulders and Right-of-Way boundaries. Unpaved median areas between inside Shoulders of divided highways and infield areas of interchanges are included.

Roadside Development Those items necessary to the complete road that provide for the preservation of landscape materials and features; the rehabilitation and protection against erosion of all areas disturbed by construction through seeding, sodding, mulching and the placing of other ground covers; such suitable planting and other improvements as may increase the effectiveness and enhance the appearance of the road.

Roadway The portion of a road within the limits of construction.

Samples Physical examples furnished by the Contractor to illustrate materials, Equipment or workmanship and to establish criteria by which the Work will be judged.

Schedule of Values See Contract Cost Breakdown.

Sewer Pipe or Conduit intended for carrying storm drainage or sanitary drainage.

Shop Drawings Drawings, diagrams, illustrations, schedules, performance charts, brochures, catalog data and other data specially prepared or provided by the Contractor, a Subcontractor or Material Supplier to illustrate some portion of the Work.

Shoulder The portion of the road contiguous to the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

Sidewalk That portion of the road constructed for the use by pedestrians.

Special Provisions Amendments to the Specifications or supplemental Specifications, which describe conditions unique to a particular Project.

Specifications Those portions of the Contract Documents consisting of the detailed written requirements and standards for materials, Equipment, construction systems and workmanship as applied to the Work and certain procedural details applicable thereto.

Standards The items named in the Specifications to denote kind, quality or performance requirement for the Work. All Bids and Proposals shall be based on the Standards as set forth in the Specifications.

State The State of Ohio.

Street See road.

Structure Bridge, Culvert, catch basin, curb inlet, drop inlet, retaining wall, cribbing, manhole, endwall, building, curb, pavement, Sewer, water main, service pipe, underdrain, foundation drain, and any other features which may be encountered in the Work and not otherwise defined herein.

Subcontractor A Person who undertakes to perform any part of the Work on the Project under a Contract with any Person other than the City, in any tier.

Subgrade The portion of a Roadbed upon which the pavement structure and Shoulders are constructed.

Substitution An item proposed by the Bidder to be used instead of a standard, but not considered in determining the lowest and best Bidder.

Substructure The part of a structure below the bearings of simple and continuous spans, skewbacks of arches and tops of footings of rigid frames, together with backwalls and wings.

Superintendent The Contractor's Authorized Representative in charge of the Work.

Superstructure The entire structure except the Substructure.

Supplemental Specifications Detailed Specifications supplemental to or amending or superseding the Specifications.

Surety A Person providing a Bid guaranty, Contract Bond or Maintenance Bond to a Bidder or Contractor, as applicable, to indemnify the City against all direct and consequential damages suffered by failure of the Bidder to execute the Contract Form or of the Contractor to perform the Contract and to pay all lawful claims of Subcontractors, Material Suppliers and laborers or to perform the Guarantee, as applicable.

Unit Price An amount stated in the Bid as the price per unit of measurement for Materials or services described in the Contract Documents, which cost shall include overhead, profit and any other expense for the applicable Work.

Warranty Legally enforceable assurance for the specified duration from Final Acceptance of quality or performance of Materials or Equipment.

Waste Area A location in which natural Materials are to be deposited when not used in the Work.

Work The construction services required by the Contract Documents, to include all labor, Materials, Equipment, tools, transportation, supplies, incidental and services performed or provided by the Contractor for the Project.

Working Drawings Stress sheets, shop Drawings, erection Plans, false work Plans, framework Plans, cofferdam Plans, bending diagrams for reinforcing steel, or any other supplementary Plans or similar data which the Contractor is required to submit for acceptance.

ITEM 103 INSTRUCTION TO BIDDERS

103.01 Contract Completion and Critical Path Scheduling. Unless otherwise provided in the Contract Documents, the time for completion of the Project indicated on the Bid or Electronic Bidding Service shall be the time for Contract Completion applicable to the Bidders. Critical path scheduling methods shall be utilized, unless waived by the Authorized Representative in writing.

103.02 Delay Claims. The only delays for which the Bidder is entitled to additional compensation are those delays which the Bidder has established were proximately caused by an improper action or failure to act by the Owner.

103.03 Giving Notice. Whenever any provision of the Contract Documents requires the giving of notice prior to the execution of the Contract Form, such notice shall be deemed to have been validly given if delivered personally to the Person for whom the notice is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address of such Person known to the giver of the notice. All notices provided to the Bidder by the Engineer shall be copied to the Authorized Representative. All notices provided to the Engineer by the Bidder shall be copied to the Authorized Representative. All notices provided to the Authorized Representative by the Bidder shall be copied to the Engineer.

103.04 Examination of Contract Documents. Contract Documents are available through the Electronic Bidding Service. The Bidder shall examine all Contract Documents, including without limitation the Drawings and Specifications for all divisions of Work for the Project, noting particularly all requirements which will affect the Bidder's Work in any way prior to submitting the Bidder's Bid. Failure of a Bidder to be acquainted with the amount and nature of Work required to complete any of the Work, in conformity with all requirements of the Project as a whole wherever set forth in the Contract Documents or reasonably inferred therefrom, will not be considered as a basis for additional compensation.

103.05 Evaluation of Work Season and Project Site. The Bidder shall evaluate when the Work may be performed and examine and evaluate the Project site and related Project conditions where the Work will be performed prior to submitting the Bidder's Bid, including without limitation the following:

(a) The condition, layout and nature of the Project site and surrounding area, including Borrow Areas and Waste Areas, if any;

(b) The availability and cost of labor;

(c) The availability and cost of Materials, supplies and Equipment;

(d) The cost of temporary utilities required;

(e) The cost of any permit or license required by a local or regional authority having jurisdiction over the Project;

(f) The usual weather conditions;

(g) Conditions bearing upon transportation, disposal, handling, and storage of Materials and waste.

103.06 Subsurface and Concealed Physical Conditions. The Contractor may rely upon the general accuracy of the technical data contained in reports and drawings provided to the Contractor by the Owner and, except for such reliance on technical data, the Contractor shall not rely upon or make any claim against the City with respect to: (1) the completeness of such reports and drawings for the Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by the Contractor, and safety precautions and programs incident thereto; or (2) other data, interpretation, opinions, and information contained in such reports or shown or indicated in such drawings; or (3) any Contractor interpretation of or conclusion drawn from any technical data or any such other data, interpretations, opinions, or information. For example, all interpolations and extrapolations of data performed by the Contractor to estimate locations or quantities of subsurface strata are independent factual assumptions which the Owner does not warrant. Subject to the foregoing, if during the progress of the Work subsurface or concealed physical conditions are encountered at the site differing materially from those indicated in the Contract Documents, or if subsurface or concealed physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the Work provided for in the Contract Documents, are encountered at the site, the Contractor shall notify the Engineer of the specific differing conditions before they are disturbed or the affected Work is performed. Upon notification, the Engineer will investigate the conditions and if it is determined that the conditions materially differ and cause an increase or decrease in the cost or time required for the performance of any Work under the Contract, a Change Order may be issued in accordance with Item 117. The City may decline to issue a Change Order if the notice required by 117.11 is not timely provided by the Contractor. If the Contractor fails to timely provide the notice required by 117.11, the Contractor shall be deemed to have waived any and all claims for additional compensation or time extension for the related subsurface or concealed physical conditions.

103.07 Pre-Bid Meeting. All Bidders are required to attend the pre-Bid meeting, where the Engineer will answer questions regarding the Contract Documents. If not given in the Legal Notice, notice of the time and place of any pre-Bid meeting to be held will be given by the Engineer to each Person of record holding Contract Documents. A Bidder's failure to attend the pre-Bid meeting will result in his or her bid being rejected as non-responsive.

103.08 Request for Information or Clarification. If the Bidder finds any perceived ambiguity, conflict, error, omission or discrepancy on or between any of the Contract Documents, including without limitation the Drawings and Specifications, or between any Contract Documents and any applicable provision of law, the Bidder shall submit a written request to the Engineer for an interpretation or clarification. Such requests must be submitted to the Engineer at least seven Days before the Bid Deadline.

103.09 Interpretation or Clarification by Addendum. If the Engineer determines that an interpretation or clarification is warranted, the Engineer shall issue an Addendum through the Electronic Bidding Service. Any interpretation or clarification of the Contract Documents made by any Person other than the Engineer, or in any manner other than an Addendum issued through the Electronic Bidding Service, shall not be binding and the Bidder shall not rely upon any such interpretation or clarification. The Bidder shall not, at any time before or after the execution of the

Contract Form, be compensated for a claim alleging insufficient data, incomplete, ambiguous, conflicting or erroneous Contract Documents, any discrepancy on or between Contract Documents or incorrectly assumed conditions regarding the nature, extent or character of the Work, if no request for interpretation or clarification regarding such matter was made by the Bidder prior to the Bid Deadline in compliance with 103.08.

103.10 Standards. The articles, devices, Materials, Equipment, forms of construction, fixtures and other items named in the Specifications to denote kind, quality or performance requirement for each significant portion of the Work shall be known as Standards and all Bids shall be based upon those Standards. Where two or more Standards are named, the Bidder may furnish any one of those Standards. Items which are not Standards may be used only if accepted pursuant to the requirements of 103.11 and 103.12.

103.11 Proposed Equals. If the Bidder proposes to use an article, device, material, Equipment, form of construction, fixture or item other than those Standards named in the Specifications, the Bidder shall submit such a proposal to the Engineer, not later than ten Days prior to the Bid Deadline, certifying that the item is equal in quality, and in all aspects of performance and appearance, to the Standards specified. In addition, the Bidder shall submit information to the Engineer not later than ten Days prior to the Bid Deadline, which information shall include:

(a) The name and a complete description of the Proposed Equal, including Drawings, performance and test data, and other information necessary for a complete evaluation of the Proposed Equal;

(b) A statement setting forth any changes which the Proposed Equal will require in the Contract Documents or the Project.

103.12 Approval or Disapproval of Proposed Equals. If the Engineer, in the exercise of the Engineer's sole unfettered discretion, approves the Proposed Equal as a Standard, the Engineer shall issue an Addendum to that effect through the Electronic Bidding Service. If the Engineer does not approve the Proposed Equal as a Standard, the Engineer shall inform the Bidder of the disapproval in writing, no later than ninety-six hours prior to the Bid Deadline, excluding Saturdays, Sundays and legal holidays, which decision shall be final. The Engineer shall have the discretion to reject a Proposed Equal for any reason, including, but not limited to, the Bidder’s failure to provide sufficient information to enable the Engineer to completely evaluate the Proposed Equal without delaying the scheduled Bid Deadline.

103.13 Substitutions. If no Addendum is issued approving the Proposed Equal as a Standard, the Bidder may list the item on the Substitution sheet. A Bidder desiring consideration for the use of an article, device, material, Equipment, form of construction, fixture or item other than those Standards named in the Specifications shall submit a Proposal for the Substitution of same for the applicable standard, using the Substitution sheet provided in the Electronic Bidding Service and listing, for each proposed Substitution: the standard specified, the Substitution, and the change in Bid amount, (or indicate no change, if applicable). The name and a complete description including Drawings, performance and test data, and other information necessary for

a complete evaluation of each Substitution shall be furnished to the Engineer by the Bidder promptly upon request. Any Substitution accepted by the City must be incorporated in the Contract in writing. Substitutions shall not be considered in determining of the lowest and best Bid but may be considered in rejecting all Bids.

103.14 Electronic Bid. Each Bid shall contain the name of every Person interested therein and be submitted through the Electronic Bidding Service. Instructions for using the Electronic Bidding Service are available on the City's website. Failure to properly submit a Bid through the Electronic Bidding Service may cause a Bid to be rejected as nonresponsive. Unless the Bidder withdraws the Bid as provided in 103.31, the Bidder will be required to comply with all requirements of the Contract Documents, regardless of whether the Bidder had actual knowledge of the requirements and regardless of any statement or omission made by the Bidder which might indicate a contrary intention.

103.15 Alternates. When an Alternate is listed in the Electronic Bidding Service, the Bidder shall complete the applicable portion, indicating an amount which will increase or decrease the Base Bid. The City reserves the right to accept or reject any or all Bids on Alternates, in whole or in part, and the right to reject any Alternate or Alternates and to accept any remaining Alternate or Alternates. Alternates may be accepted or rejected in any order.

103.16 Submission of Bid. If the Bidder is a corporation, limited liability company, partnership or sole proprietorship, an officer, member, partner or principal of the Bidder, as applicable, shall submit and electronically sign the Bid through the Electronic Bidding Service. If the Bidder is a joint venture, an officer, member, partner or principal, as applicable, of each participant of the joint venture shall electronically sign the Bid on behalf of that participant, where applicable. By submitting a Bid, the Bidder warrants that it is not now, and will not become subject to an unresolved finding for recovery under Section 9.24 ORC, prior to the award of any Contract arising out of this Project, without notifying the City of such findings. Section 9.24, ORC prohibits the City from awarding a Contract to any Bidder against whom the Auditor of State has issued findings for recovery if the findings for recovery are unresolved at the time of award. The completed Bid submission of the Bidder with whom the City executes a Contract Form shall be incorporated into the Contract Form as if fully rewritten therein.

103.17 Submittals with Bid. Where indicated in the Electronic Bidding Service, the Bidder must download all documents that are shown as requiring a download and submit every document that is shown as requiring submission. A Bid shall be rejected if the Bidder fails to submit, or submits not fully complete, any document that is shown as requiring submission.

103.18 Unit Prices. When Unit Prices are requested in the Electronic Bidding Service, any scheduled quantities listed by the City are not binding upon the City and are to be used only for the comparison of Bids for purposes of determining the lowest and best Bidder and to determine the maximum quantity to be provided without a Change Order. If Unit Prices are stated to be sought only for informational purposes, they shall not be used for comparison of Bids. Unless otherwise specified in the Contract Documents, the Unit Prices and the totals or extensions thereof set forth shall include all Materials, Equipment, insurance, labor, delivery, installation, overhead, profit and any other cost or expense, in connection with or incidental to,

the performance of that portion of the Work to which the Unit Prices apply. The Bidder shall submit Unit Prices for all items listed unless other instructions are stated.

103.19 Changes to Unit Price Work. The Bidder agrees that the City may increase, decrease or delete entirely the scheduled quantities of Work to be done and Materials to be furnished after execution of the Contract Form without invalidating the Contract. Payments, except for lump sum items in Unit Price Contracts, will be made to the Contractor only for the actual quantities of Work performed or Materials furnished in accordance with the Contract Documents, but not in excess of the maximum set by the scheduled quantities. The Contractor must obtain a Change Order prior to performing Work or furnishing Materials in excess of the scheduled quantities in order to be compensated for the excess.

103.20 Change in Bid Amount. The Bidder may amend or withdraw its Bid through the Electronic Bidding Service at any time prior to the Bid Deadline.

103.21 Timely Submission of Bids. It is the responsibility of the Bidder to submit its Bid through the Electronic Bidding Service prior to the Bid Deadline. Bids arriving after the Bid Deadline shall not be considered.

103.22 Bid Letting. Bidders may submit Bids through the Electronic Bidding Service up to the Bid Deadline. At the Bid Deadline, all Bids will be tabulated and the tabulation made public. The public bid tabulation is for informational purposes only and is not to be construed as an acceptance or rejection of any Bid submitted. The electronic Bid submissions shall be a public record and open for inspection, upon request, at any time after the Bid Deadline, except for any information which is not subject to disclosure as provided by applicable law.

103.23 Bid Deadline Extension. If any Addendum is issued within Seventy-two hours prior to the published Bid Deadline, excluding Saturdays, Sundays and legal holidays, the Bid Deadline shall automatically be extended one week, with no further advertising required. If any Addendum is issued more than seventy-two hours prior to the published Bid Deadline, excluding Saturdays, Sundays, and legal holidays, the Bid Deadline may be revised by the Addendum, at the City's discretion.

103.24 Bid Evaluation Criteria. The City reserves the right to accept or reject any or all Bids, in whole or in part, and reserves the right to reject any Bid or Bids and to award the Contract to any remaining Bidder the City determines to be the lowest and best Bidder. The City reserves the right to accept or reject any or all Alternates, in whole or in part, and the right to reject any Alternate or Alternates and to accept any remaining Alternate or Alternates. Alternates may be accepted or rejected in any order. The City may reject the Bid of any Bidder who has engaged in collusive Bidding, been involved in violations of ethics laws or who has an unresolved finding against it by the Auditor of State as provided in Section 9.24, ORC, as not the lowest and best Bid. The City reserves the right to waive, or to allow any Bidder a reasonable opportunity to cure a minor irregularity or technical deficiency in a Bid, provided the irregularity or deficiency does not affect the Bid amount or otherwise give the Bidder a competitive advantage. Noncompliance with any requirements of the Contract Documents may cause a Bid to be rejected.

103.25 Bid Evaluation Procedures. The Contract will be awarded to the lowest and best Bidder as determined in the discretion of the City or all Bids will be rejected in accordance with the procedures set forth in 103.26 through 103.31.

103.26 Lowest Bidder. In determining which Bidder is the lowest, the City shall consider the Base Bid and any Alternate or Alternates which the City determines to accept. Substitutions shall not be considered. The total of the Bids for the accepted Alternate(s) shall be added to or deducted from the Base Bid, as applicable, for the purpose of determining the lowest Bidder. If the Project involves multiple Contracts, the City may also receive combined Bids for two or more Contracts, if provided in the Electronic Bidding Service, but no Contract for the entire job or for more than one Contract shall be awarded unless the separate Bids do not cover all the Work and Materials required or unless the combined Bid is lower than the applicable separate Bids in the aggregate. The City may also receive Bids for multiple Projects if provided in the Electronic Bidding Service.

103.27 Rejection of Bids. In addition to any other reason provided for in this Item, a Bid shall be rejected if:

(a) the Bid fails to respond to the Contract Documents in all material respects;

(b) the Bid contains irregularities or deviations from the Contract Documents which would affect the amount of the Bid or otherwise give the Bidder a competitive advantage;

(c) the Bid contains a Bid guaranty executed by a Surety not licensed in Ohio; or

(d) a Bid guaranty that is otherwise determined to be insufficient by the City.

In addition to any other reason provided for in this Item, a Bid may be rejected if:

(a) the Bid is Mathematically Unbalanced;

(b) the Bid does not contain an executed Non-collusion affidavit;

(c) the Bidder fails to furnish Samples and a complete statement of the origin, composition and manufacture of any or all Materials to be used for the Work, when so requested; or

(d) the Samples provided by the Bidder fail to demonstrate that Materials are of sufficient quality or fitness for the Work.

103.28 Best Bidder. In determining whether a Bidder is best, factors to be considered include, without limitation:

(a) Preferences required by law, where applicable;

(b) The experience of the Bidder;

(c) The financial condition of the Bidder;

(d) Compliance by the Bidder and related Persons with ethics laws and City ordinances and regulations, including without limitation submission of an affirmative action program in accordance with Section 35.16 R.C.G.O.;

(e) The conduct and performance of the Bidder on previous Bids and Contracts with the City or other owners, which shall include, without limitation, compliance with prevailing wage laws, Workers' compensation, income tax laws and equal opportunity requirements;

(f) The facilities of the Bidder, including without limitation machinery, plant and Equipment, as applicable;

(g) The management skills of the Bidder;

(h) The ability of the Bidder to execute the Contract properly, including whether the Bidder's existing workload may hinder or prevent timely completion of the Work;

(i) The ability of the Bidder to perform at least fifty-one percent of the Work with its own employees;

(j) The evaluation of a Bid below the median of other Bids pursuant to 103.37.

A Bidder who submits a Bid for Work for electrical, plumbing, hydronics, refrigeration or heating, ventilating and air conditioning shall provide evidence of a valid Contractor's license from the Ohio Construction Industry Licensing board or successor.

103.29 Information. A Bidder shall submit to the Engineer, upon request, any information the Authorized Representative deems appropriate to the consideration of factors showing that such Bidder's Bid is best, including without limitation the following:

(a) Overall experience of the Bidder, including number of years in business under present and former business names;

(b) Names and qualifications of key Bidder personnel;

(c) Complete listing of all ongoing and completed public and private construction Contracts of the Bidder in the last three years, including the nature, status and value of each Contract and a name, address, and phone number for a representative of the Owner of each related Project;

(d) Complete listing of any EPA, (OSHA) or other regulating entity issues or citations in the last ten years;

(e) Complete listing of all outstanding liens against the Bidder;

(f) Certified financial statement with trade and bank references;

(g) Description of relevant facilities of the Bidder;

(h) Description of the management experience of the Bidder's Project manager(s) and Superintendent(s); who will be assigned to the Project;

(i) Complete list of all Subcontractors and Material Suppliers;

(j) To support a Contract Bond, a current and signed certificate of compliance required under Section 9.311 ORC, issued by the Department of Insurance, showing the Surety is licensed to do business in Ohio;

(k) Current Ohio Workers' Compensation Certificate.

If the Bidder is a foreign corporation, i.e., not incorporated under the laws of Ohio, a certificate of good standing from the Secretary of State showing the right of the Bidder to do business in the State; or, if the Bidder is an individual or partnership, the Bidder has filed with the Secretary of State a Power of Attorney designating the Secretary of State as the Bidder's agent for the purpose of accepting service of summons in any action brought under Section 153.05, ORC, or under Sections 4123.01 through 4123.94, inclusive, ORC.

The Engineer may obtain such information from several Bidders simultaneously. Each Bidder shall provide requested information within such time limits as the Engineer shall establish.

103.30 Notice of Intent to Award. The City shall notify the apparent lowest and best Bidder that upon satisfactory compliance with all conditions precedent for execution of the Contract Form, within the time specified, the Bidder will be awarded the Contract. The City reserves the right to rescind any Notice of Intent to Award at any time prior to the execution of the Contract if the City determines the Notice of Intent to Award was issued in error.

103.31 Withdrawal of Bid. A Bidder may withdraw its Bid at any time prior to the Bid Deadline through the Electronic Bidding Service. All Bids submitted through the Electronic Bidding Service which were not withdrawn prior to the Bid Deadline shall remain valid and open for acceptance for a period of at least sixty Days after the Bid Deadline; provided, however that during that period a Bidder may withdraw a Bid from consideration if the Bid amount was substantially lower than the amounts of other Bids, providing the Bid was submitted in good faith, and the reason for the Bid amount being substantially lower was a clerical mistake, as opposed to a judgment mistake, and was actually due to an unintentional and substantial arithmetic error or an unintentional omission of a substantial quantity of Work, labor or material made directly in the compilation of the Bid amount. Notice of such a request to withdraw a Bid must be made in writing filed with the Authorized Representative within two business Days after the Bid Deadline. The City reserves the right to request that the Bidder submit evidence substantiating the Bidder's request to withdraw the Bid. No Bid may be withdrawn after the Bid Deadline when the result would be the awarding of the Contract on another Bid to the same Bidder. If a Bid is withdrawn after the Bid Deadline, the City may award the Contract to another Bidder that the City determines to be the lowest and best Bidder, or reject all Bids and advertise for other Bids. If the City advertises for other Bids, the withdrawing Bidder shall pay the costs incurred by the City in connection with the rebidding if the City finds that such costs would not have been incurred but for such withdrawal. A Bidder may withdraw its Bid at any time after the expiration of the described sixty Day period by written notice to the Authorized Representative.

103.32 Refusal to Accept Withdrawal. If the City intends to contest the right of the Bidder to withdraw a Bid after the Bid Deadline, a hearing shall be held by the Authorized Representative within ten Days after the Bid Deadline and an order shall be issued by the City allowing or denying the claim of such right within five Days after such hearing is concluded. The City shall give the withdrawing Bidder timely notice of the time and place of any such hearing. The City shall make a stenographic record of all testimony, other evidence, and rulings on the admissibility of evidence presented at the hearing. The Bidder shall pay the costs of the hearing. If the City denies the claim for withdrawal and the Bidder elects to litigate or otherwise refuses to perform the Contract, the City may reject all Bids or award the Contract to the next lowest and best Bidder, as determined by the City, without waiving any claims against the non-performing Bidder.

103.33 Effect of Withdrawal. No Bidder who is permitted to withdraw a Bid after the Bid Deadline shall for compensation supply any material or labor to, or perform any subcontract or other Work agreement for, the Person to whom the Contract is awarded or otherwise benefit, directly or indirectly, from the performance of the Project for which the withdrawn Bid was submitted, without the written approval of the City. The Person to whom the Contract is awarded and the withdrawing Bidder shall be jointly liable to the City in an amount equal to any compensation paid to or for the benefit of the withdrawing Bidder without such approval. A Bidder who is permitted to withdraw a Bid after Bid Deadline may be considered not the best for future City Contracts.

103.34 Bid Estimate. In no instance shall Contracts be let either as a whole, or in aggregate, if Bids for parts of the Work are taken, which exceed one hundred ten percent of the estimate for the improvement contemplated.

103.35 Review of Low Bid. The City may reject a Bid which is

(a) more than twenty percent below the median of all higher Bids received for a Contract where the estimate is one hundred thousand dollars or more; or

(b) more than twenty-five percent below the median of all higher Bids received for a Contract where the estimate is less than one hundred thousand dollars.

In determining whether to reject such a bid, the City may at its discretion, but is not required to:

(a) Conducts an interview with the Bidder to determine what, if anything has been overlooked in the Bid, and to analyze the process planned by the Bidder to complete the Work;

(b) Require the Bidder to submit to the City a certified financial statement and a list of recent public Contracts which the Bidder has performed; and/or

(c) Notify the Bidder's Surety in writing that the Bidder with whom the City intends to enter a Contract submitted a Bid determined to be substantially lower than the median of all higher Bids.

103.36 Bid Guaranty. The Bidder must file with the Bid a Bid guaranty, payable to the City of Dayton, in the form of the signed Bid guaranty and Contract Bond contained in the Contract Documents, for the full amount of the Base Bid plus add Alternates. The Bid guaranty shall be submitted through the Electronic Bidding Service. The Bid guaranty shall be in form and substance satisfactory to the City and shall serve as an assurance that the Bidder will, upon acceptance of the Bidder's Bid, comply with all conditions precedent for execution of the Contract Form and execute the Contract Form within the time specified by the City. ANY BID GUARANTY MUST BE PAYABLE TO THE CITY OF DAYTON. A Bid may be rejected if the Bid guaranty is payable to any other Person. IF THE BLANK LINES FOR THE AMOUNT ON THE BID GUARANTY AND CONTRACT BOND ARE NOT FILLED IN, THE PENAL SUM WILL AUTOMATICALLY BE THE FULL AMOUNT OF THE BASE BID PLUS ADD ALTERNATES. If those blank lines are filled in, the amount must not be less than the full amount of the Base Bid plus add Alternates, stated in dollars and cents. A PERCENTAGE IS NOT ACCEPTABLE. The Bid guaranty and Contract Bond must be signed by an authorized agent with Power of Attorney from a Surety. The Bid guaranty and Contract Bond must be issued by a Surety authorized by the Department of Insurance to transact business in Ohio. The requirements of Section 3905.41, ORC, may be applicable to require the Bid guaranty and Contract Bond be countersigned by an Ohio resident agent. The Bidder must determine whether this requirement is applicable to the Bidder's Surety. Bid guaranties will be returned to all unsuccessful Bidders seventy-five Days after the Bid Deadline or upon execution of the Contract Form by the apparently successful Bidder, whichever is earlier.

103.37 Bid Guaranty Forfeiture. If for any reason, other than as authorized by 103.31 or 103.38, the Bidder fails to execute the Contract Form, and the City awards the Contract to another Bidder which the City determines is the lowest and best Bidder, the Bidder who failed to execute the Contract Form shall be liable to the City for the difference between such Bidder's Bid and the Bid of the lowest and best Bidder, or for a penal sum not to exceed ten percent of the defaulting Bidder's Bid amount, whichever is less. If the City then awards a Contract to another Bidder which the City determines is the lowest and best Bidder and such Bidder also fails or refuses to execute the Contract Form, the liability of such lowest and best Bidder shall, except as provided in 103.38, be the amount of the difference between the Bid amounts of such lowest and best Bidder and another Bidder which the City determines is the lowest and best Bidder, but not in excess of the liability specified in 103.31. Liability on account of an award to each succeeding lowest and best Bidder shall be determined in like manner. If the City does not award the Contract to the another Bidder which the City determines is the lowest and best Bidder but resubmits the Project for Bidding, the Bidder failing to execute the Contract Form shall, except as provided in 103.38, be liable to the City for a penal sum not to exceed ten percent of such Bidder's Bid amount or the costs incurred by the City in connection with the rebidding, whichever is less.

103.38 Exception to Bid Guaranty Forfeiture. A Bidder with the City for a Contract with the City costing less than five hundred thousand dollars may withdraw a Bid from consideration if the Bidder's Bid for some other Contract with the State or any political subdivision, district, institution or agency thereof, excluding ODOT, costing less than five hundred thousand dollars has already been accepted, if the Bidder certifies in good faith that the total price of all such

Bidder's current Contracts is less than five hundred thousand dollars, and if the Bidder's Surety certifies in good faith that the Bidder is unable to perform the subsequent Contract because to perform such Contract would exceed the Bidder's Bonding capacity. If a Bid is withdrawn pursuant to 103.38, the City may award the Contract to another Bidder which the City determines is the lowest and best Bidder or reject all Bids and resubmit the Project for Bidding, and neither the withdrawing Bidder nor such Bidder's Surety shall be liable for the difference between the Bidder's Bid and that of another Bidder which the City determines is the lowest and best Bidder, for a penal sum, or for the costs incurred by the City in connection with the rebidding.

103.39 Contract Bond. If the Bidder executes the Contract Form, the Bidder shall, at the time of signing the Contract Form, provide the Contract Bond required by law in form and substance, and from a Surety, satisfactory to the City. The Contract Bond shall be in the full amount of the Contract to indemnify the City against all direct and consequential damages suffered by failure of the Contractor to perform according to the provisions of the Contract Documents and in accordance with the Plans, Specifications, details and bills of material therefore and to pay all lawful claims of Subcontractors, Material Suppliers, and laborers for labor performed or Materials furnished in carrying forward, performing or completing the Contract. A Contract Bond must be signed by an authorized agent with Power of Attorney from the Surety.

103.40 Personal Property Tax Statement. The successful Bidder shall provide a properly completed and executed affidavit in a form satisfactory to the City in order to fulfill the requirements of Section 5719.042 ORC, which provides as follows:

> After the award by a taxing district of any Contract let by competitive Bid and prior to the time the Contract is entered into, the Person making a Bid shall submit to the district's fiscal officer a statement affirmed under oath that the Person with whom the Contract is to be made was not charged at the time the Bid was submitted with any delinquent personal property taxes on the general tax list of personal property of any county in which the taxing district has territory or that such Person was charged with delinquent personal property taxes on any such tax list, in which case the statement shall also set forth the amount of such due and unpaid delinquent taxes and any due and unpaid penalties and interest thereon. If the statement indicates that the taxpayer was charged with any such taxes, a copy of the statement shall be transmitted by the fiscal officer to the county treasurer within thirty Days of the date it is submitted.
>
> A copy of the statement shall also be incorporated into the Contract, and no payment shall be made with respect to any Contract to which 103.40 applies unless such statement has been so incorporated as a part thereof.

103.41 Conditions Precedent for Execution of Contract Form by City. The award of the Contract and the execution of the Contract Form are based upon the expectation that the lowest and best Bidder will execute the Contract Form and comply with all conditions precedent for execution of the Contract Form within ten Days of the date of the issuance of the Notice of Intent to Award. Failure to execute the Contract Form or noncompliance with the conditions precedent for execution of the Contract Form within ten Days of the date of the issuance of the Notice of Intent to Award shall be cause permitting the City to cancel the Notice of Intent to Award for the Bidder's failure to be best, and to award the Contract to another Bidder which the City determines is the lowest and best Bidder or to resubmit the Contract for Bidding, at the discretion

of the City. The City may extend the time for submitting the conditions precedent for execution of the Contract Form for good cause shown. No extension shall operate as a waiver of the conditions precedent for execution of the Contract Form. The conditions precedent for execution of the Contract Form by the City are as follows:

(a) Contract Form;

(b) Contract Bond and to support the Contract Bond, a power of attorney for any attorney-in-fact signing the Contract Bond and a certificate of compliance issued by the Ohio Department of Insurance showing the Surety is licensed to do business in Ohio;

(c) Ohio Workers' Compensation Certificate;

(d) Certificate of Insurance (ACORD form is acceptable) clearly setting forth all exclusions and deductibles and copy of additional insured or loss payee endorsement. The City reserves the right to request a certified copy of the Contractor's insurance policies, including all endorsements.

(e) If the Bidder is a foreign corporation, i.e., not incorporated under the laws of Ohio, a Certificate of good standing from the Secretary of State showing the right of the Bidder to do business in the State will be required. If the Bidder is an individual or partnership, the Bidder has filed with the Secretary of State a Power of Attorney designating the Secretary of State as the Bidder's agent for the purpose of accepting service of summons in any action brought under Section 153.05 ORC, or under Sections 4123.01 through 4123.94, inclusive, ORC.

(f) Personal property Tax Statement; and

(g) Evidence of registration of the Contractor and all of the Contractor's Subcontractors with the Building Department and the City's Department of Finance, Division of Revenue and Taxation.

(h) Material Declaration of Assistance/Non-Assistance to Terrorist Organization, when required.

(i) If requested by the City, the Bidder shall immediately submit evidence that the Person signing the Contract is authorized to bind the Bidder.

103.42 Time Limits. A Contract Form is not executed until it has been signed on behalf of both the Bidder and the City by Persons authorized to bind the Bidder and the City, respectively. The failure to award the Contract and to execute the Contract Form within ninety Days of the Bid Deadline invalidates the entire Bid process and all Bids submitted, unless the time is extended by written consent of the apparent lowest and best Bidder and the City concurs with such extension. If the Contract is awarded and the Contract Form is executed within ninety Days of the Bid Deadline, any increases in material, labor and subcontract costs shall be borne by the Bidder without alteration of the amount of the Bid. If the cause of the failure to execute the Contract within ninety Days of the Bid Deadline is due to matters for which the City is solely responsible, the Contractor shall be entitled to a Change Order authorizing payment of verifiable increased costs in Materials, labor or subcontracts. If the cause of the failure to execute the

Contract within ninety Days of the Bid Deadline is due to matters for which the Contractor is responsible, no request for increased costs will be granted.

103.43 Notice to Proceed and Submittals. The Authorized Representative shall issue the Contractor a Notice to Proceed which shall establish the date for commencement of the time for Contract Completion. The Contractor shall, within ten Days of the date of the Notice to Proceed, furnish the Engineer the following submittals:

(a) Contract Cost Breakdown;

(b) Preliminary schedule including shop Drawings and submittals;

(c) List of Subcontractors;

(d) List of Material Suppliers;

(e) Outline of qualifications of proposed Superintendent.

103.44 Wage Rates and Payment Dates. The Bidder shall base its Bid upon the prevailing rates of wages as ascertained by the Ohio Department of Commerce, Division of Labor & Worker Safety, Wage and Hour bureau or the U.S. Department of Labor, as applicable, for the Project as provided in Sections 4115.03 and 4115.14, ORC, or the Davis-Bacon Act, respectively. The Contractor shall, within ten Days of the date of the Notice to Proceed, provide to the Engineer for the prevailing Wage Coordinator a schedule of dates during the term of the Contract on which wages will be paid to employees for the Project.

103.45 Written Submissions in lieu of Electronic Bidding Service. Where a Bidder is required by a provision in this Item 103 to make a submission through the Electronic Bidding Service, such submission may be made in paper form only upon prior written authorization from the Engineer. The determination whether to grant such prior written authorization is left to the Engineer and may be exercised by the Engineer's sole unfettered discretion. Submissions outside the Electronic Bidding Service without such prior written authorization may result in a determination that the Bid is non-responsive.

ITEM 104 GENERAL REQUIREMENTS

104.01 Contract Documents. The Contractor, the Engineer and the Authorized Representative shall be familiar with all provisions of the Contract Documents.

104.02 Applicable Law and ODOT Matters. The Contractor and the City shall comply with all applicable Federal, State and local codes, statutes, ordinances and regulations in the performance of the Work on the Project. When the Federal government or the State pays all or any portion of the cost of the Project, the Work shall be subject to the inspection of the appropriate federal or State agency. No such inspection shall make the Federal government or State a party to the Contract and will in no way affect the rights and obligations of the City and the Contractor under the Contract. Any such inspection is solely for the benefit of the City and the Federal or State agency making it, and neither the Contractor nor the Surety shall be entitled to rely upon it for any purpose. References to ODOT matters shall be as set forth in the CMS current as of the Bid Deadline. In such instances, the CMS is incorporated only to the extent that it is not inconsistent with the Specifications.

104.03 Jurisdiction. The Montgomery County Court of Common Pleas, or the United States District Court for the Southern District of Ohio if required by law, shall be the exclusive jurisdiction in which any action or proceeding concerning any Bid, Contract, agreement or performance under the Contract Documents or in connection with the Project shall be filed. In any such action or proceeding the Contract Documents shall be construed in accordance with the laws of the State which shall govern to the exclusion of the law of any other jurisdiction.

104.04 Assignment of Antitrust Claims. By executing the Contract Form, the Contractor assigns, conveys and transfers to the City any right, title and interest to any claims or

causes of action it may have or acquire under State or Federal antitrust laws relating to any goods, products, or services purchased, procured or rendered to the City pursuant to the Contract.

104.05 Captions. Captions throughout the Contract Documents are for convenience and reference only and the words contained in a caption shall in no way be held to explain, modify, amplify or aid in the interpretation, construction or meaning of the provisions of the Contract Documents. Rights and responsibilities of the Contractor, the Engineer and the City are set forth throughout the Contract Documents and are included under different titles, articles and paragraphs for convenience.

104.06 Nondiscrimination Generally. During the performance of the Contract, the Contractor agrees that in the hiring of employees for the performance of Work, including without limitation Work to be performed by a Subcontractor, no Contractor or Subcontractor, and no Person acting on behalf of the Contractor or Subcontractor, shall, by reason of race, religion, national origin, age, sex, disability, or color, discriminate against any citizen in the employment of labor or workers who are qualified and available to perform the Work to which the employment relates. The Contractor further agrees that no Contractor or Subcontractor, and no Person acting on behalf of the Contractor or Subcontractor, shall, in any manner, discriminate against or intimidate any employee hired for the performance of Work on account of race, religion, national origin, age, sex, disability, or color. In the event of the Contractor's noncompliance with the nondiscrimination clauses, the contract may be terminated or suspended in whole or in part, and the Contractor may be declared ineligible for further City Contracts or such other sanctions as provided by law. Any provision of a hiring hall Contract or agreement which obligates a Contractor to hire, if available, only such employees as are referred to the Contractor by a labor organization shall be void as against public policy and unenforceable with respect to employment under any public improvement Contract unless, at the date of execution of such hiring hall Contract or agreement, or within thirty Days thereafter, such labor organization has in effect procedures for referring qualified employees for hire without regard to race, color, religion, national origin, or ancestry and unless such labor organization includes in its apprentice and journeymen membership, or otherwise has available for job referral without discrimination, qualified employees.

104.07 City's Nondiscrimination Requirements. The Contractor shall comply with RCGO, Section 35.14 which provides as follows and any amendments thereto:

> (A) The [Contractor] shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, ancestry, national origin, place of birth, age, marital status, or handicap. The [Contractor] shall take affirmative action in accordance with terms outlined in its [Proposal] and the provisions of this [Contract] to insure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, sexual orientation, gender identity, ancestry, national origin, place of birth, age, marital status, or handicap. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The [Contractor] agrees to post in conspicuous places, available to employees and applicants, notices to be provided by the [City] setting forth the provisions of the nondiscrimination clauses.

(B) The [Contractor] shall in all solicitations or advertisements for employees placed by or on behalf of the [Contractor], state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, ancestry, national origin, place of birth, age, marital status, or handicap.

(C) The [Contractor] shall send to each labor union or representative of workers with which [the Contractor] has a collective bargaining agreement or other contract or understanding, a notice to be provided by the [City] advising the labor union or workers' representative of the [Contractor's] commitments, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(D) The [Contractor] shall comply with all rules, regulations, and relevant orders promulgated by the Human Relations council pursuant to its duties created by ordinance.

(E) The [Contractor] shall file, and shall cause each of [the Subcontractors and Material Suppliers] to file, compliance reports with the Human Relations Council as may be directed. Compliance reports shall be filed within such times and shall contain such information as to the practices, policies, programs, and employment policies, programs and employment statistics of the [Contractor, Material Supplier, or Subcontractor] and shall be in such form as the Human Relations Council may prescribe.

(F) The [Contractor] shall furnish all information and reports required by this [Contract] and by the rules, regulations, and orders of the Human Relations Council pursuant hereto, and shall permit reasonable access to the [Contractor's] books, records, and accounts by the Human Relations Council or its representative, as necessary for purposes of investigation to ascertain compliance with this [Contract] and rules, regulations and orders.

(G) In the event of the [Contractor's] failure to comply with the equal employment opportunity and affirmative action provisions of this [Contract], including the affirmative action undertaking outlined in it is [Proposal], or with any of the rules, regulations, or orders herein referred to, it is agreed that the [City], at its option, may do any or all of the following:

(1) Cancel, terminate, or suspend this [Contract], in whole or in part [...].

(2) Declare the [Contractor] ineligible for further [City Contracts].

(3) Recover from the [Contractor] by set-off against the unpaid portion of the [Contract], or otherwise pursuant to this [Contract], the sum of fifty dollars per [Day], as [Liquidated Damages] and not as a penalty, for each [Day] that the [Contractor] shall fail to comply with these provisions of the [Contract], as determined by the Human Relations Council in accordance with its rules and regulations, the said sum being fixed and agreed upon by and between the [Contractor] and the [City] because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages which the [City] would sustain in the event of such a breach of contract, and that amount is agreed to be the amount of damages which the [City] would sustain.

(4) Impose such other sanctions as may be imposed by the Human Relations Council pursuant to ordinances passed by the Commission, or seek such other remedies as may be provided by law.

(H) The [Contractor] shall include the provisions of this [Contract] in every subcontract, so that such provisions shall be binding upon each [Subcontractor]. The [Contractor] shall take such action with respect to any subcontracts as the Human Relations Council may direct as means of enforcing such provisions, including sanctions for noncompliance. However, in the event the [Contractor] becomes involved in, or is threatened with litigation with a [Subcontractor] as a result of such direction by the Human Relations Council, the [Contractor] may request the City to enter into such litigation to protect the interests of the City.

104.08 Notice of Commencement. The Authorized Representative shall prepare a Notice of Commencement in affidavit form identifying the name and address of the City, the Project, the name, address of the Contractor, the date of execution of the Contract, and the name and address of the Surety for the Contractor, in addition to the name and address of the Authorized Representative upon whom a Claim Affidavit may be served. The Notice of Commencement shall be made available upon request.

104.09 Giving Notice. Whenever any provision of the Contract Documents requires the giving of any notice after the execution of the Contract Form, such notice shall be deemed to have been validly given if delivered personally to the Person for whom the notice is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address of such Person known to the giver of the notice. All notices provided to the Contractor by the Engineer shall be copied to the Authorized Representative. All notices provided to the Engineer by the Contractor shall be copied to the Authorized Representative. All notices provided to the Authorized Representative by the Contractor shall be copied to the Engineer.

104.10 Computation of Time. When any period of time is referred to in the Contract Documents by Days, it shall be computed to exclude the first and include the last Day of such period. If the last Day of any such period falls on a Saturday, Sunday or a legal holiday, such day will be omitted from the computation and such period shall be deemed to end on the next succeeding day which is not a Saturday, Sunday or legal holiday.

104.11 Facsimile Transmission and Electronic Mail. Any notice required to be given by the Contract Documents may be given by facsimile transmission or electronic mail, provided the original signed notice is delivered within two Days after the date of the facsimile transmission or electronic mail. Facsimile transmittals in excess of 10 pages are discouraged.

104.12 Intent. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all. The Contractor shall provide all labor, Equipment and Materials necessary for the entire completion of the Work described in the Contract Documents and reasonably inferred therefrom to produce the intended results. The Specifications may not be superseded or amended by the Drawings

unless so provided in supplemental Specifications or Special Provisions prepared by the Engineer and approved in writing by the Authorized Representative. The Drawings shall generally govern dimensions, details and locations of the Work and calculated dimensions shall govern over scaled dimensions. The Specifications shall generally govern quality of Materials and workmanship. The organization of the Specifications in divisions, sections and articles, and the arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. In the event of inconsistencies within or between the Contract Documents, the Contractor shall provide the better quality or greater quantity of Work, and shall comply with the stricter requirement. Unless otherwise specified in the Contract Documents, words which have well-known technical or construction industry meanings are used in accordance with such recognized meanings.

104.13 Requests for Information. If the Contractor finds any perceived ambiguity, conflict, error, omission or discrepancy on or between any of the Contract Documents, including without limitation, the Drawings and Specifications, or between any of the Contract Documents and any applicable provision of law, the Contractor, before proceeding with the Work, shall submit a written Request for information to the Engineer for an interpretation or clarification. The Contractor shall be responsible for the prompt delivery of any such Request for information. The Engineer shall respond in writing to any and all requests for information within three business Days of receipt. Any interpretation or clarification of the Contract Documents made by any Person other than the Engineer, or in any manner other than in writing, shall not be binding and the Contractor shall not rely upon any such interpretation or clarification. If any change to the Work is made to accommodate unforeseen circumstances, the Engineer shall initiate the appropriate action and notify the Authorized Representative.

104.14 Ownership and Use of Drawings and Specifications. All Drawings and Specifications are the property of the City. In making copies of the Drawings and Specifications available, the City does not confer a license or grant permission for any use other than Work on the Project. Unless otherwise specified in the Contract Documents, the Engineer shall furnish to the Contractor, free of charge, 7 sets of Drawings and Specifications if the Contract price is five hundred thousand dollars or less, and 10 sets of Drawings and Specifications if the Contract price is in excess of five hundred thousand dollars. The Contractor may obtain additional copies of the Contract Documents from the Engineer, upon request, at the cost of reproduction, if any.

104.15 Access to Documents. The Contractor shall maintain in good order at the Project site one copy of all Drawings, Specifications, Bulletins, Addenda, approved Shop Drawings, catalog data, manufacturer operating and maintenance instructions, certificates, warranties, Change Orders, and other modifications, including As-built Drawings. The Contractor shall at all times permit access to the documents described in 104.15, and any other Contract Documents by the Authorized Representative and the Engineer.

104.16 As-Built Drawings. For Projects administered by the Water Engineering Manager of the City's Department of Water, or the Planning and Engineering Manager of the Department of Aviation, the Contractor shall keep an accurate record of all approved changes made to the Drawings to show Work as actually performed where such Work varies from Work as originally shown, including the exact location and depth of underground utility lines. During the performance of the Work, the Contractor shall record, prior to the submission of each Contractor

Payment Request, any approved changes on the Drawings, neatly in a contrasting color, noting new information not shown on the original Drawings. Failure to so record such changes may cause payment to be withheld or delayed. Where shop Drawings are used, the Contractor shall cross reference the corresponding sheet numbers on the Drawings and sections of the Specifications. The Contractor shall note related Change Order numbers where applicable. The Contractor shall keep a record of any change made to the Specifications, noting particularly any variation from manufacturer's instructions and recommendations. 104.16 shall not apply to any Project administered by the Engineer of the Department of Public Works unless required in the supplemental Specifications or Special Provisions for the Project.

104.17 Substitutes for Standards or Approved Equals. Requests for substitutes for standards or Approved Equals shall not be considered after the Bid Deadline unless listed on the Substitution sheet or after the Contractor can conclusively demonstrate to the Engineer one of the following conditions:

(a) All applicable standards and Approved Equals are not available through no fault of the Contractor or the Contractor's Subcontractors and Material Suppliers;

(b) All applicable standards and Approved Equals are no longer produced;

(c) All applicable standards and Approved Equals will not perform as designed or intended.

104.18 Sales and Use Taxes. Only those Materials which ultimately become a part of the completed Structure or improvement which constitutes the Project will be exempt from State sales tax as provided in Section 5739.02 ORC, and State use tax as provided in Section 5741.01 ORC. The purchase, lease or rental of material, Equipment, parts or expendable items such as form lumber, tools, oils, greases and fuels, which are used in connection with the Work, are subject to the application of State sales tax and State use tax.

ITEM 105 CITY'S RIGHTS AND RESPONSIBILITIES

105.01 Generally. Information and services required of the City may be furnished through the Engineer or the Authorized Representative and shall be furnished in good faith and in a timely manner to avoid interference with, delay, hindrance, disruption or impact to the progress of the Project. The City and the City's officials, employees, consultants, agents and representatives as determined by the Engineer shall at all times have access to the Work whenever the Project is in preparation or progress. Upon the issuance of the Notice to Proceed or at a reasonable time thereafter, the City shall provide the Contractor the Project site in such condition to permit the Contractor to perform the Work. The foregoing are in addition to other rights and responsibilities of the City enumerated herein and especially those in respect to the City's right to prosecute the Work, approve payments and accept the Project.

105.02 Right to Perform and Backcharge. If the Contractor provides Defective Work or fails or neglects to perform the Work with the necessary diligence so as to complete the Work within the time specified in the Contract Documents or any portion of the Work by the applicable milestone completion date as set forth in the current Project, the Engineer shall notify the Contractor in writing of such failure or neglect. If such Defective Work, failure, or neglect results in a threat to the safety of any person or property, the Contractor shall immediately commence to correct such Defective Work, failure, or neglect upon receipt of written or oral notice thereof. Otherwise, if the Contractor fails or refuses to cure such Defective Work or failure or neglect within three business Days after receipt of the written notice or immediately in the case of a threat to any person or property, the Engineer shall recommend enforcement of the Contract to the City pursuant to 106.02 and 106.03. Without prejudice to any other remedy the City may have, the City may employ upon the Work the additional force, or supply the Materials or such part of either as is appropriate, to correct the deficiency in the Contractor's Work, as determined by the Authorized Representative. In all such cases of Defective Work, failure, or neglect, a Change Order shall be issued deducting from payments then or thereafter due the Contractor the costs arising out of or related to investigating and correcting such Defective Work, failure or neglect, including without limitation, the City's attorneys' and consultants' fees and Liquidated Damages. If the payments then or thereafter due the Contractor are not sufficient to cover such costs, the Contractor and the Contractor's Surety shall pay the amount of the insufficiency to the City. The decision of the Authorized Representative to backcharge the Contractor shall be final, subject to proceedings in accordance with 118.01 through 11

The City reserves the right to furnish at any time such Materials and labor and to prosecute such Work in addition to the Work of the Contractor as the City may desire; provided, however, that if such prosecution of additional Work should unreasonably interfere with, disrupt, hinder, delay or impact the Work of the Contractor, the Contractor shall be entitled to a reasonable extension of time in accordance with these Specifications.

105.03 Right to Partial Occupancy or Use. If the City finds it necessary to occupy or use the Project, or a designated portion of the Project prior to Contract Completion, such use may be accomplished if the Engineer informs the City that the portion in question has been approved for occupancy use, including by the Department of Building Services, if applicable. If Partial Occupancy or Use is approved by the City, the Engineer may process either a Change Order or a Certificate of Partial Occupancy or Use for the applicable portion of the Project listing the uncompleted or Defective Work under the Contract for approval by the City, provided that no such occupancy or use shall commence before any insurers providing property insurance have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. From the date of execution of the Change Order or Certificate of Partial Occupancy or Use by the Engineer, the Contractor shall be relieved of obligation to maintain the accepted portion of the Work, but shall remain obligated to correct any incomplete or Defective Work, including, without limitation any Punch List items then uncorrected. The Contractor shall continue to carry the appropriate insurance during performance of any such Work. Partial Occupancy or Use of the Project by the City shall not constitute acceptance of any Work not in conformity with the Contract Documents. Partial Occupancy or Use shall not relieve the Contractor of liability for any express or implied warranties or from responsibility for Defective Work.

105.04 City's Right to File Suit. The City may maintain an action in its own name for violations of any law relating to the Project, for any injury to Persons or property pertaining to the Work or for any other cause which is necessary in the performance of the City's duties.

105.05 No Personal Liability of Public Officials. In carrying out the provisions of the Contract Documents, or in exercising any power or authority granted to them by or within the scope of the Contract Documents, there shall be no liability upon the officers and employees of the City, whether personally or as officials of the City, it being understood that in all such matters they act solely as agents and representatives of the City.

105.06 No Waiver of Legal Rights. No action or omission by the City or the City's officers and employees, nor any approval of any request for payment, claim, or Change Order, nor any payment for or acceptance of any Work, nor any extension of time, nor any possession taken by the City or the City's officers or employees shall operate as a waiver of any provision of the Contract Documents, or of any power herein reserved to the City, or any right to damages herein provided; nor shall any waiver of any breach of the Contract be held to be a waiver of any other subsequent breach.

105.07 No Estoppel. The City shall not be precluded or estopped by any return or certificate given by the Contractor either before or after the final completion and acceptance of the Work from showing the true and correct amount and character of the Work done and Materials furnished, or from showing at any time that any such return or certificate is untrue and incorrect or improperly made, or from showing that the Work, Materials or Equipment do not conform to the Contract Documents or from demanding and recovering from the Contractor such damages as the City may sustain by reason of the Contractor's failure to comply with the Contract Documents.

ITEM 106 THE ENGINEER

106.01 Project Inspection. The Engineer or Inspector shall inspect the progress and quality of the Work, including the preparation, fabrication or manufacture of Materials and Equipment, for conformity to the Contract Documents. The Engineer shall be provided access to all parts of the Project and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection. Inspection by the Engineer or an Inspector is solely for the benefit of the City and shall not relieve the Contractor of any of its responsibilities under the Contract Documents. When any unit of government, political subdivision or railroad corporation is to pay a portion of the cost of the Work, its representatives shall have the right to inspect the Work. Such inspection shall in no sense make any unit of government, political subdivision or railroad corporation a party to the Contract, and shall in no way interfere with the rights of the City or the Contractor under the Contract. The Inspector is not authorized to issue instructions contrary to the Contract Documents or to act for, or for the benefit of, the Contractor. Changes to the Contract Documents must be made in accordance with 117.01 through 117.12. No inspection performed pursuant to this Section shall constitute acceptance of the Work.

106.02 Rejection of Work. The Engineer or an Inspector shall have the authority to disapprove or reject any item of Work which is Defective, or that the Engineer or Inspector believes will not produce a Project that conforms to the Contract Documents, or that will prejudice the integrity of the design concept of the Project as a functioning whole as indicated by the Contract Documents. The Engineer or Inspector shall immediately notify the Authorized Representative and the Contractor at any time that Work has been disapproved or rejected. The Engineer or Inspector shall not be responsible for construction means, methods, manners, techniques, sequences, procedures, safety precautions and programs in connection with the Work, or for the Contractor's failure to carry out the Work in conformity with the Contract Documents. No failure of the Engineer or Inspector to reject the Work shall constitute acceptance of the Work.

106.03 Contract Administration. The Engineer or his designee shall provide administration of the Contract for the Project as provided by the applicable agreement between the City and the Engineer, if any, and the Contract Documents. The Engineer shall attend any

and all progress and coordination meetings. The Engineer shall prepare a written report of each progress and coordination meeting and transmit it to the Authorized Representative within three business Days of the meeting. The Engineer shall not delegate the duty to prepare the written report of any Project and coordination meeting attended. The Engineer or Inspector may authorize minor changes or alterations in the Work not involving additional costs or time and not inconsistent with the overall intent of the Contract Documents but has no authority to authorize the Contractor to perform additional or extra Work for which the Contractor will seek compensation in addition to the Contract price or extension of the time for Contract Completion. The Engineer shall review and approve, or recommend approval, of all forms required under the Contract Documents. The Engineer shall render decisions in connection with the Contractor's responsibilities under the Contract Documents and submit recommendations to the Authorized Representative for enforcement of the Contract as necessary.

106.04 Monitoring Progress. The Engineer shall monitor the progress of the Work for conformance with the Construction Schedule and shall initiate revisions of the Construction Schedule as required by the Contract Documents. In the event of default by the Contractor, the Engineer may pursue the Contractor's Surety to Contract Completion. The Engineer shall keep a daily log containing a record of weather, number of workers on site, identification of Equipment, Work accomplished, problems encountered, and other similar relevant data.

106.05 Interpretation. The Engineer will be the initial interpreter of all requirements of the Contract Documents. All decisions of the Engineer shall be subject to final determination by the City. Contractor acknowledges that Engineer, within its limited agency for the City, may consult with the City's legal counsel and that all such consultation and communications are privileged.

106.06 Authorization of Inspection, Testing and Approval. The Engineer shall authorize special inspection, testing or approval of the Work, as provided in 107.31, whenever in the Engineer's reasonable opinion such action is necessary or advisable to insure conformity with the Contract Documents.

106.07 Review of Payment Requests. Based upon the Engineer's on-site observations and evaluation of the Contractor's Payment Request, the Engineer shall review and certify the amounts due the Contractor. The Authorized Representative may recommend to the City that payment be withheld from, or Liquidated Damages be assessed against, a Contractor's Payment Request, stating the reasons for such recommendation. The Engineer's certification for payment shall constitute a representation to the City that the Work has progressed to the point indicated and that, to the best of the Engineer's knowledge, information and belief, the Work is in conformity with the Contract Documents and the Contractor is entitled to payment in the amount certified.

106.08 Review of Submittals. The Engineer shall review and approve or take other appropriate action upon the Contractor's submittals within the required time for the purpose of checking for conformity with the Contract Documents. Such review and approval shall not relieve Contractor of its duty to strictly conform to the Contract Documents.

106.09 Preparation of Change Orders. The Engineer shall prepare all Bulletins and Change Orders, including a cost estimate and supporting documentation and data. Once executed, a Change Order shall constitute the full and complete satisfaction for all claims of all direct and indirect costs, overhead costs of all kinds, inefficiency costs, acceleration costs, the cumulative impact of the Change Order and other Change Orders executed prior to it, the impact of the Change Order on unchanged work and interest related thereto, which has been or may be incurred by Contractor in conjunction with the change in scope and/or project extension set forth in the Change Order.

106.10 Final Inspections. The Engineer shall conduct inspections to determine the date of Contract Completion and shall receive, review and forward to the appropriate Person all Project record submittals required by the Contract Documents. Such inspection shall not constitute acceptance of the Work, nor shall it relieve Contractor from its duty to correct defective or non-confirming work not noted during the inspection.

106.11 Claims Services. The Engineer shall render analyses, written recommendations, or decisions, within the time specified, on all claims, disputes, or other matters in question between the Contractor and the City and shall provide information or services to the City until final disposition of all such claims, disputes, and matters. If Engineer does not approve a Contractor claim or fails to act within the required time, Contractor's claim shall be considered to be denied.

106.12 Project Rules and Hours. The Engineer shall consult with the Authorized Representative to obtain full knowledge of all City rules, regulations or requirements affecting the Project. The Engineer shall establish the regular working hours with the Contractors, subject to approval of the Engineer.

106.13 Construction Schedule. The Engineer shall review the Construction Schedule together with a schedule of submittals which is coordinated with the Construction Schedule in accordance with 109.05 through 109.09. If the Contractor fails to prosecute the Work in accordance with the Construction Schedule, the provisions of 105.02 may be invoked.

ITEM 107 THE CONTRACTOR

107.01 Construction Procedures. The Contractor shall be responsible for and have control over all construction means, methods, manners, techniques, sequences and procedures for all portions of the Contractor's Work and shall be responsible for any injury or damage which may result from the Contractor's Work or from improper construction, installation, maintenance or operation to the fullest extent permitted by law. Unless otherwise specified in the Contract Documents, the Contractor shall be responsible for properly and accurately laying out all lines, levels, elevations, grades and measurements for all the Work required by the Contract Documents and for the preservation of all related stakes and markers.

107.02 Cutting, Fitting and Patching. The Contractor shall do any cutting, fitting or patching required for the Contractor's Work and shall not endanger the Project by cutting, excavating or otherwise altering the Project, or any part of it. If Contractor requires sleeves, the Contractor shall furnish and coordinate the installation of the sleeves. The Contractor shall be responsible for the exact location and size of all holes and openings required to be formed or built for the Work, to permit coordination with any Work performed by other Persons on the Project. The Contractor shall allow sufficient time for installation of any Work performed by other Persons before covering or closing the applicable portion of the Project. Patching shall match and blend with the existing or adjacent surface. Any patching required because of Defective or ill-timed Work shall be done by and at the expense of the Contractor.

107.03 Excavation. The Contractor shall not cut away any Structure or dig under any foundation or into any wall, or any other part of the Project, without the written approval of the Engineer. Unless otherwise specified in the Contract Documents, the Contractor, prior to starting excavation or trenching, shall give notice at least two business Days in advance to the Owners of underground utilities registered with the Ohio Underground Utility Protection Services (OUPS) at www.oups.org, or by phone at (800) 362-2764 and the Owners of underground utilities shown on the Drawings and Specifications who are not registered members of OUPS. The Owner of an underground utility is required within forty-eight hours of notice, excluding Saturdays, Sundays and legal holidays, to stake, mark or otherwise designate the location of its utilities in the construction area together with its approximate depth. If any underground utility Owner fails to timely perform, the Contractor shall immediately notify the Engineer and contact the Owner of the underground utility. If any underground utility must be moved or adjusted, the Contractor shall notify the Owner of the underground utility in a timely manner so that the Work will not be delayed. Unless otherwise provided in the Contract Documents, any movement or adjustment of any underground utility or utility appurtenances, including without limitation electrical and gas meters, water and gas valves and light standards within the Project site is made by the Owner of the utility at the utility Owner's expense. In performing any excavation or trenching, the Contractor shall exercise caution and implement appropriate safety precautions to avoid property damage and personal injury. The Contractor shall backfill any excavation with the material specified and approved by the Engineer. The right to construct or reconstruct any utility service in the street or right of way or to grant permits for same, at any time, is hereby expressly reserved to the City and the Contractor shall not be entitled to any damages for the digging up of the street or Right-of-Way in accordance with such a permit. Any Person wishing to make an opening in the street must secure a permit from the City. The Contractor shall allow Persons bearing such permits, and only those Persons, to make openings in the street or Right-of-Way. When required by the Engineer, the Contractor shall make all necessary repairs due to such openings under the same conditions as the Work. Any adjustment of the Contract price or of the time for Contract Completion resulting from any such opening or repair may be made by Change Order. When the Work includes construction of underground lines and Structures, the Contractor shall make temporary restoration of street surfaces immediately upon completion of the underground lines and Structures, shall remove surplus excavated Materials and shall grade the street and put it into a safe and passable condition. The Contractor shall immediately refill any settlement in or adjacent to trenches for such construction to the proper grade.

107.04 Borrow and Waste Areas. A Change Order may be issued in accordance with 117.01 to 117.12 to permit the Contractor to use natural Materials found on the site of the Project.

Whenever Materials are to be borrowed or wasted in borrow or Waste Areas or, if allowed by the Contract Documents, wasted on the Project site, the Contractor shall prior to beginning borrow or wasting operations, obtain the Engineer's written approval of a detailed operation plan that addresses the following concerns:

(a) Control of drainage water;

(b) Cleanup, shaping, and restoration of disturbed areas;

(c) Disposal of regulated Materials;

(d) Avoidance of regulated areas;

(e) Excavation and filling of waste and Borrow Areas;

(f) Saving of topsoil;

(g) Measures to minimize sediment runoff, including keeping sediment and other contaminants from leaving the Project site and from entering streams, lakes, or reservoirs by using methods provided in the Contract Documents.

The Contractor shall use the current versions of ODOT's *Sediment and Erosion Control Handbook* and the *Location and Design Manual, Volume 2, Drainage Design* to design and plot a sedimentation and erosion control plan on Project plan sheets and ensure the plan complies with all current provisions of ORC, Chapter 6111 and the NPDES permit. The Contractor shall not waste material and discharge dredge or fill Materials into the "Waters of the United States" or an isolated wetland without the required permits from U.S. Army Corps of Engineers (404 Permit) and the Ohio EPA (401 Permit). The Contractor shall have the proposed borrow and Waste Areas reviewed by a qualified environmental consultant approved by the City and have the environmental consultant certify that the proposed borrow and waste operations will not impact the "Waters of the United States" or an isolated wetland. If consultant certification is not provided, the Contractor shall obtain the 404/401 Permits necessary to perform the operations as proposed and have the environmental consultant certify that the Work conforms to the requirements of the permits. The Contractor shall provide copies of all documentation submitted to obtain the appropriate permits and copies of the permits to the Engineer. The Contractor shall not waste or borrow material from a cultural resource site or a site eligible for the national Register of Historic Places. For sites found to have historic or prehistoric human remains, the Contractor shall comply with the requirements of Sections 2909.05 and 2927.11, ORC. If the Contract Documents require a cultural resource investigation, a qualified environmental consultant approved by the City for cultural resource investigation shall be used to review and certify that the waste or Borrow Area:

(a) does not impact a cultural resource;

(b) is not a cultural resource;

(c) is not eligible for the national Register of Historic Places; or

(d) does not consist of historic or prehistoric human remains.

If burning is permitted under the OAC-3745-19 and Section 1503.18, ORC, the Contractor shall submit a copy of the Ohio EPA permit and the Ohio DNR permit to the Engineer and copies

of all information used to obtain the permit. All damage to surrounding property resulting from the instability of borrow and Waste Areas, the removal of borrow Materials, the placement of waste Materials, or the hauling of material to and from these areas is the sole responsibility of the Contractor. Prior to the disposal of waste Materials outside the Project site, the Contractor shall submit to the City an executed copy of the Contract or permission statement from the property Owner. The Contract or permission statement must indicate that the waste Materials are not the property of the City, that the City is not a party to the Contract or permission statement and that the Contractor and property Owner will hold the City harmless from claims that may arise from their Contract or permission statement. Restoration of all borrow and Waste Areas includes cleanup, shaping, replacement of topsoil, and establishment of vegetative cover by seeding and mulching according to the Contract Documents. The Contractor shall ensure that the restored area is well drained unless approval is given by the Engineer to convert a pit area into a pond or lake, in which case the Contractor shall confine restoration measures to the disturbed areas above the anticipated normal water level, and that any proposed waste location is not within the FEMA mapped one hundred year floodplain. If the proposed waste location is within the FEMA mapped one hundred year flood plain, the Contractor shall submit written approval from the local floodplain coordinator for the site. The floodplain coordinator contacts for each county are available through the Ohio DNR, Division of Water, (614) 265-6750. No extension of time or additional compensation will be paid for any delays due to not having the written permit(s) to waste in a floodplain.

107.05 Construction and Demolition Debris. OAC-3745-37, OAC-3745-400, and Chapter 3714 ORC, regulate the use and disposal of construction and demolition debris. The Contractor shall notify the local Board of Health or the local Ohio EPA office seven Days before placing clean hard fill off the Project site or Right-of-Way and submit copies of this notification to the Engineer. The Contractor shall dispose of debris containing wood, road metal, or plaster at a licensed construction and demolition debris site. The disposal of brush, trees, stumps, tree trimmings, branches, weeds, leaves, grass, shrubbery, yard trimmings, crop residue, and other plant matter is restricted. If allowed by the Contract Documents, the Contractor may waste brush, trees, stumps, tree trimming, branches, weeds, leaves, grass, shrubbery, yard trimmings, crop residue, and other plant matter within the Project site or the Right-of-Way. Otherwise, the Contractor shall submit a plan and any required permits to legally dispose of these Materials off the Project site or Right-of-Way to the Engineer and shall provide all documents submitted to obtain this permit to the Engineer. If the Project contains garbage or solid and hazardous waste, the Contractor shall comply with applicable laws and any applicable provisions of the Contract document for the removal of these items. When wasting PCC, the Contractor shall mix the PCC with at least thirty percent natural soil to construct an inner core in the Waste Area, cover this inner core with 3 feet of natural soil on the top and eight feet on the side slopes and place and compact the material according to the Contract Documents to prevent future settlement and sliding.

107.06 Manufacturer's Recommendations. The Contractor shall install all Work in accordance with the Contract Documents and any recommendations of the manufacturer, including required temperature and humidity for installation of the various Materials.

107.07 Construction Supervision. The Contractor shall provide continuous supervision at the Project by a competent Superintendent when any Work is being performed, unless waived by the Authorized Representative. The Superintendent shall have responsibility and authority to

act on behalf of the Contractor. All communications to the Superintendent shall be as binding as if given directly to the Contractor. The Contractor shall submit an outline of the qualifications and experience of the Contractor's proposed Superintendent, including references, to the Engineer within ten Days of the Notice to Proceed. The City reserves the right to reject the Contractor's proposed Superintendent. Any such rejection shall be determined by the Authorized Representative. Failure of the Authorized Representative to notify the Contractor of such rejection within thirty Days of receipt of the required information shall constitute notice that the City has no objection. If the City rejects the Contractor's proposed Superintendent, the Contractor shall replace the Superintendent at no additional cost to the City. The Contractor shall not change or terminate the Superintendent without written approval of the Authorized Representative. If the Contractor proposes to change or terminate the Superintendent, the Contractor shall submit to the Engineer a written justification for the change or termination, along with the name and an outline of qualifications experience of the Contractor's proposed new Superintendent, not less than ten Days prior to any change or termination. The procedure provided above shall be applied to evaluate the Contractor's proposed new Superintendent. If in the City's sole discretion, the performance of the Superintendent is unsatisfactory at any time, the City may require that Contractor replace such Superintendent with a Superintendent satisfactory to the City at no additional cost to the City.

107.08 Protection of Project, Property and Utilities. The Contractor shall protect the Work from weather, and shall maintain the Work and all Materials, including Materials delivered to the Contractor by the City, apparatus, fixtures and other items on or adjacent to the Project site free from injury or damage until Final Acceptance. Non-rubber tired vehicles or Equipment shall not be moved on City streets and off road vehicles shall not be used on bases or pavements without the written approval of the Engineer. Work or items likely to be damaged shall be covered or protected at all times to prevent damage. Any Work or item damaged by failure of the Contractor to provide coverage or protection shall be removed and replaced with new Work or a new item, as applicable, at the Contractor's expense. The Contractor shall perform the Work within the site of the Project and any applicable easement or Right-of-Way. Any adjacent property, including without limitation roads, walks, shrubbery, plants, trees or turf, damaged during the Contractor's Work shall be properly repaired or replaced at the Contractor's expense. Unless otherwise specified in the Contract Documents, the Contractor shall protect the Project and existing or adjacent property and utilities from damage at all times and shall erect and maintain necessary barriers, furnish and keep lighted necessary danger signals at night, and take precautions to prevent injury or damage to individuals or property. When mailboxes, road or street name signs and supports are within the Project site, the Contractor shall remove and erect them in a temporary location during construction in a manner satisfactory to the Engineer. After completion of the Work, the Contractor shall erect the mailboxes, road or street name signs and supports in a permanent location in accordance with the Drawings unless otherwise required by Change Order. Removal, temporary erection and permanent erection shall be in accordance with United States postal regulations. When cornerstones, monuments and property corner pins are encountered in the performance of the Work, and monument covers are not listed in the Bid, the City will supply them and supervise their precise location and installation, and the Contractor will furnish all the labor, Materials and Equipment required for such installations. 105.02 may be invoked for the cost to the City for repair, re-evaluation of location and replacement of any cornerstone, monument or property corner pin within the Project, damaged, destroyed or made inaccessible during the progress of the Work by the Contractor. Existing surface or overhead Structures or utility lines are not necessarily shown on the Drawings and the locations of those shown are approximations. The Contractor shall make such investigations as are necessary to determine the extent to which existing surface or overhead Structures may interfere with the

performance of the Work. Any sizes, locations, and depths for such Structures are approximations and the Contractor shall make such investigation or exploration as may be necessary to determine the actual sizes, locations and depths. The Contractor shall field locate all existing utilities before setting line and grade. Unless otherwise specified in the Contract Documents, the Contractor shall remove all snow and ice as may be required for access to and performance of the Work.

107.09 Load Restrictions. The Contractor shall not load, nor permit any part of the Project to be loaded, in any manner that will endanger the Project, or any portion thereof, nor shall the Contractor subject any part of the Project or existing or adjacent property to stress or pressure that will endanger the Project or property. The Contractor shall provide all temporary bracing, shoring and other structural support required for safety of the Project and proper execution of the Work, including without limitation all necessary support and protection of the property of any utility. The Contractor shall comply with all legal load restrictions in the hauling of Materials on public roads and shall operate Equipment of a weight or so loaded as to not cause damage to Structures, Roadway, or other construction. A special permit will not relieve the Contractor of sole liability for damage which may result from the moving of Equipment or Materials. The Contractor shall not haul on concrete pavement, base or Structures before the expiration of the curing period.

107.10 Materials and Equipment. The Contractor shall provide only new Materials and Equipment of the quality specified in the Contract Documents. The Contractor shall immediately remove Materials or Equipment not conforming to the requirements of the Contract Documents. The Contractor shall not incorporate Materials or Equipment, the defects of which have been corrected without written approval from the Engineer. If the City is to furnish any Materials, the City shall deliver them in accordance with the Contract Documents. The Contractor shall coordinate and schedule sufficient time for any such delivery. The Contractor shall provide domestically produced steel as required by law including Sections 153.011 and 5525.21, ORC, and Federal laws and regulations, if applicable. The Contractor shall furnish documentation to the Engineer evidencing the domestic origin of applicable steel and iron products before they are incorporated into the Project. Steel and iron products without a traceable, documented domestic origin will be treated as non-domestic products. The City may reject any item or material provided by a Contractor in violation of this requirement. The Contractor shall notify the Engineer of proposed sources of Materials prior to delivery. The Engineer may approve Materials at the source of supply before delivery. If the proposed source of supply cannot produce the specified Materials, the Contractor shall furnish Materials from Alternate sources without adjustment of the Contract price or the time for Contract Completion.

107.11 Storage. Only the material and Equipment which are to be used directly in the Work shall be brought to or stored at the Project by the Contractor and the Contractor's Subcontractors and Material Suppliers. The Contractor shall be responsible for the proper handling and storage of all material and Equipment brought or delivered to the Project to assure preservation of their quality and fitness for the Project and to facilitate inspection of them. Aggregates shall be transported from any storage site to the Project in tight vehicles so constructed as to prevent loss or segregation of Materials after loading and measuring in order that there may be no inconsistencies in the quantities of Materials intended for incorporation in the Project as loaded, and the quantities as actually received at the site of the Project. After any material or Equipment is no longer required for the Work, the Contractor shall promptly remove

such material and Equipment from the Project. The Contractor's Materials and Equipment shall not be stored in any Right-of-Way unless the location of such storage is approved by the Engineer. The Contractor shall, before storing Materials in gutters, lay suitable drains of sufficient size to carry all the storm water flowing in such gutters. Where the drainage from cross streets or alleys is interfered with or cut off by reason of the nature of the Work, the Contractor shall provide suitable crossings for pedestrians. No material or Equipment shall be stored within 20 feet of any fire hydrant. Private property shall not be used for storage of material and Equipment without the prior written permission of the Owner or lessee of the private property, and if requested by the Engineer, the Contractor shall provide a copy of the written permission to the Engineer. The Contractor shall restore all storage sites to their original conditions. The Contractor's material and Equipment shall not cause damage to the Project or adjacent property and shall not endanger any individual at, or in the vicinity of, the Project. Any injury to any individual or damage to property resulting from the Contractor's material or Equipment shall be the responsibility of the Contractor.

107.12 Labor. The Contractor shall maintain a sufficient workforce to timely perform the Work and enforce good discipline and order among the Contractor's employees and the employees of the Contractor's Subcontractors and Material Suppliers. The Contractor shall not permit employment of individuals not skilled in tasks assigned to them. The Contractor shall dismiss from the Project any individual employed by the Contractor or the Contractor's Subcontractors and Material Suppliers who is found by the Authorized Representative, pursuant to a recommendation from the Engineer, to be incompetent, guilty of misconduct, or detrimental to the Project. The Contractor shall employ all legal efforts to minimize the likelihood or effect of any strike, Work stoppage or other labor disturbance. Informational pickets shall not justify any Work stoppage.

107.13 Maintenance of Utilities. The Contractor shall at all times provide and maintain access to fire hydrants, water valves, water service boxes, gas valves, gas service boxes, manholes and other similar appurtenances. During the course of construction, the Contractor shall be solely responsible to notify any utility or other service when such utility or service is encountered. The Contractor shall protect all above ground utilities, Structures and appurtenances and shall replace any damaged portions thereof. The Contractor shall protect all below ground utilities, Structures and appurtenances that may be accurately located by removing manhole covers, valve box covers, and other access point coverings with reasonable effort using hand tools for such removal and shall replace any damaged portions thereof.

107.14 Maintenance of Traffic. Vehicular and pedestrian public traffic shall be maintained during the Project whether it is traffic through the Project or only cross traffic at intersections, unless otherwise provided in the Contract Documents. The Contractor shall make all repairs to roads necessary to maintain traffic to the satisfaction of the Engineer. If there are locations on the Project where Sewer or water line construction only is called for and a part of the existing pavement will remain in place, traffic shall be maintained and ingress and egress to all public and private entrances shall be provided. The Contractor shall provide all necessary flaggers. The Contractor shall provide and maintain access to adjacent property including by constructing necessary temporary walks, driveways, Bridges, crossings, and Roadways. The Contractor shall notify the applicable fire and police department whenever a street or alley, or a portion of a street or alley is about to be closed to traffic and shall provide notice when such street or alley or portion thereof is to be opened. In the event of the complete closure of any street,

alley or private drive, the City shall give notification to the occupants of all premises affected by the closure. The Contractor shall promptly notify the Engineer of all unforeseen effects of the Project on traffic. Unless the Contract Documents provide otherwise, all traffic control devices shall be furnished, erected, maintained and removed by the Contractor in accordance with the OMUTCD.

107.15 Safety Precautions. The Contractor shall take reasonable, diligent precautions and shall be responsible for the safety of individuals on or adjacent to the Project and shall comply with all applicable provisions of federal, State and municipal safety laws, regulations, and building codes to prevent injury to individuals on or adjacent to the Project. The Contractor shall comply with the rules, regulations and orders of OSHA. The Contractor shall be responsible for any fine or cost incurred as a result of any violation or alleged violation of such rules, regulations or orders. The Contractor shall take reasonable, diligent precautions and shall be responsible for the safety of the Project, including without limitations all Materials and Equipment incorporated or to be incorporated in the Project. Prior to the start of any Work, the Engineer shall meet with the Contractor and other applicable Person to coordinate the Contractor's methods and Equipment for protecting the Project, other property and individuals from damage or injury, in accordance with applicable regulations. The Engineer efforts at coordination shall not relieve the Contractor of any responsibility for safety or ensure the Engineer to become responsible for safety. Methods and Equipment for protecting the Project, other property and individuals shall be subject to inspection and approval of the appropriate authority having jurisdiction over the Project site.

107.16 Work Stoppage Due to Hazardous Materials. In the event the Contractor, except a licensed abatement Contractor, encounters Materials reasonably believed to contain asbestos, polychlorinated biphenyl (PCB) or other hazardous waste or material, which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Authorized Representative and the Engineer in writing. A licensed abatement Contractor shall report the condition to the Authorized Representative and the Engineer in writing and shall remove the waste or material or render it harmless. The Work in the affected area shall be resumed upon written notice from the Engineer that the waste or material has been removed or rendered harmless. The term "rendered harmless" shall mean that the level of exposure is less than any applicable exposure standards set forth by OSHA or other applicable regulations. Hazardous Materials to be used at the Project shall be identified by a MSDS. The applicable MSDS shall be prepared by the Contractor and submitted to the Engineer prior to a hazardous material being brought to the Project site. The Contractor shall maintain all applicable MSDS on site whenever Work is in preparation or progress.

107.17 Vehicle Damage Claims. When a Person reports damage to a vehicle, whether orally or in writing, to the Contractor, the Contractor shall file a written report, including copies of applicable police reports, with the Authorized Representative within three Days.

107.18 Fire Hydrants. The Contractor shall make any necessary arrangements with the City Department of Water for any use of fire hydrants in connection with the Work and shall pay for all water used from the hydrants. Permits from the Department of Water for use of fire hydrants shall be provided to the Engineer upon request.

107.19 Engineer Facilities. Unless otherwise specified in the Contract Documents, the Contractor shall provide and maintain in a clean condition the following temporary facilities, Equipment and services for use by the Engineer:

(a) If space is available near the Project, 2 separate office spaces, both of which shall be adequately heated, lighted, air conditioned, and with doors which lock, the keys to which shall be provided to the Engineer;

(b) If space is not available near the Project, a standard width job trailer shall be provided, which shall be adequately heated, lighted, air conditioned, and with doors which lock, the keys to which shall be provided to the Engineer;

(c) Each office space shall be equipped with at least 1 desk, 1 desk chair and 2 side chairs and reasonable circulation space;

(d) Each office space shall have 1 four-drawer filing cabinet or equivalent;

(e) A plan rack and 4 by 8 foot plan table shall be provided in 1 office space;

(f) Each office space shall have at least 1 telephone in service;

(g) Use of a facsimile and copy machine shall be provided for use either in one of the office spaces or in an adjacent office space;

(h) One office space shall have a computer to the City’s criteria with electronic mail capabilities.

107.20 Meeting Spaces. Unless otherwise specified in the Contract Documents, the Contractor shall provide adequate space, Equipment and furnishings to conduct progress and coordination meetings for the Project. The meeting area shall be furnished with an appropriate meeting table and an appropriate number of folding or stacking chairs to adequately seat all participants at the meetings.

107.21 Temporary Heat. Unless otherwise specified in the Contract Documents, the Contractor shall provide temporary heat necessary so that the Work shall proceed expeditiously during inclement weather, and to protect the Contractor's Work and Materials from damage. From a date of partial occupancy, the City is responsible for the cost of providing heat for the occupied portion of the Project.

107.22 Water. Unless otherwise specified in the Contract Documents, the Contractor shall provide all water necessary for the Contractor's Work. From a date of partial occupancy, the City is responsible for the cost of water consumed for the occupied portion of the Project.

107.23 Hoists and Elevators. The Contractor shall provide and maintain adequate hoisting and elevator facilities as required for the Contractor's Work in coordination with the Engineer. If electric service requirements of hoisting or elevator facilities differ from that available at the Project site, the Contractor requiring use of such hoisting or elevator facilities shall make

and pay for all necessary connections. Unless otherwise specified in the Contract Documents, the Contractor requiring use of hoisting or elevator facilities, after the Project is enclosed, shall be responsible for transporting individuals and Materials as required for the Contractor's Work.

107.24 Electricity. Unless otherwise specified in the Contract Documents, the Contractor shall make all arrangements for temporary light and power services and shall pay all charges, both for service installation and removal, if required, and for energy consumed until Final Acceptance of the Project. Unless otherwise specified in the Contract Documents, the Contractor requiring any electrical service requirements relating to temporary hoists, cranes, welding Equipment or elevators shall subcontract with a licensed Contractor for such service requirements and shall be responsible for all costs of such services. From a date of partial occupancy, the City is responsible for the cost of energy consumed for the occupied portion of the Project.

107.25 Temporary Facilities. Unless otherwise specified in the Contract Documents, the Contractor shall provide, and maintain in a clean condition, adequate and approved sanitary facilities for use by all Persons at the Project in coordination with the Engineer.

107.26 Drainage. The Contractor shall be responsible for all temporary drainage necessary for the Contractor's Work and shall employ pumps, trenches, drains, sumps or other necessary elements as required to afford satisfactory working conditions for the protection, execution and completion of the Project.

107.27 Environmental Protection. The Contractor shall comply with all applicable federal, State and local laws and regulations relating to pollution of the environment and shall take precautions to prevent pollution of water with fuels, oils, bitumens, calcium chloride, sediments and other Materials. When the work area is located in or adjacent to streams and other watercourses, the area shall be separated from the main stream by a dike or barrier to keep sediment from entering the stream. The Contractor shall take care during the construction and removal of such barriers to minimize siltation of the stream and watercourse. Control of ground water and water in excavations shall be accomplished in a manner that will prevent degradation of the quality of any surface water. Wells and well points shall be installed with suitable screens and filters where necessary to prevent the continuous pumping of fines. The discharge of sediment laden water from pumping shall be performed in a manner to prevent degradation of streams, watercourses, lakes, ponds, or other areas of water impoundment. Such prevention may require, without limitation, the use of ditch check dams, sediment traps, sediment basins, sediment pits, filters, filtration bags or other control devices and methods necessary to prevent adverse effects to surface waters as provided in Chapter 3745-1-04 OAC. The cost of constructing and maintaining these measures shall be borne by the Contractor. Water from aggregate washing or other operations containing sediment shall be treated by filtration, settling basins or other measures sufficient to reduce the sediment concentration to not more than that of the stream, watercourse, lake, pond or the area of water impoundment. The Contractor shall not cause or permit the handling or transporting or storage of any material in a manner which allows or may allow unnecessary amounts of particulate matter to become airborne or cause or permit the Project to be constructed, used, repaired or demolished without applying all such reasonable measures as may be required to prevent particulate matter from becoming airborne. The Engineer may require necessary measures to prevent particulate matter from becoming airborne including without limitation the paving or frequent cleaning of roads, driveways and parking lots,

the application of dust-free surfaces, the application of water and the planting and maintenance of vegetative ground cover. When dust, fumes, gases, mist, odorous matter, vapors, or any combination thereof escape from the Project or Equipment in such manner and amount as to cause a nuisance or to violate any regulation, the Engineer may require that the Project or Equipment in which processing, handling and storage are done be tightly closed and ventilated in such a way that all air and gases and air or gas-borne material leaving the Project or Equipment are treated by removal or destruction of air contaminants be discharged to the open air.

107.28 NPDES General Permit. The Contractor shall secure any required NPDES general permit by submitting a notice of intent application form to the Ohio EPA at least forty-five Days prior to the start of construction. When required by law, the Contractor shall prepare and certify a storm water pollution prevention plan and process the required notice of termination prior to completion of the Project. The Contractor shall comply with all requirements and conditions of any NPDES general permit, including, but not limited to, implementing and maintaining the control measures specified in the storm water pollution prevention plan, maintaining records of construction activities, and removing Materials no longer required and taking proper action if there is a reportable quantity spill.

107.29 Building Permits. Unless otherwise specified in the Contract Documents, the Contractor shall secure the required general building permits. The Contractor shall schedule and attend all intermediate and Final Inspections required for any permit certification. The Contractor shall schedule inspection for occupancy permits with the appropriate local fire authority and State Fire Marshal. The Contractor shall give the Engineer and the Authorized Representative reasonable notice of the date arranged for any inspection.

107.30 Other Permits. Unless otherwise specified in the Contract Documents, the Contractor shall apply for, secure and pay the fees for any permit, license or tap in required by State or local authorities having jurisdiction over the Project, except the NPDES permit and the general building permits secured by the Engineer in accordance with 107.29. The Contractor shall give the Engineer and the Authorized Representative reasonable notice of the date arranged for any related inspection.

107.31 Inspection, Testing and Approval. Unless otherwise specified in the Contract Documents, the Contractor shall apply for, secure and pay for any inspection, testing or approval required by the Contract Documents, laws, ordinance, rules, regulations or orders of any public authority having jurisdiction over the Project. The Contractor shall give the Engineer and the Authorized Representative reasonable notice of the date arranged for such inspection, testing or approval. The Contractor shall provide an original report of the inspection, testing or approval to the Engineer for approval. If, after the commencement of the Work, the Engineer determines that any portion of the Work requires special inspection, testing or approval, in addition to any inspection, testing or approval provided for or required by the Contract Documents, in order to insure conformance to the Contract Documents, the Engineer may instruct the Contractor in writing to order such special inspection, testing, or approval, or the Engineer may make the arrangements for same. If such special inspection, testing or approval reveals a failure of the Work to comply with the requirements of the Contract Documents, the Contractor shall pay all costs associated with such special inspection, testing or approval. If such special inspection, testing or approval reveals that the Work is in compliance with the Contract Documents, the

Contractor will be paid, by appropriate Change Order, for all costs associated with such special inspection, testing or approval. Neither the observations of the Engineer in the administration of the Contract, nor any inspections, tests or approvals by Persons other than the Contractor shall relieve the Contractor from the Contractor's obligation to perform the Work in conformity with the Contract Documents.

107.32 Uncovering the Work. If any Work is covered contrary to the requirements of the Contract Documents or contrary to the written request of the Engineer, such Work must, if required by the Engineer in writing, be uncovered for observation and replaced, if not in conformity with the Contract Documents, and recovered at the Contractor's expense. If any Work has been covered in accordance with the Contract Documents and is Work which the Engineer had not requested the opportunity to observe prior to covering, the Engineer may request that such Work be uncovered by the Contractor. If such Work is found not to be in conformity with the Contract Documents, the Contractor shall pay all costs of uncovering, correcting, replacing, and recovering the Work. If such Work is found to be in conformity with the Contract Documents, a Change Order will be processed to pay the Contractor for the cost of uncovering, correcting, replacing, and recovering the Work, subject to final approval by the City Commission.

107.33 Correction of the Work. The Engineer shall notify the Contractor in writing if any Work is found by the Engineer to be Defective, whether observed before or after Contract Completion. The Engineer shall specify in the written notice the time within which the Contractor shall correct the Defective Work. The Contractor shall bear all costs of correcting such Defective Work, including the cost of any consequential damages. If the Contractor fails to correct any Defective Work within the time fixed in the written notice, the City may correct such Work and obtain recovery of all costs, including without limitation any consequential damages, and all attorneys' and consultants' fees, from the Contractor or the Contractor's Surety.

107.34 Interruption of Existing Services. Whenever it becomes necessary to interrupt existing services in use by the City or its residents, such as Sewer, water, gas, and steam lines, electric or telephone and cable service, the Contractor shall continue the Work on a non-stop twenty-four hour per Day basis until the Work is completed and the service restored, or at such Alternate time required by the Authorized Representative. Before beginning such Work, the Contractor shall apply in writing to and receive approval in writing from the Authorized Representative and the Person with appropriate jurisdiction over the Project, to establish a time when interruption of the service will cause a minimum of interference with the activities of the City, its tenants, if any, and the public.

107.35 Clean Up. During the progress of the Work, the Contractor shall be responsible for the removal and off-site disposal of all waste, excess Materials and rubbish, including without limitation layout stakes, sediment control devices and temporary Structures, attributable to the Work to an appropriate disposal site. Temporary on-site storage of waste, excess Materials and rubbish may be permitted as designated by the Engineer. Unless otherwise provided in the Contract Documents, the Contractor shall perform daily broom cleaning in the area of the Contractor's Work and shall, at the end of each working Day or upon notice from the Engineer, remove all waste Materials and rubbish from the Project. The Contractor shall, as required for the Project or upon notice from the Engineer, clean and remove any waste Materials or rubbish from areas adjacent to the Project. The Contractor shall, as required for the Project or upon

notice from the Engineer, take all necessary actions to minimize and clean dust and mud from the Project and adjacent property in accordance with City ordinances and regulations. If the Contractor fails to clean up during the progress of the Work, the provisions of 105.02 may be invoked. If the Contractor fails to maintain the areas adjacent to the Project clean and free of dust, mud, waste, excess Materials and rubbish, upon written notice from the Engineer, the Authorized Representative shall direct the local jurisdiction having responsibility for the area to clean the area or shall employ City employees or another Person to clean the area. The cost of cleaning the area adjacent to the Project shall be deducted from the Contractor as the Engineer recommends and the Authorized Representative determines to be appropriate. The decision of the Authorized Representative shall be final, subject to proceedings in accordance with 118.01 through 118.11.

107.36 Explosives and Blasting. Blasting will not be permitted and explosives may not be brought onto or kept on the site of the Project, except with prior written approval of the Authorized Representative and any other authorities having jurisdiction, including without limitation the City's Fire Department. All blasting and all purchasing, storing and handling of explosives shall be done as prescribed in any applicable federal, State or City statutes, ordinances or regulations by Persons experienced in such Work. The Contractor shall carry appropriate liability insurance and shall be responsible for any injuries to individuals or damage to property resulting from any blasting operation. The Contractor shall provide a copy of the policy of such insurance to the Engineer prior to bringing any explosives to the Project and to the Authorized Representative upon request. The Contractor shall take all necessary precautions to protect the Project, existing or adjacent property, water lines, and other underground Structures from blasting. Where there is danger to Structures or property from blasting, the charges shall be reduced and the material shall be covered with suitable timber, steel or rope mats. The Contractor shall notify all Owners of adjacent or utility property which may be affected of any intention to use explosives at least eight hours before blasting is commenced. Any inspection of use of explosives by the Engineer does not in any way reduce the responsibility of the Contractor or its Surety for damages that may be caused by such use.

107.37 Emergency. In the event of an emergency affecting the safety of the Project, other property, or individuals, the Contractor, without special instruction or authorization, shall act to prevent any threatened damage, injury, or loss. The Contractor shall give the Engineer and the Authorized Representative prompt written notice if the Contractor believes that any significant change in the Work or variation from the Contract Documents has been caused by any emergency or action taken in response to an emergency. If the Engineer recommends that a change in the Contract Documents be made because of any emergency or action taken in response to an emergency, and the Authorized Representative approves, a Change Order will be processed, subject to final approval by the City Commission, if applicable.

107.38 Royalties and Patents. The Contractor shall pay all royalties and license fees and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents and if, to the knowledge of the Engineer, use of the specified item is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by the Engineer in the Contract Documents. If the Contractor has reason to believe that use of the specified item is subject to

patent or copyright protection, the Contractor shall immediately notify the Authorized Representative.

ITEM 108 - SUBCONTRACTORS AND MATERIAL SUPPLIERS

108.01 Approval by City. Within ten Days of the Notice to Proceed, the Contractor shall list the Contractor's proposed Subcontractors and Material Suppliers on forms approved by the Authorized Representative and submit such forms to the Engineer for approval by the Authorized Representative. The City reserves the right to reject any Subcontractor or Material Supplier for any reason, in its sole discretion. Failure of the Engineer to notify the Contractor of rejection within ten Days of receipt of the forms shall constitute notice that the City has no objection. If the City rejects any Subcontractor or Material Supplier, the Contractor shall replace the Subcontractor or Material Supplier at no additional cost to the City.

108.02 Replacement. The Contractor shall not replace any Subcontractor or Material Supplier after execution of the Contract Form without written approval of the Authorized Representative. The Contractor shall submit to the Engineer amended approval forms and a written justification for the change of the Contractor's Subcontractors or Material Suppliers. The Contractor shall submit to the Engineer amended forms whenever any listed information changes for the Contractor's Subcontractors or Material Suppliers. The City may withhold approval of any such proposed replacement for any reason, in its sole discretion.

The City may require the Contractor to replace any Subcontractor or Material Supplier previously approved at no additional cost to the City if the Contractor is in default because of the Subcontractor's or Material Supplier's performance.

108.03 Contractor's Responsibility. The Contractor shall be fully responsible for all acts and omissions of the Contractor's Subcontractors and Material Suppliers and shall be responsible for scheduling and coordinating the Work of the Contractor's Subcontractors and Material Suppliers. Interference, disruption, hindrance, delay or impact attributable to the Contractor's Subcontractors or Material Suppliers shall be deemed to be interference, disruption, hindrance, delay or impact within the control and responsibility of the Contractor. The Contractor shall require that each of the Contractor's Subcontractors have a competent supervisor at the Project whenever Work is being performed by the Subcontractor. The Contractor agrees to bind the Contractor's Subcontractor and Material Supplier to the terms of the Contract Documents, so far as applicable to the Work of such Subcontractor or Material Supplier, and shall not agree to any provisions which seek to bind the City to terms inconsistent with or at variance from the terms of the Contract Documents. Contractor shall require the City to be named as an intended third-party beneficiary of all contracts between Contractor and Subcontractors and Material Suppliers such that the City will be entitled to enforce any rights thereunder to its benefit.

108.04 Warranty and Guarantee. The Contractor shall require each Subcontractor and Material Supplier to fully warrant and Guarantee, for the benefit of the City, the effectiveness, fitness for the purpose intended, quality and merchantability of any Work performed or item provided or installed by such Subcontractor or Material Supplier.

108.05 Prompt Payment. If a Subcontractor or Material Supplier requests payment in time to allow the Contractor to include the request in the Contractor's Contractor Payment Request, the Contractor shall pay within ten Days after receipt of payment from the City:

(a) To a Subcontractor an amount equal to percent of completion allowed by the City for the Subcontractor's Work;

(b) To a Material Supplier an amount equal to all or a portion of the Material Supplier's request for Materials furnished.

108.06 Prompt Payment Reduction and Interest. The Contractor may reduce the amount to be paid to a Subcontractor or Material Supplier pursuant to 108.05 by the amount of any retainage withheld from the Contractor and may withhold amounts necessary to resolve disputed liens or claims involving the Work of the Subcontractor or Material Supplier. If the Contractor fails to comply with the provisions of 108.05, the Contractor shall pay to the applicable Subcontractor or Material Supplier eighteen percent interest on any unpaid amount beginning on the eleventh Day after receipt of payment from the City.

108.07 Affidavit of Claim. In order to establish lien rights, Subcontractors and Material Suppliers not in privity of Contract with the Contractor must serve a notice of furnishing on the Contractor whose Contract is the Contract under which the Subcontractor or Material Supplier is performing. The notice of furnishing must be served upon the Contractor within twenty-one Days of performing the Work or furnishing the Materials. Subcontractors and Material Suppliers not in privity of Contract with the Contractor must, at the time of filing a Claim Affidavit with the Authorized Representative, provide a copy of the notice of furnishing and proof that it was received by the Contractor. In order to establish lien rights, a claimant must file a Claim Affidavit with the Authorized Representative, within one hundred twenty Days from the date of the last Work or furnishing of Materials. In order to receive priority over similar claims, the claimant must file a copy of the claim with the Montgomery County Recorder's office within thirty Days of serving the Authorized Representative. All claimants who serve the Authorized Representative, and file with the Montgomery County Recorder within thirty Days, have no priority among themselves and share in the funds prorata. Claimants, who file with the Authorized Representative, but not with the Montgomery County Recorder, are paid only if there are sufficient funds left after paying those claimants who file with the Montgomery County Recorder. The Authorized Representative shall notify the Contractor of the receipt of the claim within five Days of receiving the Claim Affidavit. A copy of the Claim Affidavit and a statement advising the Contractor of the Contractor's right to dispute the claim will accompany the notice. The Contractor shall have twenty Days to dispute the claim. If the Contractor does not notify the Authorized Representative in writing of an intention to dispute the claim within twenty Days after receipt of the Claim Affidavit, the Contractor is deemed to have assented to its correctness. The City shall detain the amount stated in the Claim Affidavit from subsequent Contractor Payment Requests and deposit said amount in an escrow

account in accordance with a general escrow agreement between the City and a bank. The escrow agent shall hold the deposit and any interest earned thereon until receipt of notice from the Authorized Representative specifying an amount to be released and the Person to whom the amount is to be released. The City reserves the right to pay a Claim Affidavit which is not timely disputed.

108.08 Claims Against Contract Bond. Laborers, Subcontractors or Material Suppliers who have furnished or delivered labor or Materials to the Project may, at any time after performing the labor or delivering the Materials, but not later than ninety Days after Final Acceptance of the Project, by the City, furnish the Surety a statement of the amount due. After furnishing the statement, laborers, Subcontractors or Material Suppliers must wait sixty Days to bring a suit for the amount due. If the Surety has not paid the claim at the expiration of sixty Days, laborers, Subcontractors or Material Suppliers may bring suit for amounts not paid, but must bring the suit within one year of Final Acceptance of the Project, by the City.

108.09 Assignment of Contract. The Contractor shall not sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or of any right, title or interest therein, without written consent of the Authorized Representative. No sale, transfer, assignment or other disposition of the Contract shall in any case release the Contractor of liability under the Contract and the Contract Bond.

ITEM 109 CONSTRUCTION PHASE SCHEDULING

109.01 Compliance with Schedule. The Contractor shall complete portions of the Work in such order and time as provided in the current Construction Schedule.

109.02 Responsibility of Contractor. The Contractor shall afford other Persons on the Project reasonable opportunity for the introduction and storage of Materials and Equipment and execution of Work and shall properly connect and coordinate the Contractor's Work with the Work of other Persons on the Project. The Contractor shall perform the Work so as not to interfere with, disturb, hinder, delay, or impact the Work of other Persons on the Project. If the Contractor, or any of the Contractor's Subcontractors or Material Suppliers, causes damage or injury to the property or Work of any other Person on the Project, or by failure to perform the Work with due diligence, delays, interferes with, hinders, disrupts or impacts any other Person on the Project, who suffers damage, injury or expense thereby, the Contractor shall be responsible to the other Person for such damage, injury or expense. Claims, disputes or actions between the Contractor and other Persons on the Project concerning such damages, injury or expense shall not delay completion of the Work which shall be continued by the parties to any such claim dispute or action. The Contractor shall coordinate the Work with the activities and responsibilities of other Persons on the Project, the Engineer and the City to complete the Project in accordance with the Contract Documents. In the event the Contractor fails to prosecute the Work in accordance with the Project Schedule, the Engineer may recommend that the provisions of 105.02 be invoked.

109.03 Preceding Work. If any part of the Contractor's Work is preceded by the Work of another Person, the Contractor shall inspect such preceding Work before commencing any Work, and report in writing to the Engineer any defects which render the preceding work unsuitable as related to the Contractor's work. Failure of the Contractor to make such inspection and report in writing shall constitute an acceptance of the preceding work as fit and proper for the reception of the Contractor's work, except for latent defects which such an inspection would fail to disclose.

109.04 Coordination with City. The Contractor shall supervise and coordinate the Work in conformity with any coordination from the Engineer and the Authorized Representative, as provided in the Contract Documents. The Contractor shall give reasonable notice to the Engineer

when the Engineer's presence is required for special consultations, decisions or recommendations, as required by the Contract Documents. The Contractor shall consult with the Engineer and the Authorized Representative to obtain full knowledge of all rules, regulations or requirements affecting the Project. The Contractor shall establish the regular working hours, subject to approval by the Engineer and the Authorized Representative. Night working hours and working hours on Sundays and holidays are not permitted without the prior written consent of the Engineer and the Authorized Representative. Such consent will not be provided unless the Contractor has given at least forty-eight hours' notice in writing to the Engineer. The Contractor shall cooperate with the Engineer and the Authorized Representative so as not to interfere with, disturb, hinder or delay the responsibilities of the Engineer and the City.

109.05 Construction Schedule. The Contractor shall prepare the Construction Schedule for the Project and a schedule of submittals which is coordinated with the Construction Schedule within thirty Days of the date of the Notice to Proceed or such longer period as mutually agreed between the Engineer and the Contractor in writing upon timely written request by the Contractor. The Contractor shall, within seven Days of the date of the Notice to Proceed, furnish to the Engineer a preliminary Construction Schedule for the prosecution of Work on the Project. The Engineer shall, within seven Days of receipt of the Contractor's preliminary Construction Schedule, provide comments on the preliminary Construction Schedule to the Contractor. The Contractor shall, within five Days of receipt of the comments, prepare a revised Construction Schedule to incorporate those comments and submit the revised Construction Schedule to the Engineer together with all information requested and required by the Engineer. The Engineer shall submit 4 copies of the revised Construction Schedule, together with any recommendation thereon in writing, to the Authorized Representative within three Days of receipt. The Construction Schedule shall not exceed the time limits specified in the Contract Documents and the Notice to Proceed, shall provide for reasonable, efficient and economical execution of the Work and shall be coordinated with the Work of all other Persons or the entire Project to the extent required by the Contract Documents. The Construction Schedule shall be used to plan, organize, and execute the Work, record and report actual performance and progress and show how the Contractor Plans to coordinate all Work to Contract Completion. In preparing the Construction Schedule the Contractor shall use critical path scheduling methods and shall provide without limitation, the information listed in 109.06, unless waived by the Authorized Representative in writing upon the written recommendation of the Engineer.

109.06 Schedule Information. In accordance with 109.05, the Contractor shall provide the following information:

(a) A graphic presentation of the sequence of the Work for the Project which includes, without limitation, the Contractor's resource loading curve in the media and format required by the Engineer;

(b) Identification of each phase of the Work and any milestone completion dates;

(c) Identification of activities and durations for all shop drawing and other submittal review and approval, fabrication and review of mock-up Work, product review and procurement, fabrication, shop inspection and delivery including, without limitation, lead time, coordination drawing delivery, Punch List, Punch List corrections, Project close-out requirements, Contract Completion, and occupancy or utilization requirements;

(d) Identification of disruptions and shutdowns due to other operations, facilities and functions, if any;

(e) Identification of the critical path of the Work;

(f) Identification of crew size and total resource hours for each activity in the Construction Schedule;

(g) The Contractor's signature and date thereof on the Construction Schedule.

109.07 Construction Schedule Requirements. The Engineer shall provide complete Specifications for the paper and electronic formats of the Construction Schedule. The Contractor shall develop the Construction Schedule using commercially available Personal computer software acceptable to the Engineer, in graphic and tabular form. Final copies shall be provided in color and in such size as is appropriate for the level of detail and shall clearly and legibly show all relevant information. The Contractor shall provide monthly updates of the Construction Schedule and shall update the Construction Schedule if a time recovery plan is approved in accordance with 109.12, in electronic and paper formats, to the Engineer in graphic and tabular form. All base line and updated schedules shall be submitted electronically to the Engineer, in graphic and tabular form. The Contractor shall provide clear graphics, legends and other necessary data, including without limitation, milestones, constraints and items required by the Project and the Engineer. Unless waived by the Authorized Representative in writing upon written recommendation of the Engineer, each baseline and updated schedule shall show the Project name and Contract and contain lines for signatures and dates of signature for all Contractors involved in the Project. Each baseline and updated schedule shall provide activity identification and a description for each activity broken down to a maximum fifteen Day duration, responsibility of each applicable Contractor, the Contractor's resources and crew size for each activity, early start dates, early finish dates, late start dates, late finish dates, predecessor and successor activities for each activity, free float, total float and percentage completion. Each baseline and updated schedule shall identify the logic relationship between all activities and shall show all submittal dates, coordination drawing preparation, Working Drawing submittals and mark-up review and approval durations. Together with each updated schedule, the Contractor shall provide a list of all changes to the previously approved base line Construction Schedule or the previous updated Construction Schedule, including without limitation logic, float and actual start and finish dates of activities.

109.08 Use of Schedule and Float. The Construction Schedule and the Project Schedule, if applicable, shall be used as a tool for scheduling and reporting sequenced progress of the Work using early start dates and early finish dates. Free float and total float are resources of the Project and the use of float associated with an activity is not permitted without the concurrence of the Engineer, and other Contractors, if any.

109.09 Approval and Acceptance Schedule. The Contractor shall review and sign each updated Construction Schedule. The Contractor's signature or any base line or updated Construction Schedule shall serve as an affirmation of the Contractor's approval of and agreement to the Construction Schedule and a representation that the Contractor can meet the requirements of the Construction Schedule without additional compensation. Immediately after the Contractor has signed the Construction Schedule, the Engineer shall submit it and the

schedule of submittals to the Authorized Representative or return them to the Contractor with recommendations for revision. In the absence of a Construction Schedule approved by the Contractor and accepted by the Authorized Representative, the City may withhold payment from the Contractor in accordance with 114.08 and 114.09. Alternatively, the City, in its sole discretion, may backcharge the Contractor in accordance with 105.02, reassign scheduling responsibility or suspend or terminate the Contract in accordance with 119.01 through 119.04.

109.10 Weekly Contractor Reports. Unless otherwise specified by the Contract Documents, the Contractor shall, on a bi-weekly basis, prepare and submit to the Engineer a written report describing activities begun or finished during the preceding week, work in progress, expected completion of the Work, a Projection of all activities to be started or finished in the upcoming two weeks including without limitation the Contractor's workforce crew size with respect to each activity of Contractor, and total resource hours associated with such Work and any other information requested by the Engineer.

109.11 Monthly Progress Reports. Unless otherwise specified in the Contract Documents, the Engineer shall provide monthly progress reports to the Authorized Representative, which shall include recommendations for adjusting the Construction Schedule or the Project Schedule, as applicable, to meet milestone completion dates and Contract Completion dates.

109.12 Time Recovery Plan. When it is apparent to the Engineer that critical path activities, scheduled milestone completion dates, or Contract Completion dates will not be met, the Engineer shall submit to the Contractor a time recovery plan to avoid or minimize any delay. A time recovery plan may include, without limitation, increasing the Contractor's workforce in such quantities as will eliminate the backlog of Work, increasing the number of working hours per shift, shifts per workday, workdays per week, the amount of construction Equipment, or any combination thereof, rescheduling of activities to achieve maximum practical concurrency of work efforts and, if appropriate, time extensions. If the Contractor approves the time recovery plan within ten Days of receipt, a revised Construction Schedule shall be prepared by the Contractor and signed and accepted in accordance with 109.11 and, if applicable, a revised Project Schedule shall be prepared by the Engineer and approved and signed by the Contractors in accordance with 109.10. If the Contractor fails to approve a time recovery plan within ten Days of receipt, the Contractor shall immediately provide an Alternate time recovery plan to the Engineer in writing, for review and acceptance in accordance with 109.11 and, if applicable, 109.10.

109.13 Project Meetings. The Contractor and all appropriate Subcontractors shall attend Project meetings as requested by the Engineer. The purpose of the Project meetings may include, without limitation, review of progress in the Work, discussion of anticipated progress, and review of critical operations and existing and potential problems and safety matters. The Contractor shall be represented at every Project meeting by a Person authorized with signature authority to make decisions regarding possible modification of the Contract Documents. The Engineer shall notify the Contractor of the time and place of each Project meeting. The Contractor shall have any of the Contractor's Subcontractors and Material Suppliers attend a Project meeting as deemed advisable by the Contractor or as requested by the Engineer. The Engineer or the Engineer's designated representative shall prepare a written report of each Project meeting and distribute such report to the Authorized Representative and the Contractor. The Engineer or the Engineer's designated representative, as applicable, shall not delegate the duty to prepare a

written report of each Project meeting. If any Person objects to anything in a report of a Project meeting, the Person shall notify the Engineer, the Authorized Representative and any other affected Person in writing explaining the objection. The Engineer shall attach any objection made to a report of a Project meeting and any response thereto to the report.

ITEM 110 - WORKING DRAWINGS AND SAMPLES

110.01 Requirement to Provide. Working Drawings, Samples and other submittals, including without limitation stress sheets, erection Plans, falsework Plans, cofferdam Plans, bending diagrams for reinforcing steel, formwork, Plans, and tunneling Plans, shall be provided by the Contractor for any item required by the Contract Documents but not fully described in the Drawings and Specifications, unless waived by the Engineer, and shall include, without limitation:

(a) Construction of the various parts, method of jointery, type of material, grade, quality and thickness of material, alloy of material, profiles of all sections, reinforcement, anchorage, type and grade of finish;

(b) Capacities, types of Materials and performance charts that are pertinent to the Materials and performance charts that are pertinent to the Work. Wiring diagrams, control diagrams, schematic diagrams, working and erection dimensions, arrangement and Specifications;

(c) Notwithstanding any measurements in Drawings or Specifications, where the Work involves repair, renovation, extension or alteration of, or addition to, an existing Structure, the Contractor shall make such measurements of the existing Structure as may be required to accurately attach the Work to the Structure.

110.02 Samples, Tests, Cited Specifications. Unless otherwise provided in the Contract Documents, the City shall test Samples of Materials in accordance with AASHTO, ASTM, AWWA or methods on file in the office of the Director at the expense of the City. Samples will be taken by a qualified representative of the City. References included in these Specifications to AASHTO, ASTM, AWWA, or federal Specifications shall be to the test method, sampling method or specification in effect upon the date of the notice to Bidders for the Contract. Copies of all test results will be furnished to the Contractor. The Contractor shall cooperate fully in the sampling and inspection of Materials and shall notify the Engineer immediately upon the arrival of Materials to be used in the Work. The City reserves the right to retest all Materials and Equipment that have been stored prior to incorporation of those Materials into the Project and to reject all Materials and Equipment which, when retested, do not meet the requirements of the Contract Documents. The Contractor, in all cases, shall furnish the required Samples without charge. Transports and distributors hauling bituminous material shall be equipped with an approved submerged bituminous Materials sampling device.

110.03 Source Sampling and Testing. The Engineer may undertake the sampling and testing of Materials at the source of supply. If source sampling and testing is undertaken:

(a) The Contractor shall cooperate and assist the Engineer, including without limitation in compliance with applicable inspection, sampling and test requirements, and shall provide all necessary documentation;

(b) The Contractor shall provide full entry at all times to the parts of the source as may concern the manufacture or production of the Materials being sampled and tested;

(c) If required by the Engineer, the Contractor shall arrange for an approved building for the use of the inspection which building shall be located conveniently near the source and independent of any building used by the Materials producer;

(d) The Contractor shall provide and maintain adequate safety measures at the plant at all times;

(e) The City reserves the right to retest all Materials that were tested at the source prior to the incorporation of those Materials into the Project and to reject all Materials which, when retested, do not meet the requirements of the Contract Documents.

110.04 Form of Submittals. The Contractor shall provide a submittal letter and shall stamp and submit the working Drawings or other submittals to the Engineer in accordance with a schedule established by the Engineer and the Contractor. Unless otherwise specified in the Contract Documents, the Contractor shall submit 3 prints of all working Drawings and 4 copies of any other submittal. Only 1 print copy of all working Drawings will be returned to the Contractor by the Engineer. If the Contractor requires more than 1 copy, additional copies must be provided to the Engineer at the time of the original submission. The Engineer will not produce copies of the working Drawings. The data shown on the working Drawings shall be complete with respect to quantities, dimensions, specified performance and design criteria, Materials and similar data to show the Engineer the Materials and Equipment which the Contractor proposes to provide. Each sample shall be identified clearly as to material, supplier, and pertinent data such as catalog numbers and the use for which intended and other uses as the Engineer may require to enable the Engineer to intelligently review the submittal. All working Drawings shall indicate the applicable plan sheet and Specifications.

110.05 Variation from Contract Documents. If the working Drawings or other submittals show variations from the requirements of the Contract Documents, the Contractor shall make specific mention of such variations in the Contractor's letter of submittal to the Engineer. If the variation is acceptable to the Engineer, the Engineer shall recommend acceptance of the variation to the Authorized Representative in writing. Upon written approval of the Authorized Representative, the variation shall be incorporated into the Contract Documents. The Contractor shall not be relieved of any responsibility for deviations from the requirements of the Contract Documents by the Engineer's review of working Drawings, Samples or other submittals.

110.06 Contractor's Review. All working Drawings, Samples and other submittals shall be reviewed and stamped by the Contractor prior to submittal to the Engineer. If it is apparent to the Engineer that the Contractor has not reviewed the submittals, or has conducted an incomplete

review, the Engineer shall reject the submittals. The Contractor shall field verify conditions as necessary and make corrections of dimensions, location of various items, encroachments of Work or variations from the requirements of the Contract Documents. If required by the Contract Documents or applicable law, the Contractor shall have the working Drawings or other submittals prepared by Persons possessing expertise and experience in an appropriate trade or profession or by a licensed Engineer, landscape architect, or other design professional.

110.07 Engineer's Review. The Engineer shall review and approve or disapprove working Drawings, Samples or other submittals within fifteen Days of receipt or in accordance with the approved submittal schedule or such other period of time as is mutually agreed by the Engineer and the Contractor. The Contractor shall make any corrections required by the Engineer and shall resubmit the required number of corrected copies of working Drawings, Samples or other submittals until approved, which resubmission shall be acted upon by the Engineer with fifteen Days of receipt or such other period of time as is mutually agreed by the Engineer and the Contractor. When resubmitting submittals, the Contractor shall direct the Engineer's attention to any revisions made by noting such revisions on the resubmitted submittal. All costs incurred by the Engineer, the City or other Persons due to the failure of the initial submittal to substantially meet the requirements of the Contract Documents, or due to excessive resubmittals, for attendant delay, interference, hindrance, disruption or impact of the Project, shall be paid by the Contractor. Resubmittals in excess of two may be deemed excessive by the City. The Engineer's review and approval of working Drawings, Samples and other submittals is to determine if the items covered by such submittals will, after installation and incorporation into the Work, conform to the Contract Documents and be compatible with the design concept of the Project as a functioning whole. The Engineer's review and approval shall not extend to means, methods, manners, techniques, sequences, procedure of construction or to safety precautions or programs incident thereto. The Engineer's review and approval of a separate item will not indicate approval of the assembly in which the item functions.

110.08 Risk of Nonpayment. No portion of the Work requiring a Working Drawing, sample or other submittal shall be commenced until the submittal, has been reviewed and approved by the Engineer. Any Work commenced by the Contractor prior to final approval of the Working Drawing, sample or other submittal by the Engineer shall be performed by the Contractor under risk that no payment will be approved or made by the City for such Work.

110.09 Manufacturer’s Statement. Working Drawings on all Equipment shall include the following written statement from the manufacturer of the Equipment:

"This Equipment submitted for approval shall perform as specified when installed by the Contractor in the arrangement shown on this drawing and in the Contract Documents and in conjunction with all other accessories such as flues, breachings, piping, controls and Equipment not furnished by this manufacturer but required as an accessory or supplement to this Equipment, providing that the accessory or supplementary items perform as specified and are installed as shown in the Contract Documents."

ITEM 111 PREVAILING WAGE RATES

111.01 Prevailing Wages
111.02 Prevailing Wage Determination
111.03 Fines and Penalties
111.04 Wage Schedule
111.05 Payroll Reports

111.01 Prevailing Wages. The Contractor shall pay the prevailing wage rates of the Project locality, as determined by the Ohio Department of Commerce, Division of Labor and Worker Safety, Wage and Hour bureau, or the U.S. Department of Labor to laborers and mechanics performing Work on the Project, as applicable. The Contractor shall comply with the provisions, duties, obligations, and is subject to the remedies and penalties of Sections 4115.03 to 4115.22, ORC or the Davis-Bacon Act, as applicable.

111.02 Prevailing Wage Determination. The Contract Documents include pages setting forth the prevailing rates of wages as ascertained by the Ohio Department of Commerce, Division of Labor and Worker Safety, Wage and Hour Bureau, or the U.S. Department of Labor for the Project, as applicable. The City shall, within seven business Days after receipt of a notice of a change in the prevailing rates, notify the Contractor of the change. The Contractor shall make the necessary adjustment in the prevailing wage rate and shall pay any wage increase during the term of the Contract.

111.03 Fines and Penalties. Whoever violates Section 4115.08 or 4115.09, ORC, shall be fined pursuant to the applicable provisions of the Ohio Revised Code. Whoever violates division (C) of Section 4115.071, or Section 4115.10 or 4115.11, ORC is guilty of a misdemeanor of the second degree for a first offense. For each subsequent offense such Person is guilty of a misdemeanor of the first degree. Fines and penalties under the Davis-Bacon Act shall be as determined by the U.S. Department of Labor and in accordance with applicable law.

111.04 Wage Schedule. Within ten Days of the date of the Notice to Proceed, the Contractor shall provide the City's prevailing wage Coordinator a schedule of dates during the term of the Contract on which wages will be paid to employees for the Project.

111.05 Payroll Reports. The Contractor shall submit weekly payroll reports with each Contractor Payment Request, which reports shall be certified by the Contractor that the payroll is correct and complete and the wage rates shown are not less than those required by the Contract. The Contractor shall be responsible for submitting all payroll reports of the Contractor's Subcontractors. The payroll report shall indicate the week covered and shall include a list containing the name, address and social security number of each employee of the Contractor and the Contractor's Subcontractors paid for the Work. The payroll report shall list the number of hours each employee worked each Day on the Project during the reporting period, the total hours each week on the Project, the employee's hourly rate of pay, job classification, fringe benefits and all deductions from wages and net pay. The payroll report shall also list each fringe benefit and state if it is paid as cash to the employee or to a named plan. The Contractor and the Contractor's

Subcontractors shall also submit apprenticeship agreements for all apprentices utilized on the Project.

ITEM 112 INSURANCE

112.01 Contractor's Liability Insurance. The Contractor shall purchase and maintain such liability and other insurance as will protect the Contractor from claims described below which may arise out of or result from the Contractor's performance or obligations under the Contract Documents, whether due to action or inaction by the Contractor, a Subcontractor, any Person directly or indirectly employed by the Contractor or a Subcontractor or any Person for whom the Contractor or a Subcontractor is responsible, or by any Person for whose acts the Contractor or a Subcontractor may be liable:

(a) Claims under workers' compensation, occupational sickness or disease, disability benefit and other similar employee benefit acts;

(b) Claims for damages because of bodily injury, disease, illness, death or Personal injury, and other claims usually covered by bodily injury liability insurance;

(c) Claims for damages because of injury to or destruction of property and other claims usually covered by property damage liability insurance.

The Contractor shall comply with all provisions of the Ohio Workers Compensation Act and all rules of the Ohio Bureau of Workers' Compensation. In addition, if a portion of the Work is performed from a barge or a ship or requires unloading Materials from a barge or a ship on a navigable waterway of the United States, the Contractor shall arrange coverage for that portion of the Work under the Longshore and Harborworkers' Compensation Act, 33 U.S.C. Section 901, et seq., and the Jones Act, 5 U.S.C. Section 751, et seq. and shall provide proof of such coverage to the City. Comprehensive Automobile Liability Insurance shall cover owned, non-owned and hired vehicles.

112.02 Policy Limits. A Commercial General Liability policy and Business Automobile Liability policy shall be maintained to provide insurance as described below. An Umbrella or Excess Liability policy may be used in combination with the Commercial General Liability and business Automobile insurance to meet such limits:

(a)	**Policy Limits**	**Commercial General Liability**
	$2,000,000	General Aggregate
	$2,000,000	Products/Completed Operations Aggregate
	$1,000,000	Occurrence Limit
	$1,000,000	Personal and Advertising Injury Limit
	$100,000	Fire Legal Liability Limit
	$10,000	Medical Payments

(b)	**Policy Limits**	**Comprehensive Automobile Liability**
	$1,000,000	Bodily Injury & Property Damage Occurrence Limit

Contracts in the amount of one hundred thousand dollars or less shall require coverage in the amount of not less than two million dollars general aggregate and one million dollars per occurrence. Contracts in excess of one hundred thousand dollars, but not more than five million dollars shall require coverage in the amount of not less than three million dollars general aggregate and per occurrence. Contracts exceeding the amount of five million dollars shall require coverage in an amount to be determined by the Authorized Representative but in no case less than five million dollars general aggregate and per occurrence. Such policies shall be endorsed to provide that the General Aggregate Limit applies separately to each of the insured Contractor's Projects. By requiring such insurance and insurance limits herein, the City does not represent that coverage and limits will necessarily be adequate to protect the Contractor, and such coverage and limits shall not be deemed as a limitation on the Contractor's liability under the indemnities granted to the City.

112.03 Explosion, Collapsed and Underground Insurance. For any demolition, excavating, tunneling, shoring or similar operations, the Contractor shall purchase and maintain Explosion, Collapse and Underground (XCU) coverage with a limit of liability equal to such limit as specified in 112.02. In addition, if blasting is to be performed, the Contractor shall purchase and maintain XCU coverage providing a minimum Aggregate Limit of 5,000,000 dollars and Each Occurrence Limit of 1,000,000 dollars.

112.031 Pollution Liability Insurance. If required by the Contract Documents, Contractor shall purchase and maintain pollution liability insurance with a limit for any one incident of not less than $1,000,000 and an aggregate limit of not less than $2,000,000.

112.032 Completed Operations Insurance. Contractor shall purchase and maintain completed operations coverage to cover such claims for bodily injury or property damage arising out of the Contractor's completed operations, which coverage shall be maintained for no less than five (5) years following final payment.

112.04 Builder's Risk Insurance. Unless otherwise specified in the Contract Documents, the Contractor shall provide and maintain, during the progress of the Work and until the execution of the Certificate of Contract Completion by the Authorized Representative, a builder's risk insurance policy to cover all Work in the course of construction including falsework, temporary buildings and Structures and Materials used in the construction process, stored on or off site, or while in transit. The amount of coverage shall equal the total completed value of the Project (including the value of permanent fixtures and decorations). Such insurance shall be on a special cause of loss form, which provides coverage on an open perils basis insuring against the direct physical loss of or damage to covered property including flood and earthquake. It shall also include debris removal and demolition occasioned by enforcement of any applicable legal requirement, and shall cover reasonable compensation for the City's services and expenses required to limit further loss. Coverage must include provision to pay the reasonable extra costs of expediting temporary and permanent repairs to, or permanent replacement of, damaged property. This shall include overtime wages and the extra cost of "express" or other means for rapidly transporting Materials, Equipment and supplies necessary to such repair or replacement. The builder's risk policy shall protect both the Contractor and the City from loss and provide coverage for Materials in transit or stored off site and identified for the Project. Coverage for other perils may be required if specified in the Special Provisions.

112.05 Coverage Amount. Unless otherwise specified in the Contract Documents, the builder's risk policy shall be written in the amount equal to one hundred percent of the Contract price, including landscaping, paving and other sitework. The builder's risk policy shall specifically permit and allow for partial occupancy by the City prior to Final Acceptance of the Project by the City.

112.06 Railroad Protective Insurance. Where the Contract requires railroad Protective Insurance and no specific Bid item is provided in the Proposal for the payment of the premium therefore, the cost of such insurance shall be included in the various other Bid items in the Contract.

112.07 Insurance Policy Requirements. Each policy of insurance required to be purchased and maintained by the Contractor shall be obtained from an insurance company authorized by the Ohio Department of Insurance to do business in the State and shall name the City as an additional insured or loss payee, as applicable; provided, however, that such designation shall not cause any claim between the Contractor and the City to be waived except as set forth in 112.09. Each policy and the respective certificate of insurance shall expressly provide that no less than thirty Days prior written notice shall be given to the City in the event of cancellation, non-renewal, expiration or material alteration of the coverage contained in such policy or evidenced by such certificate of insurance. Each policy shall provide that the City shall be covered notwithstanding any action, omission or negligence of the Contractor. Each policy shall be primary and non-contributory. Each policy must include contractual liability insurance covering the Contractor's indemnity obligations. The Contractor shall furnish the City, when requested, a certified copy of any insurance or additional insured or loss payee endorsement required to be purchased or maintained by the Contract Documents. In no event shall any failure of the City to demand a certified copy of any required insurance or endorsement be construed as a waiver of the obligation of the Contractor to obtain insurance required to be purchased or maintained by the Contract Documents. Except for its completed operations insurance, the Contractor shall maintain all insurance in the required amounts, without interruption, from the date

of the execution of the Contract Form until the date of approval of the Certificate of Contract Completion by the Authorized Representative. The Contractor shall require all Subcontractors to provide Workers' Compensation, CGL, and Automobile Liability insurance with the same minimum limits specified herein, unless the Owner agrees to a lesser amount and require the City be named as an additional insured and/or loss payee under such policies. Failure to maintain the required insurance during the time specified shall be cause for termination of the Contract. If the Contractor fails to purchase and maintain, or require to be purchased and maintained, any insurance required under these Specifications, the Owner may, but shall not be obligated to, upon three (3) days written notice to the Contractor, purchase such insurance on behalf of the Contractor and shall be entitled to be reimbursed by the Contractor upon demand. Insurance policies required to be purchased and maintained by the Contractor may include a reasonable loss deductible and exclusions, which shall be the responsibility of the Contractor to pay in the event of loss. The prompt repair or reconstruction of the Work as a result of an insured loss or damage shall be the Contractor's responsibility and shall be accomplished at no additional cost to the City.

112.08 Renewal Certificates. If the Contractor provides certificates of insurance showing expiration prior to the date of final completion, the Contractor shall provide new certificates to the City showing continuing coverage prior to expiration.

112.09 Waivers of Subrogation. The City and the Contractor waive all rights against each other for damages caused by fire or other perils to the extent of actual recovery of any insurance proceeds under any property insurance obtained pursuant to Item 112 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the City as fiduciary.

ITEM 113 INDEMNIFICATION

113.01 Indemnification for Injury or Damage
113.02 Indemnification for Patent or Copyright Use

113.01 Indemnification for Injury, Damage or Breach of Contract. To the fullest extent permitted by law, the Contractor shall defend, indemnify and hold harmless the City, the Engineer, any participating railroad or railway company, any property Owner or lessee of adjacent property, or utilities and any private Person providing financing for the Project, their respective members, officials, officers, consultants, agents, representatives and employees, in both individual and official capacities, from and against all claims, damages, losses, and expenses, direct, indirect or consequential, including but not limited to all fees and charges of design professionals, attorneys, and other professionals and all court, arbitration, or other dispute resolution costs, arising out of or resulting from any claim or action, legal or equitable, caused or alleged to have been caused by the Contractor's performance of the Work or any breach of the Contractor's obligations under the Contract Documents, including but not limited to the breach of any warranty provided in the Contract Documents.

In the event of any such injury, including death, or loss or damage, or claims therefore, the Contractor shall give prompt notice thereof to the Engineer and the Authorized Representative. This provision is intended to be, and shall be construed, as consistent with, and not in conflict with, Section 2305.31 ORC, to the fullest extent permitted. The indemnification obligations of the Contractor under this 113.01 shall not extend to the liability of the Engineer, the Engineer's officials, consultants, agents, representatives or employees for negligent preparation or approval of Drawings, specification, Change Orders, opinions, and any other responsibility of the Engineer, except to the extent covered by the Contractor's insurance.

113.02 Indemnification for Patent or Copyright Use. To the fullest extent permitted by law, the Contractor shall indemnify, hold harmless and defend the City and the Engineer, their respective members, officials, officers, consultants, agents, representatives and employees, in both individual and official capacities from and against all claims, damages, losses and expenses arising out of the Contractor's infringement of patent rights or copyrights.

ITEM 114 CONTRACTOR PAYMENT

114.01 Contract Cost Breakdown. The Contractor shall submit to the Engineer a full, accurate and detailed estimate (the Contract Cost Breakdown) of the various kinds of labor to be performed and material to be furnished, with separate amounts shown for labor and Materials for each branch of Work, following the preferred titles and sequences of sections in the format used by the Engineer in developing the Specifications. The grand total shown on the Contract Cost Breakdown must equal the total Contract price. The City reserves the right to use the approved Contract Cost Breakdown to determine the cost or credit resulting from any change in the Work. The first item should be actual aggregate cost of Contract Bond, insurance, permits and tests required for the Work. The amounts for labor and material shall accurately reflect the cost for each item. Separate items shall not be shown for overhead or profit, but shall be included in the totals for labor and Materials. Whenever the material allocation exceeds fifty-five percent of the Contract price, the Contractor shall provide, upon request, sufficient information to support such higher percentage. Subcontract Work shall show amounts for labor and Materials. Fringe benefits shall be shown as a part of labor costs. When more than one major Structure is included in the Contract, the Contract Cost Breakdown shall be subdivided accordingly if requested by the Engineer, with cost details for each Structure shown separately. A line item shall be included for commissioning, Punch List Work, Project record document submittals, delivery of inventory and specified training. The Contract Cost Breakdown will be returned to the Contractor for resubmittal if it does not meet the requirements set forth above or contains insufficient items or details of the Work. No payment will be made without an approved Contract Cost Breakdown.

114.02 Contractor Payment Request. The Contractor shall submit monthly to the Engineer an itemized Payment Request for Work performed based upon the Contract Cost Breakdown on a form satisfactory to the Authorized Representative. The Contractor Payment Request shall be supported by documentation substantiating the Contractor's right to payment. The Contractor shall supply any additional documentation the Engineer may request in connection with each payment to the Contractor. Certified payroll reports for the period of time indicated shall be attached to one copy of every Payment Request. The Contractor shall list on the Contractor Payment Request any approved Change Orders processed and performed during the time covered by the Payment Request.

114.03 Payment Date. Payment of an approved Payment Request shall be made within thirty Days from the date of approval by the Engineer. The City reserves the right to require proof of the renewal of required insurance as a condition precedent to payment. Payments due and not paid to the Contractor within such thirty Day period shall bear interest from the date payment is due under the Contract Documents at the rate paid by the STAR Account in accordance with 120.04. The amount of Liquidated Damages to which the City is apparently entitled under the Contract Documents may be deducted from any Payment Request by the Engineer and the Authorized Representative.

114.04 Labor Payments. Partial payments to the Contractor for labor performed under either a Unit Price or lump sum Contract shall be made at the rate of ninety percent of the amount invoiced through the Payment Request which shows the total Contract Completion at fifty percent or greater. After the Contract is fifty percent complete, as evidenced by payments in the amount of at least fifty percent of the Contract price to the Contractor, partial payments for labor performed under either a Unit Price or lump sum Contract shall be made at the rate of ninety-five percent of the amount involved.

114.05 Material Payments. Through the Payment Request which shows total Contract Completion at fifty percent or greater, the City shall pay to the Contractor a sum at the rate of ninety percent of the invoice cost, not to exceed the applicable Bid amount in a Unit Price or lump sum Contract, for material delivered on the site of the Project, or other point in the vicinity of the Project, or other storage site approved by the Engineer, provided the Contractor provides the following information with the Payment Request:

(a) A list of the fabricated Materials consigned to the Project, giving the place of storage, together with copies of invoices, in order to verify quantity and cost;

(b) A certification of Materials stored off site, prepared by the Contractor and signed by the Engineer to evidence that the Materials are in conformity with the Specifications and have been tagged with the Project name and number for delivery to the Project. All costs incurred by the Engineer to visit a storage site, other than the areas adjacent to the Project, shall be paid by the Contractor.

After the Contract is fifty percent complete, as evidenced by payments in the amount of at least fifty percent of the Contract price to the Contractor, partial payments for Materials furnished under either a Unit Price or lump sum Contract shall be made at the rate of ninety-five percent of the amount involved. When payment is allowed on account of material delivered on the site of the Project or in the vicinity thereof or under the possession and control of the Contractor but not yet incorporated therein, such material shall become the property of the City, but if such material is stolen, destroyed, or damaged by casualty before being used, the Contractor will be required to replace it at the Contractor's expense. Any such material not ultimately incorporated into the Project may, at the option of the City, be retained by the City or returned to the Contractor for credit to the City of a proportionate amount. Completed line items concealed, underground and buried and not subject to final Punch List may be paid for at the rate of one hundred percent. Such completed line items subject to a final Punch List requiring testing or start-up shall be paid at the rate of ninety-eight percent.

114.06 Retainage. The City will not deposit retainage in any escrow account and will not pay interest on retainage. Any contrary provisions of 153.12, 153.13, 153.14 and 153.63, ORC, do not apply to this Contract. Payment of retainage to the Contractor shall not be due until thirty Days after approval of a final Contractor Payment Request by the City and execution of the Certificate of Contract Completion by the City. Any reduction or release of retainage, or portion thereof, shall not be a waiver of the City's right to retainage in connection with other payments to the Contractor, or any other right or remedy the City has under the Contract Documents, at law or in equity.

114.07 Retainage Reduction with Consent of Surety. Upon consent by the Contractor's Surety, the City may reduce the amount of funds retained for the faithful performance of Work by fifty percent of the amount of funds required to be retained, provided the Contractor's Surety remains responsible for all damages that may be caused due to default by the Contractor, including without limitation, the following:

(a) Completion of the Work;

(b) All interference, disruption, hindrance, delay and impact claims;

(c) All Liquidated Damages; and

(d) All additional expenses incurred by the City.

114.08 Payments Withheld. The Engineer shall have the authority to recommend to the City that payments be withheld from, or Liquidated Damages be assessed against and withheld from, a Payment Request, stating the reasons for such recommendation. The City reserves the right to decline to approve any Contractor Payment Request or part thereof, or because of subsequent evidence or inspection, may nullify any previous Payment Request, in whole or in part, to such extent as may be necessary in the Authorized Representative's opinion to protect the City from loss because of:

(a) Defective Work not remedied;

(b) Damage caused by the Contractor;

(c) Failure to comply with the requirements of Sections 4115.03 to 4115.22, ORC or the Davis-Bacon Act as applicable; and/or

(d) Liquidated Damages.

(e) Other damages the City has incurred or is expected to incur due to Contractor's fault.

If a basis for withholding payment is removed, payment shall be made for the amount withheld because of the basis.

114.09 Payments Detained. Whenever the City receives a Claim Affidavit, the Authorized Representative shall detain the stated amount from the Contractor's subsequent Payment Requests unless the Contractor provides a release and waiver of lien with a Payment

Request. The release and waiver of lien shall be executed by the Person supplying labor, Materials or services on a Project, which has or may have a right of claim against the Contractor's proceeds. If the City detains an amount as set forth above, such action shall not be construed as conferring any right on such Subcontractor or Material Supplier, nor as enlarging or altering the application or effect of the existing lien law.

114.10 Measurement of Quantities. For all Contracts, except lump sum Contracts, after an item of the Work is completed and before final payment is made by the City, the Engineer will determine the quantities of various items of Work performed as the basis for final payment. The Contractor, in case of Unit Price items, will be paid as provided in 103.19. After issuance of a Certificate of Contract Completion in accordance with 115.05, the Engineer shall prepare a final estimate for payment based on the actual quantities of completed Work and deducting there from all previous payments made to the Contractor. Any prior estimate is subject to correction in the final estimate.

114.11 Final Payment Request. The Contractor, as a condition precedent to execution of the Certificate of Contract Completion and to final payment, shall provide all documents required pursuant to 115.06 for approval by the Engineer with the Contractor's final Payment Request.

114.12 Final Payment Date. Payment of the final Payment Request shall be made within thirty Days from the date of approval by the Engineer unless the City has reason to withhold amounts pursuant to the terms of this Agreement. Payments due and not paid to the Contractor within such thirty Day period shall bear interest from the date payment is due under the Contract Documents at the rate paid by the STAR Account in accordance with 120.04.

114.13 Waiver of City's Claims. The making of final payment by the City shall constitute a waiver of claims by the City except those relating to unresolved claims of the Contractor or the City and those arising after Contract Completion including, without limitation, the following:

(a) Defective or nonconforming Work;

(b) Error by Contractor;

(c) Outstanding liens, claims, security interests, or other encumbrances arising out of the Contract Documents and unsettled;

(d) Failure of the Contractor to comply with any warranties or Guarantees required by the Contract Documents;

(e) audits performed by the City after final payment;

(f) any claims, damages, losses, or expenses for indemnification under Item 113;

(g) Inadvertent overpayment by the City.

114.14 Waiver of Contractor's Claims. The acceptance of final payment by the Contractor shall constitute a waiver of all claims against the City except those that the Contractor has previously made in writing in accordance with 118.01 through 118.11 and which remain unresolved at the time of final payment. This provision is intended to be, and shall be construed as, consistent with, and not in conflict with, Section 4113.62 ORC, to the fullest extent permitted.

ITEM 115 FINAL INSPECTION AND ACCEPTANCE

115.01 Contractor's Request. When the Work or a designated portion thereof, is nearly complete, the Contractor shall submit a request for a Final Inspection of the Work ("the "Final Inspection") to the Engineer in writing.

115.02 Engineer's Punch List. The Engineer shall, within seven Days of receipt of the request for Final Inspection, notify the Contractor of acceptance or rejection of the request for Final Inspection, stating reasons for any rejection. Upon acceptance of the Contractor's request, the Engineer shall conduct the Final Inspection to determine whether the Work or the designated portion thereof, is in conformity with the Contract Documents. The Engineer shall notify the Contractor and the Authorized Representative of the scheduled time of the Final Inspection. Within three Days of the Final Inspection, the Engineer shall notify the Contractor of any items of Work remaining in a Defective, incomplete or unacceptable condition. The list of such items shall be known as the Engineer's Punch List.

115.03 Completion and Correction of Punch List Items. Within fourteen Days of receipt of the notice required by 115.02, the Contractor shall complete and correct all items on the Engineer's Punch List. If the Contractor does not complete the items on the Engineer's Punch List within fourteen Days of receipt of the notice, the provisions of 105.02 may be invoked. If the Work on the Engineer's Punch List cannot be completed within fourteen Days of receipt of the notice, the Contractor shall justify to the reasonable satisfaction of the Engineer the reasons the items cannot be so completed, and the Contractor shall propose, for approval of the Engineer, a time when such items will be completed. If the Contractor fails to timely correct the items on the Punch List, the City, in its discretion, may perform the Work by itself or others and the cost thereof shall be charged against the Contractor. If the balance of the Contract price is insufficient, the Contractor and/or its surety will pay the Owner the balance on demand. The Contractor's warranties and obligations under the Contract Documents shall remain in full force and effect and cover any remedial work even if performed by others. Failure of the Engineer to include any items on the Engineer's Punch List shall not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents. If multiple inspections of items on the Engineer's Punch List are required due to the Contractor's failure to properly and timely complete

them, the Contractor shall be responsible for any additional costs incurred by the Contractor, other Persons, the Engineer and the City resulting from any attendant delay.

115.04 Deferred Items. With the approval of the Engineer, when upon Final Inspection, items of Work cannot be completed because of seasonal conditions, such as bituminous paving or landscaping, or if the Authorized Representative agrees that a particular item need not be completed until a subsequent date, the Authorized Representative may release payment to the Contractor less twice the cost of completing the remaining Work as determined in the sole discretion of the Authorized Representative.

115.05 Certificate of Contract Completion. When all items on the Engineer's Punch List have been corrected to the satisfaction of the Engineer and the provisions of 115.06 through 115.14 have been fulfilled, the Engineer shall process a Certificate of Contract Completion for execution by the Authorized Representative. The City reserves the right of Final Acceptance of the Project.

115.06 Project Record Document Submittals. The Contractor, as a condition precedent to execution of the Certificate of Contract Completion, release of retainage and final payment, shall provide all Project record documents to the Engineer for approval, which may include, without limitation:

(a) Certificate of occupancy, if required;

(b) Any inspection certificates required such as pressure piping, elevator, boiler, electrical, plumbing or piping purification;

(c) Letter of Approval for fire suppression system, if required;

(d) Any operating and maintenance manuals, which shall be organized into suitable sets of manageable size. Indexed data shall be bound in individual binders, with pocket folders for folded sheet information and appropriate identification shall be marked on the front and the spine of each binder;

(e) Neatly and accurately marked sets of As-built Drawings and other Contract Documents reflecting the actual construction of the Project;

(f) Reproducible detailed Drawings reflecting the exact location of any concealed utilities, mechanical or electrical systems and components;

(g) Assignment to the City of all warranties and guaranties, including the most recent address and telephone number of any Subcontractors, Material Suppliers, or manufacturers;

(h) An affidavit from the Contractor to certify that all Subcontractors and Material Suppliers have been paid in full for all Work performed or Materials furnished for the Project and an affidavit from each Subcontractor and Material Supplier that the Subcontractor or Material Supplier has been paid in full for all Work performed or Materials furnished for the Project;

(i) Final certified payroll reports;

(j) Affidavit to certify that the Contractor and an affidavit from each Subcontractor to certify that the Subcontractor has complied with all requirements of Sections 4115.03 to 4115.22, ORC, or the Davis-Bacon Act, as applicable.

115.07 Record Drawings. Unless otherwise provided in the supplemental Specifications or Special Provisions, upon completion of the Work on Projects administered by the Water Engineering Manager of the City's Department of Water or administered by the Chief Engineer of the Department of Aviation, the Contractor shall organize the As-built Drawings into manageable sets, bind the sets with durable paper cover sheets, certify to the accuracy of the As-built Drawings by signature thereon, and deliver the As-built Drawings to the Engineer. The Engineer shall revise the original Contract drawing tracings or computer files with the information contained on the As-built Drawings provided by the Contractor and create the Record Drawings. The City may thereafter use the As-built Drawings for any purpose relating to the Project including, without limitation, additions to or completion of the Project.

115.08 Guarantee. The Contractor shall provide a Guarantee to the City that all Work is in conformity with the Contract Documents and free from defects in workmanship, Materials and Equipment for full period permitted under Ohio law. The Contract Bond shall remain in effect for the full Guaranty period, unless the Contractor shall provide a Maintenance Bond in form and substance and from a Surety satisfactory to the City. The Guarantee time period shall commence on the date of approval of the Certificate of Contract Completion by the Authorized Representative, unless otherwise provided in writing. The Guarantee time period for any incomplete or uncorrected Work at the time of Partial Occupancy or Use, if any, shall commence with the date of approval of the Certificate of Contract Completion by the Authorized Representative, unless otherwise provided in writing. The Guarantee provided in this 115.08 shall be in addition to, and not in limitation of, any other Guarantee, Warranty or remedy provided by law or by the Contract Documents.

115.09 Warranty. The Contractor shall, prior to installing material or Equipment which is subject to a Warranty, provide a copy of the Warranty to the Engineer for review and approval.

115.10 Exercise of Guarantee or Warranty. If defects in workmanship, material or Equipment become apparent within the applicable Guarantee or Warranty period, the Authorized Representative shall notify the Contractor in writing and provide a copy of the notice to the Engineer. Within ten Days of receipt of the notice, the Contractor shall visit the Project in the company of a representative of the City to determine the extent of all defects and shall promptly repair or replace the defects, including all adjacent property damaged as a result of such defects or as a result of remedying the defects. If the repair or replacement is considered by the Authorized Representative to be an emergency, the Authorized Representative may require the Contractor to visit the Project within one Day of receipt of the notice. The Contractor shall be fully responsible for the cost of and all expenses associated with temporary Materials or Equipment required during the repair or replacement of the defects, including without limitation labor, permits and other incidentals. If the Contractor does not promptly repair or replace the defects, the City may repair or replace the defects and charge the cost thereof plus any Consultant and attorney fees incurred by the City in enforcing its Guaranty or warranty rights to the Contractor or the Contractor's Surety. Work which is repaired or replaced by the Contractor shall be inspected and

accepted by a representative of the City and shall be Guaranteed by the Contractor for the remainder of the original Guarantee time period.

115.11 Final Cleaning. At the completion of the Work, the Contractor shall restore all property not designated for alteration by the Contract Documents to as near its original condition as practicable and clean the site of the Project and adjacent property of all dust, mud, waste Materials, and rubbish attributable to the Work and shall remove any temporary controls required pursuant to the storm water pollution prevention plan and permit.

115.12 Final Cleaning Remedies. Final cleaning shall be done to the satisfaction of the Engineer and the Authorized Representative. If the Contractor fails to clean up at completion of the Work, the provision of 105.02 may be invoked. If a dispute arises as to responsibility for final cleaning, the Engineer may employ City employees or engage a qualified cleaning company, to perform the clean up and deduct the cost from amounts due to the Contractor as the Engineer recommends and the Authorized Representative determines to be appropriate. The decision of the Authorized Representative on the responsibility for such cost shall be final, subject to 118.01 through 118.11.

115.13 Work After Final Cleaning. If any Work is performed after a final cleaning by the Contractor, the Contractor shall clean any affected area again as provided in 115.11 and 115.12 so that upon Contract Completion, the Project shall be left ready for occupancy or utilization by the City.

ITEM 116 TIME

116.01 Time of Essence
116.02 Time Extensions
116.03 Critical Path
116.04 Extension Sole Remedy
116.05 Time for Contract Completion
116.06 Liquidated Damages

116.01 Time of Essence. Time is of the essence to the Contract Documents and all obligations thereunder. By executing the Contract Form, the Contractor acknowledges that the time for Contract Completion is, and by signing the Construction Schedule and Project Schedule, if applicable, that any specified milestone completion dates are, reasonable taking into consideration the usual weather and other conditions prevailing in the locality of the Project. The Contractor agrees that the Notice to Proceed shall establish the date for commencement of the Work. The Contractor agrees that the City has entered into, or may enter into, agreements or representations for use of all or part of the Project based upon the Contractor achieving Final Acceptance within the time for Contract Completion. The Contractor agrees that the Work will be prosecuted in a reasonable, efficient and economical sequence, in cooperation with the Engineer and in the order and time as provided in the current Construction Schedule and Project Schedule, if applicable. The Contractor shall perform the Work so as not to interfere with, disrupt, hinder, delay or impact the Work of other Persons on the Project and of such other Persons' Subcontractors and Material Suppliers. The Contractor agrees that the possibility that the Contractor may be subject to interference, disruption, hindrance, delay or impact in the progress of the Work from any and all causes is within the contemplation of the Contractor and the City and that the sole remedy for such interference, disruption, hindrance, delay or impact shall be an extension of time granted pursuant to 116.02, except where the Contractor establishes such interference, disruption, hindrance, delay, or impact was proximately caused by an improper action or failure to act by the Owner, in which case the Contractor may be entitled to additional compensation.

116.02 Time Extensions. If the Contractor is interfered with, disrupted, hindered, delayed or impacted at any time in the progress of the Work by any of the following causes, the time for Contract Completion shall be extended for such reasonable time which the Authorized Representative determines, in consultation with the Engineer, has been caused by the interference, disruption, hindrance, delay, or impact in the Work:

(a) Due to suspension of the Work for which the Contractor is not responsible; unusually severe weather conditions not normally prevailing in the particular season; labor dispute, excluding informational pickets; fire; or flood; or

(b) Due to any unforeseeable cause beyond the control and without fault or negligence of the Contractor;

(c) The Contractor shall request any extension of time pursuant to 117.01 through 117.11.

116.03 Critical Path. Notwithstanding any other provision of the Contract Documents, time extensions will depend upon the extent to which the Work on the critical path of the Construction Schedule is affected, or if the Project involves multiple Contractors the extent to which Work on the critical path of the Project Schedule is affected. A Change Order granting a time extension may provide that the time for Contract Completion will be extended for only those specific elements so interfered with, disrupted, hindered or delayed and that remaining milestone completion dates will not be altered and may further provide for adjustment of Liquidated Damages.

116.04 Extension Sole Remedy. Any extension of time granted pursuant to 116.02 shall be the sole remedy which may be provided by the City, unless Contractor has established that a delay was proximately caused by an improper action or failure to act by the Owner, in which case Contractor may be entitled to additional compensation. . It is within the contemplation of the Contractor and the City that the Contractor may accelerate its performance to meet the Construction Schedule and that such acceleration is solely within the discretion of the Contractor.

116.05 Time for Contract Completion. The Contractor shall diligently prosecute the Work and shall complete all Work so that Final Acceptance occurs on or before the number of consecutive Days set forth in the Contract Documents following the date set forth in the Notice to Proceed, unless the Contractor timely requests and the City grants an extension of time in accordance with the Contract Documents. The period of time established by the preceding sentence is referred to herein as the time for Contract Completion. Each applicable portion of the Work shall be completed upon the respective milestone completion date unless the Contractor timely requests and the City grants an extension of time in accordance with the Contract Documents.

116.06 Liquidated Damages. Upon failure to complete all Work within the time for Contract Completion, the City shall be entitled to retain or recover from the Contractor, as Liquidated Damages, and not as a penalty, the applicable amount set forth in the following table for each and every Day thereafter until Contract Completion, unless the Contractor timely requests and the City grants an extension of time in accordance with the Contract Documents.

LIQUIDATED DAMAGES	Contract
Contract Amount	Completion
$0 to $50,000	$150
more than $50,000 to $150,000	$250
more than $150,000 to $500,000	$500
more than $500,000 to $2,000,000	$1,000
more than $2,000,000 to $5,000,000	$2,000
more than $5,000,000 to $10,000,000	$2,500
more than $10,000,000	$3,000

The amount of Liquidated Damages is agreed upon by and between the Contractor and the City because of the impracticability and extreme difficulty of ascertaining the actual amount of damage the City, its taxpayers and the public would sustain. Liquidated Damages only replace the City's actual damages for delays, are not the City's exclusive remedy for breach by the Contractor and are not to be construed in any way as a limitation of any other rights or remedies available to the City under the Contract Documents or otherwise. If a delay of the critical path in

completion of the Project occurs which is caused by the City and the Contractor concurrently, the applicable Liquidated Damages shall be apportioned, and the specific number of Days for which the City is solely responsible for shall be deducted from the total number of Days of the concurrent delay used in calculating the Liquidated Damages and the Contractor shall pay Liquidated Damages for the remaining number of Days of delay. In addition to the amounts specified above, the City may charge the Contractor for all inspection regardless of any time extension.

ITEM 117 - CHANGES IN THE WORK

117.01 Change Order. The City Commission or the Authorized Representative, without invalidating the Contract, may order changes in the Work consisting of additions, deletions or other revisions, including without limitation revisions resulting from an extension granted in accordance with 116.04. To the extent the time for Contract Completion or the Contract price is affected, the Contract may be adjusted by Change Order in accordance with 117.01 through 117.12. The Contractor shall proportionately increase the amount of the Contract Bond whenever the Contract price is increased. If notice of any change affecting the Contract is required by the provision of any Contract Bond, the giving of any such notice shall be the Contractor's responsibility, and the amount of each applicable Contract Bond shall be adjusted accordingly.

117.02 Payment of Change Order. The Contractor shall not proceed with any change in the Work without the required written Change Order. If the Contractor believes that any item is not Work required by the Contract Documents or reasonably inferred therefrom to produce the intended results, the Contractor shall obtain a Change Order before proceeding with such item. Except as provided in 118.01 through 118.11, failure to obtain such a Change Order shall constitute a waiver by the Contractor of any claim for additional compensation for such item. The Contractor understands and agrees that agreement to a Change Order is final and without reservation of any rights.

117.03 Requirement to Perform Changed Work. If the Contractor does not agree to, or fails or refuses to sign, a Change Order, the Contractor shall perform any Work related to the Change Order as required by the Authorized Representative in accordance with 117.04; provided, however, the Contractor may seek compensation and time extension in accordance with 117.04 and 117.10 through 117.12, as applicable, and 118.01 through 118.11 for any such Work performed. The City reserves the right to cancel or modify any Change Order authorization.

117.04 Change Order Price Determination. The maximum cost or credit resulting from a change in the Work shall be determined as provided in 117.04 through 117.10. Proposals which do not set forth all information required by 117.05 and 117.10 will not be considered or accepted under any circumstances. A Unit Price Proposal shall only be valid when incorporated into the Contract by Change Order; provided, however, that Unit Price Work set forth on the Bid, included

in the Contract price and which does not exceed the scheduled quantities on the Bid may be performed and paid for without a Change Order. The amounts allowed for overhead and profit are all-inclusive, include all Contractor Project costs relating to field and home office operations, and no additional or other amounts for overhead or profit shall be allowed. The maximum cost or credit as determined by 117.10 includes all compensation for direct, indirect, and cumulative impact costs and no additional or other amounts for impact costs shall be allowed. The Contractor shall not assign any portion of the Work to another whereby the Contractor would benefit directly or indirectly from the double application of charges for overhead or profit. If no agreement can be reached between the Contractor and the City as to the cost or credit resulting from a change in the Work or the Contractor fails or refuses to sign a Change Order, the cost or credit shall be determined by the Authorized Representative, upon the recommendation of the Engineer. The Contractor shall proceed with the Change Order Work when so required by the Authorized Representative in writing. The Contractor may dispute the Authorized Representative's determination of the cost or credit by filing a claim in accordance with 118.01 through 118.11. The City reserves the right to require certified payrolls for labor costs and certified invoices for material costs, together with any other documentation the City deems in its sole discretion to be useful in analyzing the Contractor's claim and reserves the right to audit the records of the Contractor and the Contractor's Subcontractors and Material Suppliers. Failure by the Contractor to provide all requested documentation within 10 days shall constitute an irrevocable waive of Contractor's claim.

117.05 Change Order Procedures. The Contractor must be certain to comply with the applicable procedures or payment may be delayed or denied. The Engineer has responsibility for:

(a) Preparing, reviewing, recommending, coordinating, monitoring and processing a Change Order and related documents;

(b) Reviewing the Contractor's pricing within the stated time period, verifying the pricing complies with the pricing guidelines set forth in 117.10 and negotiating pricing, if necessary, to an amount acceptable to the City;

(c) If the change is to have a not-to-exceed price based on performing the Work on a time and material basis or other cost-plus basis, monitoring the Contractor's progress toward completing the revised portion of the Work and requiring that the Contractor prepare daily records of additional labor, Materials and Equipment required along with a certification from the Contractor that the records are accurate and appropriate for the revised Work. The Engineer shall review these daily records and sign them, but solely for the purposes of signifying that the records are an accurate accounting of the items described therein, and provide a signed copy of the daily records to the Authorized Representative. The signed daily records are also to be attached to the Change Order. If the changed Work should cost less than the maximum amount noted on the Change Order, the Engineer is also responsible for preparing a deduct Change Order for the cost difference;

(d) Reviewing and resolving the Contractor's request for an extension of time related to a Change Order in accordance with 116.01 through 116.06 and 117.12;

(e) Confirming that the City concurs with the change and has available funds or a written commitment for funding the Change Order;

(f) Monitoring the overall Change Order process for timeliness and follow up.

The Contractor has responsibility for:

(a) Responding to requests for pricing within the stated time period;

(b) Preparing all necessary Proposals in sufficient detail for intelligent review with pricing and schedule impact, including those of all affected Subcontractors and Material Suppliers according to the pricing guidelines set forth in 117.10 or Unit Prices, as applicable, and negotiating pricing, if necessary;

(c) If the change is proposed to have a not-to-exceed price based on performing the Work on a time and material basis or other cost plus basis, furnishing and certifying detailed records of all labor, Materials and Equipment provided. If the changed Work should cost less than the maximum amount noted on the Change Order, the Contractor is also responsible for executing a deduct Change Order prepared for the cost difference;

(d) Proceeding with the Work upon receipt of a fully signed Change Order;

(e) If the Contractor performs Work without the appropriate, required Change Order, the Contractor does so at the Contractor's own risk that payment for such Work may not be approved or made, unless the City has required the Contractor to perform the Work in accordance with 117.03 and 117.04;

(f) Providing the changed Work in a timely manner and as authorized by the Change Order, all in accordance with the requirements of the Contract Documents; and

(g) Timely providing to Engineer and the Authorized Representative all requested backup documentation.

117.06 Change Order Process. When a change to the Work is ordered, the Engineer shall:

(a) Prepare an estimate of the cost of the changed Work and verify with the Authorized Representative that the change is ordered and that funds are available in the amount of the estimate for the Work;

(b) Prepare a detailed scope of Work in Bulletin form, including any necessary Drawings;

(c) Submit the Bulletin to the Authorized Representative for approval, along with a justification letter indicating the reason for the change in the Work;

(d) Upon receipt of approval by the Authorized Representative, release the Bulletin to the Contractor with a date specified for the Contractor to return a Proposal. If the Contractor fails to respond to the Engineer within the time specified, or as otherwise agreed to in writing by the Contractor and the Engineer, the Contractor shall be responsible for any additional costs incurred by the Contractor, the Engineer and the City resulting from any attendant delay;

(e) Review the Contractor's Proposal, verifying that pricing complies with the pricing guidelines set forth in 117.10 or Unit Prices, as applicable, and negotiate the price if required to obtain a price less than the maximum established by the pricing guidelines or different from the amount calculated using Unit Prices where appropriate. Within seven Days of receipt of the Contractor's Proposal, the Engineer shall notify the Contractor whether the Proposal is acceptable in form or advise the Contractor in writing of the reasons for disapproval. If negotiation of the price is necessary, any failure of the Contractor to respond appropriately and within the time specified, or as otherwise agreed to in writing by the Contractor and the Engineer shall cause the Contractor to be responsible for any additional costs incurred by the Contractor, the Engineer and the City resulting from any attendant delay;

(f) Determine the basis for pricing the Work and confirm whether the Work is for a fixed price, or for a not-to-exceed price based on performing the Work on a time and material basis, or other cost-plus basis. Verify that any Subcontractor and Material Supplier pricing is included and complies with the pricing guidelines set forth in 117.10 or Unit Prices, as applicable. Review any requested time extension with the Authorized Representative to be determined according to 116.01 through 116.06 and 117.12 and obtain written recommendation of approval of the Change Order from the Engineer and the applicable Director if other than the Engineer. Sign and obtain the Contractor's signature on the Change Order;

(g) Submit the Proposal to the Authorized Representative or the City Commission, as applicable, for approval along with the written recommendation of approval or disapproval of the Proposal of the City Engineer and other City Department head, if applicable;

(h) Deliver multiple copies of the signed Change Order package to the Authorized Representative for signing and any necessary fund certification. Upon signing by the Authorized Representative, the Authorized Representative shall return copies of the executed Change Order to the Contractor and the Engineer. The Contractor may bill for Work covered by the Change Order only after this final step.

117.07 Paperwork Consolidation. Related transactions occurring at or about the same time shall, whenever possible, be consolidated into the same Bulletin or Change Order, or both. Add and deduct items may be included on the same Change Order, as well as items with different reasons for changed Work so long as the reason and pricing for each item is separately stated.

117.08 Change Order Numbering System. Unless otherwise provided in the Contract Documents, the Engineer shall assign a number to each change which shall be stated on the Bulletin, starting with number 001. All Contractors affected by the change will be recorded under the same number. The Engineer will establish and maintain a Change Order log to track all activities related to Change Order processing and taking care not to duplicate or reuse any Change Order number throughout the Project.

117.09 Project Contingency Funds. Project Contingency Funds shall be reserved to pay costs resulting from Change Orders, unanticipated job conditions, to comply with rulings regarding building and other codes, to pay costs related to errors and omissions in Contract Documents, and to pay the cost of settlements and judgments related to the Project. Change

Orders for which there are sufficient moneys in the Contract price including the Project Contingency Funds must be approved by the Engineer and the Authorized Representative. Change Orders which would increase the Contract price must be approved by the City Commission.

117.10 Change Order Pricing Guidelines. For each change, the Contractor shall furnish a detailed, written Proposal itemized according to these pricing guidelines. Any Subcontractor or Material Supplier pricing shall also be itemized according to these pricing guidelines. Where Unit Prices were included in the Bid and the Contract price, the Engineer may also require incorporation of such Unit Prices or preparation of an Alternate Proposal incorporating such Unit Prices. These pricing guidelines are intended to establish the maximum amount which the City will pay for any Change Order, including without limitation all amounts for interference with, delay, hindrance, disruption or impact of the Work. A Change Order may provide that the City may pay less than the amount established by these pricing guidelines if such amount is negotiated by the Engineer in accordance with 117.06 or is determined in accordance with 118.01 through 118.11. As provided in 114.01 the Contract Cost Breakdown may be used by the City to determine any cost or credit. In order to expedite the review and approval process, all Proposals shall be prepared in the categories and in the order listed below. This provision is intended to be, and shall be construed as, consistent with, and not in conflict with, Section 4113.62, ORC to the fullest extent permitted. The pricing guidelines are:

(a) LABOR - All field labor shall be priced at the current base rate, excluding fringe benefits, of the prevailing wage in the Project locality. The Proposal and documentation is to include number of hours and rate of pay for each classification of worker. If the Contractor pays an employee a base rate exceeding prevailing wage, the Contractor shall submit certified payroll records that substantiate that rate. Any Contractor performing Work on a time and material basis or the cost-plus basis Work shall submit certified payroll records for all employees performing that Work;

(b) FRINGES - All established payroll taxes, assessments and fringe benefits on the labor. This may include, without limitation, FICA, Federal and State Unemployment, Health and Welfare, pension Funds, Workers' Compensation and Apprentice Fund. Each of the fringes is to be a separate line item. The Contractor shall submit documentation supporting the calculation of the amounts for each fringe for each worker classification;

(c) EQUIPMENT RENTALS - All charges for certain non-owned heavy or specialized Equipment at up to one hundred percent of the documented rental cost. No rental charges will be allowed for hand tools, minor Equipment, simple scaffolds, etc. Downtime due to repairs, maintenance and weather delays will not be allowed. The Contractor shall submit copies of actual paid invoices to substantiate rental costs;

(d) OWNED EQUIPMENT - All charges for certain owned, heavy or specialized Equipment at up to one hundred percent of the cost listed by the Associated Equipment Dealers Green book rental rates and Specifications for construction Equipment. No recovery will be allowed for hand tools, minor Equipment, simple scaffolds, etc. The longest period of time that the Equipment is to be required for the Work will be the basis for the pricing. Downtime due to repairs, maintenance and weather delays will not be allowed;

(e) TRUCKING - A reasonable delivery charge or per-mile trucking charge for delivery of required Materials or Equipment. Charges for use of a pick-up truck will not be allowed;

(f) OVERHEAD - Overhead on items in 117.10 (a)-(d) up to ten percent, which shall include all costs required to schedule and coordinate the Work. Overhead includes, without limitation, telephone, telephone charges, facsimile, electronic mail, telegrams, postage, photos, photocopying, hand tools, simple scaffolds (1 level high), tool breakage, tool repairs, tool replacement, tool blades, tool bits, home office estimating and expediting, home office clerical and accounting support, home office labor (management, supervision, engineering), all other home office expense, legal services, travel and parking expenses; provided, however, shop or engineering labor, which shall not be subject to prevailing wage rates, for steel Fabricators, sheet metal Fabricators and sprinkler system Fabricators will be allowed under 117.10 (a)-(d);

(g) MATERIALS - All Materials purchased by the Contractor and incorporated into the changed Work, showing costs, quantities, or Unit Prices of all items, as appropriate. Reimbursement of material costs shall only be allowed in the amount of the Contractor's actual cost, including any and all discounts, rebates or related credits. One-third of the cost of reusable Materials for each use, such as formwork lumber, shoring or temporary enclosures;

(h) PROFIT - Profit on items in 117.10 (a)-(g) up to ten percent;

(i) SUBCONTRACTOR - The reasonable cost of all labor and material provided by a Subcontractor whose pricing is included and which complies with these pricing guidelines;

(j) CONTRACTOR MARK-UP ON SUBCONTRACTOR - Mark-up on items in 117.10 (i) up to five percent or 2,500 dollars, whichever is less;

(k) MISCELLANEOUS - The following items are allowable as the cost of the Work, with no overhead or profit:

.1 Any additional bond or insurance premium specifically incurred as a result of the Change Order;

.2 Fees for permits, licenses, inspections, test, etc.; and

(l) Costs which will not be reimbursed for Change Order Work include the following:

.1 Overnight lodging, travel and food;

.2 Employee Profit Sharing Plans - regardless of how defined or described, the Contractor will pay these charges from
Contractor profit and will not be reimbursed; and

.3 Voluntary Employee Deductions - examples are United Way and U.S. Savings Bonds.

(m) State sales tax shall be allowed on items as described in 104.18.

117.11 Differing Site Conditions. Subject to 103.06, during the progress of the Work, if subsurface or concealed conditions are encountered at the site differing materially from those indicated in the Contract Documents or if subsurface or concealed physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the Work provided for in the Contract Documents, are encountered at the site, the Contractor shall promptly notify the Engineer in writing of the specific differing conditions before they are disturbed or the affected Work is performed and if such notice is not possible, in no event later than 2 Business Days after Contractor first observed the conditions. Upon notification, the Engineer will investigate the conditions and if it is determined that the conditions materially differ and cause an increase or decrease in the cost or time required for the performance of any Work under the Contract, a Change Order may be issued in accordance with the 117.01 through 117.12, as applicable. The City may decline to issue a Change Order if the notice required by this 117.11 is not timely provided by the Contractor. If the Contractor fails to timely provide the notice required by this 117.11, the Contractor shall be deemed to have waived any and all claims for additional compensation or time extensions for the related subsurface or concealed physical condition.

117.12 Time Extension. Notwithstanding any other provision of the Contract Documents, time extensions for changes in the Work will depend upon the extent to which the change causes delay in Work on the critical path of the Construction Schedule or if the Project involves multiple Contractors of the Project Schedule as determined pursuant to 109.06 and 109.05, respectively. If extending the time for Contract Completion is not possible, the Contractor shall price, and separately state, all costs of accelerated performance in the Contractor's Proposal. A Change Order granting a time extension may provide that the time for Contract Completion will be extended for only those specific elements actually delayed and that remaining milestone completion dates will not be altered and may further provide for adjustment of Liquidated Damages, to the fullest extent permitted by law. The Contractor shall not be entitled to any time extensions for delays caused by Contractor, its subcontractors, suppliers, normal weather conditions for the time of year and locality, or abnormal weather conditions that do not affect the critical path.

ITEM 118 DISPUTE RESOLUTION PROCEDURE

118.01 Notice and Claim Requirements. Whenever the Contractor intends to seek additional time or compensation or mitigation of Liquidated Damages, whether due to delay, extra Work, additional time or Work, breach of Contract, or other causes arising out of or related to the Contract or the Project, the Contractor shall follow the procedures set forth in 118.01 through 118.11. The Contractor acknowledges and agrees that the Owner may delay, interfere with, and/or disrupt the Work of the Contractor, and such actions do not constitute a material breach of contract by the Owner, since the Contractor is entitled to additional compensation by properly submitting and pursuing a Claim as permitted by these Specifications. To the fullest extent permitted by law, failure by the Contractor to follow the procedures in 118.01 through 118.11 is a waiver of any claim for additional time or compensation or for mitigation of Liquidated Damages. Compliance with all applicable procedures in 118.01 through 118.11 is a condition precedent to the filing by the Contractor of any litigation related to the Contract or the Project.

118.02 Filing of Notice. Unless a shorter notice period is provided elsewhere in this Agreement, the Contractor shall file notice of any claim with the Engineer, in writing, no more than ten Days after the initial occurrence of the events, which are the basis of the claim. To the fullest extent permitted by law, failure of the Contractor to timely and completely provide such notice shall constitute a waiver by the Contractor of any claim for additional time or compensation or for mitigation of Liquidated Damages. Every such written notice shall provide the following information to permit timely and appropriate evaluation of the claim, determination of responsibility and opportunity for mitigation:

(a) Nature of claim and estimated amount of the claim, including all costs for interference, disruption, hindrance, delay and any impact, which amount shall be calculated in accordance with the pricing guidelines set forth in 117.10, shall be based upon the Contractor's experience and shall be a fair and reasonably accurate assessment of the damages suffered or anticipated by the Contractor, as applicable;

(b) Specific number of Days of extension requested and specific number of Days for remobilization requested;

(c) Identification of Persons and events responsible for causing the claim, including without limitation the date or anticipated date, as applicable of the commencement of any interference, disruption, hindrance, delay or impact;

(d) Identification of activities on the Construction Schedule and the Project Schedule, if applicable, which will or may be affected by the claim or new activities which will or may be created and the relationship with existing activities;

(e) Anticipated impacts and anticipated duration of any interference, disruption, hindrance, delay or impact and any remobilization period; and

(f) Recommended action to avoid or minimize any interference, disruption, hindrance, delay or impact.

118.03 Filing of Claim. With respect to every claim submitted, the Contractor shall file three copies of its claim with the Engineer not more than thirty Days after the notice required by 118.02 and, in all events prior to Contract Completion. The Contractor's claim shall detail the amounts claimed and provide the following information to permit timely and appropriate evaluation of the claim, determination of responsibility and any remaining opportunity for mitigation. If the Contractor is unable to calculate any amount claimed in detail, the Contractor shall use its best efforts to provide a reasonable estimate of such amount:

(a) A narrative of the event, or combination of events, claimed as resulting in interference, disruption, hindrance, delay or impact to the Contractor, including the start date of the event or events and the actual, or anticipated, finish date;

(b) A quantification of the planned Work items and the changed scope of Work items claimed as having been impacted;

(c) A time impact analysis, consistent with standard critical path methodology for scheduling, demonstrating the impact to the Contractor's scheduled activities;

(d) Copies of the Contractor's daily log for each Day of impact;

(e) Copies of relevant correspondence and other information regarding or supporting Contractor entitlement;

(f) Copies of Contractor payroll records for labor impacts claimed by Contractor and any Subcontractor affected by the event or events;

(g) Copies of invoices for material impacts claimed by the Contractor and any Subcontractor affected by the event or events;

(h) Copies of Equipment records, or rental invoices, for any Equipment impacts claimed by the Contractor or any Subcontractor affected by the event or events;

(i) Copies of the most recent Contractor's income statement, including segregated general and administrative expenses for the most recent reporting period, and for the period of the Contract, if available, and similar information for any Subcontractor claim included;

(j) A copy of Contractor's original coded bid takeoff and estimating records that formed the basis of Contractor's bid;

(k) Contractor's coded Job Cost Report with a key to the coding;

(l) A statement, signed by an authorized representative of the Contractor, certifying that the claims are made in good faith, the supporting data is accurate and complete to the best of the Contractor's knowledge and belief and the amount requested accurately reflects the Contract adjustment for which the Contractor believes the City is liable in accordance with the Contract Documents, in particular the pricing guidelines set forth 117.10.

The City may request documents and information from the Contractor in addition to those listed in this 118.03, as the City determines necessary to evaluate and comment upon the Claim. Upon receipt of such request from the Owner, the Contractor shall provide all requested documents and information within ten (10) days. The Contractor shall provide the requested documents in the formats requested, which include both paper and electronic copies. If requested by the City, the electronic copies shall be provided in native computer language. The Contractor's provision of the requested documents to the City in the format requested by the City shall be a condition precedent to any further proceeding under the Contract Documents. Failure to provide the requested documents shall be a material breach of the Contract, and the Contractor shall indemnify the City for all of the City's costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the Contractor's failure to comply with this provision. If the Contractor fails to provide the requested documents, the Contractor shall be deemed to have irrevocably waived its claim.

118.04 Claim Response. Immediately upon receipt of any claim submitted by the Contractor in accordance with 118.03, the Engineer shall deliver 2 copies to the Authorized Representative. Upon submission of the claim by the Contractor, the Engineer shall convene a meeting with the Contractor and any applicable Subcontractors and Material Suppliers to review and discuss the claim. The Engineer shall review the Contractor's claims with all attendees and discuss any questions regarding the nature or content of the required items. Any items deemed deficient shall be corrected by the Contractor before the Engineer will commence review in accordance with 118.05. The Engineer shall document the timeliness of notice provided under paragraph 118.02 and the actual date of corrected submission of the claim.

118.05 Claim Review and Decision. Upon corrected submission of the claim and all requested documentation by the Contractor, the Engineer shall review the claim and prepare a written analysis of its content. The analysis may include a narrative of the examination of the facts giving rise to the claim, relevant Contract Documents and language therein, an analysis of claimed additional labor, Materials and Equipment for the scope of the Work items described and an analysis of any time extension for any interference, disruption, hindrance, impact or delay claimed (including the calculation of any concurrent delays affecting entitlement) and shall include confirmation of the calculation of claimed labor, Materials and Equipment as conforming to the pricing guidelines set forth in 117.10 and a concluding recommendation regarding Contractor entitlement to, and the appropriateness and reasonableness of, all or any part of, the claimed costs and time extension. The Engineer may include copies of contemporaneous documentation supporting any recommendation regarding the sufficiency or inadequacy of the Contractor's claim, the Contractor's performance or the rebuttal of the claim. The Engineer shall prepare and submit the claim analysis to the Authorized Representative within thirty Days of the corrected

submission of the claim. The Authorized Representative shall examine the Contractor's claim, and the analysis of the claim submitted by the Engineer. The Authorized Representative shall approve or deny all or any part of, the Contractor's claim and forward a written decision to the Contractor and the Engineer within thirty Days after receipt of the Engineer's claim analysis. The decision of the Authorized Representative shall be final and conclusive, unless the Contractor appeals the decision to the Board of Review in accordance with 118.06. In the event either the Engineer or the Authorized Representative fail to act in accordance with the foregoing schedule, the claim shall be deemed denied.

118.06 Appeal to Board of Review. The Contractor may appeal the decision of the Authorized Representative to the Board of Review by written notice to the Authorized Representative within ten Days of receipt of the Authorized Representative's decision or, in the absence of a decision, within 10 days of the expiration of the time set forth in 118.05. Failure by the Contractor to provide notice of an appeal within the said 10-day period shall result in the Engineer's decision becoming final and binding upon the Contractor. The Board of Review shall meet within thirty Days of receipt of the notice by the Authorized Representative. The Contractor shall be given an opportunity to present the claim at the meeting. The purpose of the meeting shall be to settle the issues in dispute. The Board of Review shall render a decision on the claim within thirty Days of the meeting unless a mutual agreement is made between the Contractor and the Board of Review to extend the time for decision. The decision of the Board of Review shall be final and conclusive, unless the Contractor provides written notice to the Authorized Representative of the Contractor's intention to file litigation within ten Days of receipt of the decision. The filing of an appeal and the provision of notice of intention to file litigation are each a condition precedent to the filing of any litigation related to the Project or the Contract by the Contractor and any failure by the Contractor to timely fulfill them will preclude the Contractor from filing any such litigation.

118.07 Alternate Dispute Resolution. If, upon consideration of a claim, the Contractor and the City mutually agree in writing, the dispute resolution procedure may be waived, or the claim may be referred to a form of Alternative Dispute Resolution, including a procedure to equitably share the costs of the Alternative Dispute Resolution.

118.08 Delegation. No provision shall prevent the Board of Review or the Authorized Representative from delegating the duties or authorities of the Board of Review or the Authorized Representative to any third Person selected at the discretion of the Board of Review or Authorized Representative, as applicable.

118.09 Auditing of Claims. All claims by the Contractor shall be subject to audit at any time following the filing of such claim, whether or not such claim is part of litigation pending in the courts of this State. The audit may be performed by employees of the City or by a consultant engaged by the City. The audit may begin on ten Days' notice to the Contractor, Subcontractor or Material Supplier, as applicable. The Contractor, Subcontractor or Material Supplier shall use its best efforts to cooperate with the audit. Failure of the Contractor, Subcontractor or Material Supplier to maintain and retain sufficient records to allow the City to verify the claim shall constitute a waiver of any portion of such claim that cannot be verified. Without limiting the foregoing, and as a minimum, the Contractor, Subcontractor or Material Supplier shall make available to the City the following documents:

(a) Daily time sheets and foreperson's daily reports;

(b) Union agreements, if any and employer agreements;

(c) Insurance, welfare, fringes and benefits records;

(d) Payroll register;

(e) Earnings records;

(f) Payroll tax returns;

(g) Material invoices, purchase orders, Subcontractor Contracts and all material and supply acquisition Contracts;

(h) Material cost distribution worksheets;

(i) Equipment records (list of Contractor Equipment, rates, etc.);

(j) Vendor rental agreements, and Subcontractor invoices;

(k) Subcontractor payment certificates;

(l) Canceled checks (payroll and vendors);

(m) Job cost reports;

(n) Job payroll ledger;

(o) General ledger, general journal, (if used) and all subsidiary ledgers and journals together with all supporting documentation pertinent to entries made in these ledgers and journals;

(p) Cash disbursements journal;

(q) Financial statements for all years reflecting operations on the Project;

(r) Income tax returns for all years reflecting operations on the Project;

(s) Depreciation records on all Equipment utilized whether such records are maintained by the Contractor involved, its accountant, or others;

(t) If a source other than depreciation records is used to develop costs for the Contractor's internal purposes in establishing the actual cost of owning and operating Equipment, all such other source documents;

(u) All documents which reflect the Contractor's actual profit and overhead, or the calculation of overhead multipliers, during the years the Project was being performed and for each of the five years prior to the commencement of this Project;

(v) All documents related to the preparation of the Contractor's Bid, including the contemporaneous final calculations on which the Bid was based;

(w) All documents which relate to each and every claim together with all documents which support or negate the amount of damages as to each claim;

(x) Worksheets used to prepare the claim establishing the cost components for items of the claim including, but not limited to, labor, fringes, benefits and insurance, Materials, Equipment, Subcontractors, and all documents which establish the time periods, individuals involved, the hours and rate of pay for the individuals; and

(y) All other documents required by the City in its discretion to intelligently review the claim.

118.10 False Certification of Claims. The Contractor shall not knowingly present or cause to be presented to the Owner a false or fraudulent Claim. "Knowingly" shall have the same meaning as in Section 3729(b) USC of the Federal False Claims Act. If the Contractor knowingly presents or causes to be presented a false or fraudulent Claim, then the Contractor shall be liable to the Owner for the same civil penalty and damages as the United States Government would be entitled to recover under such Section 3729(a) USC and shall also indemnify and hold the City harmless from all costs and expenses, including the City's attorneys' and consultants' fees and expenses incurred in investigating and defending against such Claim and in pursuing the collection of such penalty, damages, and fees and expenses. If any Contractor falsely certifies all or any part of a claim, the portion of the claim so certified shall be denied. If any Contractor is found to have falsely certified all or any part of any claim, that fact may be used to support a finding of ineligibility in future Bids for the award of any City Contract.

118.11 Performance and Payment. The Contractor shall proceed with performance of the Work during any dispute resolution process, unless otherwise agreed by the Contractor and the Authorized Representative in writing. The City shall continue to make payment of any undisputed amounts in accordance with the Contract Documents pending final resolution of a claim, unless otherwise agreed by the Contractor and the Authorized Representative in writing. If the Contractor accepts the decision of the Authorized Representative or the City Commission and foregoes litigation of the claim, any payment to be made, credit to be provided or extension of time to be granted pursuant to the decision shall be evidenced by a Change Order package consisting of a completed Change Order form signed by the Contractor, the Engineer and the Authorized Representative, a copy of the approval of the City Commission and any necessary supporting documentation and any payment shall be made pursuant to a Payment Request in accordance with 114.02 and 114.03 or 114.10 through 114.13, as applicable.

118.12 Settlement Offers. If the Contractor initiates a Claim, the City may make settlement offers to settle the Claim at any time up to the date of the trial. Such settlement offers shall be subject to Rule 408 (Compromise and Offers of Compromise) of the Ohio Rules of Evidence. If at any stage of the litigation, including any appeals, the Contractor's Claim is dismissed or found to be without merit, or if the damages awarded to the Contractor on its Claim do not exceed the City's last settlement offer, the Contractor shall be liable to the City and shall reimburse the City for all of the City's attorneys' fees and expenses, and arising out of or related to such Claim since the date of such last settlement offer.

ITEM 119 CONTRACT TERMINATION

119.01 Notice to Surety. The Authorized Representative shall provide notice to the Contractor's Surety of any Suspension or Termination pursuant to 119.01 through 119.05; provided, however, the failure to provide such notice shall not release the Surety from any of its obligations.

119.02 Suspension of Work. If, in the judgment of the Authorized Representative, the Contractor is causing undue risk of damage to any part of the Project or adjacent area, the Authorized Representative may suspend the Work temporarily, either wholly or in part, for such period until, in the judgment of the Authorized Representative, the safe and proper prosecution of the Work may be resumed. The Authorized Representative may also suspend the Work either in whole or in part for a specified number of Days on account of public necessity, adverse weather conditions, or other similar reasons which are beyond the control of the Contractor. In case of such a suspension, an extension of time, if appropriate, may be allowed as provided in the Contract Documents but no payment will be made to the Contractor for any expense or damages resulting therefrom, except where Contractor has established that a delay was proximately caused by an improper action or failure to act by the Owner, in which case Contractor may be entitled to additional compensation. Any failure of the Authorized Representative to suspend the Work shall not relieve the Contractor of the Contractor's responsibility to perform the Work safely and in accordance with the Contract Documents. The Contractor shall, upon receipt of notice of suspension, cease Work on the suspended activities and take all necessary or appropriate steps to limit disbursements and minimize costs with respect thereto. The Contractor shall furnish a report to the Authorized Representative, within five Days of receipt of the notice of suspension, describing the status of the Work, including without limitation, results accomplished, conclusions resulting therefrom, and such other information as the Authorized Representative may require. In the event of suspension, the Contractor shall be entitled to payment of compensation due under the Contract Documents, upon submission of a proper invoice, for the Work performed prior to receipt of notice of suspension, which shall be payable based upon the Contract Cost Breakdown.

119.03 Termination for Convenience. The City may, at any time upon seven Days written notice to the Contractor, terminate the Contract in whole or in part for the City's convenience and without cause. Upon receipt of the notice of termination for convenience, the Contractor shall immediately, in accordance with instructions from the Authorized Representative, proceed with performance of the following duties:

(a) Cease operation as specified in the notice;

(b) Place no further orders and enter into no further subcontracts for Materials, labor, services or facilities except as necessary to complete continued portions of the Project;

(c) Terminate all subcontracts and orders to the extent they relate to the Work terminated;

(d) Proceed to complete the performance of any Work not terminated; and

(e) Take actions that may be necessary, or that the Authorized Representative may require, for the protection and preservation of the terminated Work.

Upon termination for convenience, the Contractor shall be paid in accordance with the Contract Cost Breakdown for Work completed, including any amount retained, and the value of Materials ordered and delivered, less any salvage credit the Contractor may receive for them. All Materials, Equipment, facilities and supplies at the Project site, or stored off site, for which the Contractor has been compensated, shall become property of the City. The Contractor may submit evidence of any reasonable expenses directly attributable to the termination of the Work for consideration by the City. The Contractor shall not be entitled to any profit or overhead for Work not performed and in no event shall the Contractor's compensation exceed the total Contract price. Any dispute as to the sum then payable to the Contractor shall be resolved in accordance with the provisions of 118.01 through 118.11.

119.04 Termination for Cause. If the City determines that the Contractor has failed to prosecute the Work with the necessary force or in a timely manner; failed to make payments to Subcontractors or Suppliers pursuant to the agreements between the Contractor and Subcontractors or Suppliers; disregards any applicable laws, statutes, ordinances, codes, rules, regulations, or lawful orders of a public authority; has refused to remedy any Defective Work; or is otherwise in substantial breach of the Contract Documents, the Authorized Representative shall notify the Contractor and the Contractor's Surety of such failure or refusal. The Contractor shall begin to cure such failure or refusal within two Business Days of receipt of the notice. If the Contractor fails to continuously and diligently pursue and cure such failure or refusal within twenty Days of receipt of the notice, the City may, without prejudice to any of its other rights or remedies, terminate the Contract and employ upon the Work the additional force, or supply the Materials or such part of either as is appropriate, and may remove Defective Work. If the Contractor is so terminated, the Contractor's Surety may be given the option to engage another Contractor to perform the Contract, with the approval of the Authorized Representative. If the Contractor's Surety does not commence performance of the Contract within ten Days of the date on which the Contract was terminated, the City may complete the Work by such means as the Authorized Representative deems appropriate. The City may take possession of and use all Materials, facilities, and Equipment at the Project site or stored off site for which the City has paid. If the Contract is so terminated, the Contractor shall not be entitled to any further payment. If the City completes the Work and if the cost of completing the Work exceeds the balance of the Contract price, including compensation for all direct and consequential damages incurred by the Engineer and/or the City as a result of the termination, such excess shall be paid by the Contractor or the Contractor's Surety. If the Contractor's Surety performs the Work, the provisions of the Contract Documents shall govern the Surety's performance, with the Surety being substituted for the Contractor in all such provisions including, without limitation, provisions for payment for the Work and provisions about the right of the City to complete the Work. Upon a final determination, by a court of competent jurisdiction, that the termination pursuant to 119.04 was improper, the termination shall be deemed a termination for convenience pursuant to 119.03.

119.05 Contractor Bankruptcy. If the Contractor files a voluntary petition in bankruptcy or has an involuntary petition in bankruptcy filed against the Contractor, or if the Contractor makes

a general assignment for the benefit of creditors, or if a receiver is appointed for all or a substantial part of the Contractor's business or property, the Authorized Representative shall serve written notice on the Contractor and the Contractor's Surety stating that any failure of the Contractor to provide adequate assurances of continued performance will be considered a rejection of the Contract, which shall result in termination of the Contract for cause. In such event, Surety shall be immediately responsible for timely and property completion of the Work. Such termination of the Contract need not be evidenced by an order of any court rejecting the Contract. Upon a final determination, by a court having jurisdiction, that the termination was improper, the termination will be deemed to be a termination for convenience pursuant to 119.03.

ITEM 120 - AUDITS AND RECORDS

120.01 Examination
120.02 Termination and Disputes
120.03 Non-Disclosure by Contractor
120.04 Interest

120.01 Examination. The City shall have the right to examine all books, records, documents and other data of the Contractor and of the Contractor's Subcontractors and Material Suppliers related to the Bidding, pricing, or performance of the Work, including without limitation for the purpose of evaluating any Proposal or claim. Such Materials shall be made available at the office of the Contractor, Subcontractor, or Material Supplier, as applicable, at all reasonable times for inspection, audit and reproduction until the expiration of seven years after the date of Final Acceptance of the Project by the City. To the extent that the Contractor, Subcontractor, or Material Supplier, as applicable, informs the City in writing that any documents copied by the City are trade secrets, the City shall treat such documents as trade secrets of the Contractor, Subcontractor, or Material Supplier, as applicable. In the event, any dispute arises with any other Person about whether such other Person should be given access to the documents, the Contractor, Subcontractor, or Material Supplier, as applicable, agrees to indemnify the City against all costs, expenses and damages, including without limitation attorneys' fees, incurred or paid by reason of such dispute. The right of inspection, audit, and reproduction shall extend to all documents necessary to permit adequate evaluation of the cost of pricing data submitted along with the computations and Projections used therein.

120.02 Termination and Disputes. If the Contract has been terminated, in whole or in part, the records relating to the Work terminated shall be made available to the City for a period of seven years from the date of any applicable final settlement or payment, as applicable. Records which relate to disputes, litigation, or settlement of claims arising out of the performance of the Work shall be made available until such dispute, litigation or settlement has been finally decided or settled.

120.03 Non-Disclosure by Contractor. The Contractor shall not disclose, at any time during or after the Work, either directly or indirectly, any confidential records, knowledge or information which the Contractor may acquire about the Project or the City, except as may be required by law or order of a court of competent jurisdiction.

120.04 Interest. Moneys owed to the Contractor by the City pursuant to the terms of the Contract Documents, which are not paid when due shall accrue straight interest at the rate paid by the STAR Account, from the date the moneys become due until the moneys are paid. Any contrary provisions of 153.12, 153.13, 153.14 and 153.63, ORC, do not apply to this Contract.

CITY OF DAYTON CMS MODIFICATIONS FOR ONLINE BIDDING MODIFICATIONS

The City of Dayton Construction and Material Specifications Modifications for Online Bidding are hereby modified by this Contract as follows:

1. The definition of Authorized Representative contained in Section 102 shall be removed and replaced with the following:

   Authorized Representative: The Authorized Representative for the Contract is the Director of the City of Dayton, Department of Public Works, or duly authorized designee.

2. The definition of Engineer in Section 102 shall be removed and replaced with the following:

   Engineer: The Engineer for the Contract the Chief Engineer – Division of Civil Engineering, Department of Public Works or duly authorized designee.

3. Section 103.36 is hereby removed and replaced with the following:

   103.36 Bid Guaranty. The Bidder must file with the Bid a Bid guaranty, payable to the City of Dayton, in the form of the signed Bid guaranty and Contract Bond contained in the Contract Documents, for at least 10% of the full amount of the Base Bid plus any Alternates. The Bid guaranty shall be submitted through the Electronic Bidding Service. The Bid guaranty shall be in form and substance satisfactory to the City and shall serve as an assurance that the Bidder will, upon acceptance of the Bidder's Bid, comply with all conditions precedent for execution of the Contract Form and execute the Contract Form within the time specified by the City. ANY BID GUARANTY MUST BE PAYABLE TO THE CITY OF DAYTON. A Bid may be rejected if the Bid guaranty is payable to any other Person. IF THE BLANK LINES FOR THE AMOUNT ON THE BID GUARANTY AND CONTRACT BOND ARE NOT FILLED IN, THE PENAL SUM WILL AUTOMATICALLY BE THE FULL AMOUNT OF THE BASE BID PLUS ADD ALTERNATES. If those blank lines are filled in, the amount must not be less than the full amount of the Base Bid plus add Alternates, stated in dollars and cents. A PERCENTAGE IS NOT ACCEPTABLE. The Bid guaranty and Contract Bond must be signed by an authorized agent with Power of Attorney from a Surety. The Bid guaranty and Contract Bond must be issued by a Surety authorized by the Department of Insurance to transact business in Ohio. The requirements of Section 3905.41, ORC, may be applicable to require the Bid guaranty and Contract Bond be countersigned by an Ohio resident agent. The Bidder must determine whether this requirement is applicable to the Bidder's Surety. Bid guaranties will be returned to all unsuccessful Bidders seventy-five Days after the Bid Deadline or upon execution of the Contract Form by the apparently successful Bidder, whichever is earlier.

4. Section 106.13 is hereby removed and replaced with the following:

   106.13 Construction Schedule. If the Contractor fails to prosecute the Work in accordance with the Construction Schedule, the provisions of Section 105.02 may be invoked.

5. Section 107.19 is hereby removed.

6. Sections 109.05, 109.06, 109.07, 109.08, 109.09, 109.10, 109.11, and 109.12 are hereby removed and replaced with the following:

109.05 Construction Schedule. The Contractor shall prepare a preliminary Construction Schedule within 30-days of the issuance of a Notice to Proceed. The Contractor shall submit the preliminary Construction Schedule in the form of a Gantt Chart. A Gantt Chart consists of a table of project task information and a bar chart that graphically displays the project schedule, depicting progress in relation to time and often used in planning and tracking projects. The Engineer within seven Days of receipt of the preliminary Construction Schedule shall provide written comments to the Contractor. Within 5 days of receipt of the Engineer's comments, the Contractor shall incorporate the comments and submit a revised Construction Schedule to the Engineer. The Contractor shall update the Construction Schedule every thirty days. The table associated with the Gantt Chart shall be formatted in accordance with the following tables as a minimum:

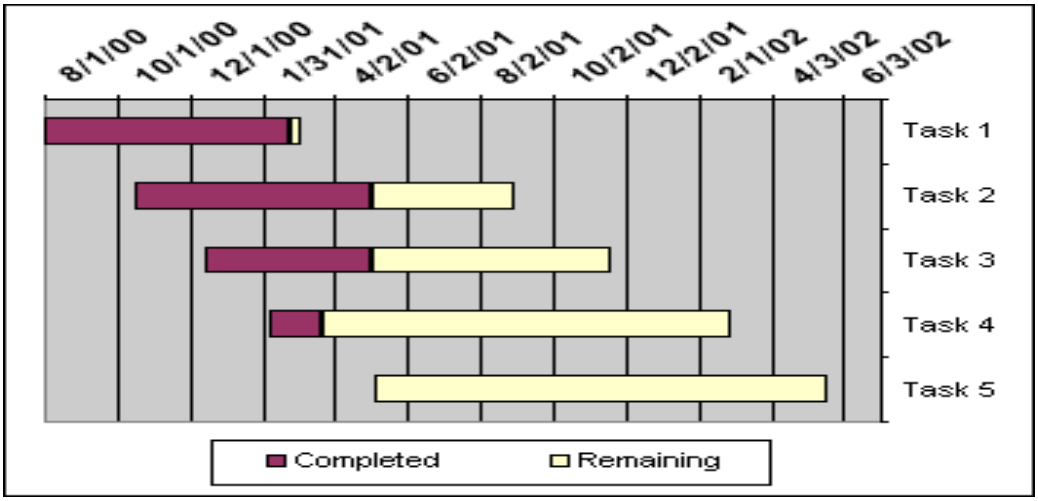
Sample Gantt Chart Table

Task ID	Task Description/ Name	Resource Performing Task	Duration of Task (days)	Start Date	Completion Date	Status
1	Submittals	GC	30	5/15	6/15	Done
2	Mobilize/Setup	GC	10	6/1	6/11	10%
3	Site Clearing	Subcontractor	15	6/12	6/27	0%
Etc.	Etc.	Etc.	Etc.	Etc.	Etc.	Etc.

Note: Table entries are for illustration purposes only.

1. Task ID: Sequential identifier for task (number, alphabetical, alpha-numeric).
2. Task Description/ Name: Brief description or name of major task items.
3. Resource Performing Task: Individuals or company responsible for completion of task and/or with the majority of the work in the task.
4. Duration of Task: Number of days estimated to complete task.
5. Start/Completion dates: Projected dates.
6. Status: Percent completed, description of status, etc.

Sample Graphical Representation of Gantt Chart



109.06 Approval and Acceptance of Contractor Schedule. The Contractor shall review and sign each updated Construction Schedule. The Contractor's signature on any base line or updated Construction Schedule shall serve as an affirmation of the Contractor's approval of and agreement to the Construction Schedule and a representation that the Contractor can meet the requirements of the Construction Schedule without additional compensation.

7. Sections 114.01, 114.02, 114.04, 114.05, and 114.07 are hereby removed and replaced by the following:

114.01 Contractor Payment Request. After confirming the quantities of work performed with the Engineer, the Contractor shall submit monthly to the Engineer an itemized Payment Request, showing the quantities of work performed. The Contractor shall sign the Payment Request thereby certifying that the quantities are correct and the work has been done in accordance with the Contract, and that it constitutes the total amount of work performed during the period. The Contractor shall supply any additional documentation the Engineer may request in connection with each payment to the Contractor. Certified payroll reports for the period of time indicated shall be attached to one copy of every Payment Request. The Contractor shall list on the Contractor Payment Request any approved Change Orders processed and performed during the time covered by the Payment Request.

114.02 Partial Payment. The City shall pay the Contractor an amount equivalent to 90% of the amount listed in each Payment Request within 30 days of the date each Payment Request is executed by the Contractor and approved by the Engineer. After the Contract is 50% complete, as determined by the Engineer, the retainage shall be reduced and the City shall pay 95% of the amount listed in each remaining Payment Request. The amount of Liquidated Damages to which the City is apparently entitled under the Contract Documents may be deducted from any Payment Request by the Engineer and Authorized Representative. Payments due and not paid within such thirty day period shall accrue interest from the date that payment is due under the Contract Documents at the rate paid by the STAR Account in accordance with 120.04.

8. Section 117.06 is hereby removed and replaced with the following:

117.06 Change Order Process. When a change to the Work is ordered, the Engineer shall:

1. Prepare a written request to the Contractor detailing the changes to be made.

2. Reach a written agreement with the Contractor concerning the cost of the Change Order using Unit Prices or the Pricing Guidelines set forth in Section 117.10, whichever the Engineer determines in his or her discretion is applicable.

3. If the cost of the agreed Change Order is less than the available Project Contingency Funds, the Change Order agreement need only be signed by the Engineer.

4. If the cost of the agreed Change Order exceeds the available Project Contingency Funds then the Change Order must be approved by the City Commission and signed by the City Manager. The Contractor may bill for Work covered by the Change Order only after the Change Order is properly executed in accordance with this Section.

9. Section 117.12 is hereby removed and replaced with the following:
   117.12 Time Extension. Notwithstanding any other provision of the Contract Documents, time extensions for changes in the Work will depend upon the extent to which the change causes delay in Work on the Critical Path of the Construction Schedule. If extending the time for Contract Completion is not possible, the Contractor shall price, and separately state, all costs of accelerated performance in the Contractor's Proposal. A Change Order granting a time extension may provide that the time for Contract Completion will be extended for only those specific elements actually delayed and that remaining milestone completion dates will not be altered and may further provide for adjustment of Liquidated Damages, to the fullest extent permitted by law.

Miami Well Field Expansion Phase 2						
ITEM CODE	**ITEM DESCRIPTION**	**UofM**	**QUANTITY**	**UNIT PRICE**	**EXTENSION**	
G-1	Mobilization and Demobilization	L.S.	1			
This work item shall include mobilization, demobilization, permitting, bonds, and insurance costs associated with the Project. This shall include furnishing all labor, materials, tools, equipment, and incidentals required to mobilize, demobilize, bond, and insure the Work for the Project in accordance with the Contract Documents, complete in place.						
C-1	Construction of Pond P8	L.S.	1			
This work item includes the construction of Pond P8, including but not limited to, the bulk excavation of the trench and pond; the relocation of excavated soil to designated spoil areas; the installation of a new monitoring manhole; the installation of level control mechanisms including communications, wiring, cabling, terminations, equipment and instruments; the installation of new piping; the filling of trench with stone as specified in the Details; the installation of a tapping sleeve and valve; the installation of new recharge valve vault and accessories; the installation of the access ramps; the installation of headwalls; the installation of instrumentation conduit, wiring, control panel and associated connections to equipment; the						
Alternate No.1						
A-1	Pond P5	L.S.	1			
This work item includes the construction of Pond P5, including but not limited to, the bulk excavation of the trench and pond; the relocation of excavated soil to designated spoil areas; the installation of a new monitoring manhole; the installation of level control mechanisms including communications, wiring, cabling, terminations, equipment and instruments; the installation of new piping; the filling of trench with stone as specified in the Details; the installation of a tapping sleeve and valve; the installation of new recharge valve vault and accessories; the installation of the access ramps; the installation of headwalls; the installation of instrumentation conduit, wiring, control panel and associated connections to equipment; the calibration of installed instruments; and any associated electrical work.						
Alternate No.2						
A-2	Pond P7	L.S.	1			
This work item includes the construction of Pond P7, including but not limited to, the bulk excavation of the trench and pond; the relocation of excavated soil to designated spoil areas; the installation of a new monitoring manhole; the installation of level control mechanisms including communications, wiring, cabling, terminations, equipment and instruments; the installation of new piping; the filling of trench with stone as specified in the Details; the installation of a tapping sleeve and valve; the installation of new recharge valve vault and accessories; the installation of the access ramps; the installation of headwalls; the installation of instrumentation conduit, wiring, control panel and associated connections to equipment; the						
Alternate No.3						
A-3	Pond P12	L.S.	1			
This work item includes the construction of Pond P12, including but not limited to, the bulk excavation of the trench and pond; the relocation of excavated soil to designated spoil areas; the installation of a new monitoring manhole; the installation of level control mechanisms including communications, wiring, cabling, terminations, equipment and instruments; the installation of new piping; the filling of trench with stone as specified in the Details; the installation of a tapping sleeve and valve; the installation of new recharge valve vault and accessories; the installation of the access ramps; the installation of headwalls; the installation of instrumentation conduit, wiring, control panel and associated connections to equipment; the						
Alternate No. 4						
A-4	Contingency Allowance (10% of Base Bid and Fixed Price Items)					
This item shall be reserved as a contingency for use during construction of the Project. Use of the contingency allowance shall only be authorized by the Owner for the changes in the Work following the procedures for change orders in accordance with the City of Dayton Construction and Materials Specifications, most recent edition. The contingency shall be applied to all base bid items as well as Alternate No.1, Alternate No.2, Alternate No. 3, and Alternate No. 4. For contract award the amount of this "Contingency Allowance" shall be ten percent (10%) of the Contractor's total base bid including those alternates (Alternate No.1, Alternate No.2, Alternate No. 3 and/or Alternate No. 4) the City elects to include.						

TETRA TECH

Supplemental Specifications

CITY OF DAYTON
DIVISION OF WATER SUPPLY AND TREATMENT

MIAMI WELL FIELD EXPANSION PHASE II
Project No. 200-23773-23002

BID DOCUMENTS

December 17, 2025

Prepared For:

1048 Ottawa Street
Dayton, OH 45402

Prepared By:

Tetra Tech
250 W. Court Street, Suite 200W
Cincinnati, OH 45202

Tt #200-23773-23002

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Seals and Certification Page

SUPPLEMENTAL SPECIFICATIONS

FOR

CITY OF DAYTON
DAYTON, OHIO

MIAMI WELL FIELD EXPANSION PHASE II

Certification of the Engineers of Record
I hereby certify that these documents were prepared by me, or under our direct personal supervision, and I am a duly Licensed Professional Engineer under the laws of the State of Ohio.

Herbert R. Lemaster
Ohio License No. E-77200
Specification Divisions 01, 02, 05, 08, 09, and 15

Phillip Fleming
Ohio License No. E-88505
Specification Division 03

Bill Paison
Ohio License No. E-80028
Specification Divisions 13 and 16

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PART 1 - GENERAL

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1.02 GENERAL

A. All work shall be conducted in accordance with the City of Dayton, Construction and Material Specifications, latest edition. The following sections supplement or amend the City of Dayton, Construction and Material Specifications. All provisions which are not so amended or supplemented remain in full force and effect.

B. This section is arranged in the same order as the paragraphs in the Construction and Material Specifications, and the paragraphs herein bear comparable numbers to those of the Construction and Material Specifications but with the prefix "SC."

1.03 SUMMARY

A. SC-103.47 Notice of OEPA Funding Requirements

Add the following paragraph immediately after paragraph 103.46 in its entirety:

103.47 Notice of OEPA Funding Requirements. This project is being funded by the Bipartisan Infrastructure Law (BIL) through the Ohio EPA Water Supply Revolving Loan Account (WSRLA). This source of funding requires modifications to the Specifications and multiple forms to be submitted with the bid proposal. The requirements and forms are

included within this Supplemental Section of the Specifications. The Ohio EPA has provided the document 'Construction-Contract-Guidance' for complete details and guidance. The document can be found here: https://epa.ohio.gov/static/Portals/29/documents/ofa/Construction-Contract-Guidance.pdf.

B. SC-104.19 Equal Employment Opportunity (EEO) Requirements

Add the following paragraph immediately after paragraph 104.18 in its entirety:

104.19 Equal Employment Opportunity (EEO) Requirements.
The Contractor's EEO Certification Form must be completed and submitted with the bid proposal. The form is included as an attachment to this Section.

C. SC-104.20 Debarment

Add the following paragraph immediately after paragraph 104.19 in its entirety:

104.20 Debarment. The Certification Regarding Debarment, Suspension, and Other Responsibility Matters must be completed and submitted with the bid proposal. The form is included as an attachment to this Section.

D. SC-104.21 Disadvantaged Business Enterprises (DBE) Utilization

Add the following paragraph immediately after paragraph 104.20 in its entirety:

104.21 Disadvantage Business Enterprises (DBE) Utilization. The forms 6100-2, 6100-3, and 6100-4 must be completed and submitted with the bid proposal. The forms are included as an attachment to this Section.

As a condition of receiving capitalization grants from U.S. EPA for the Water Pollution Control Loan Fund (WPCLF) and the Water Supply Revolving Loan Account (WSRLA), the Ohio EPA negotiates "fair share" Disadvantaged Business Enterprises (DBE) objectives with U.S. EPA. The current negotiated goals for construction related activities are 1.3% of all contracts to MBEs and 1.0% of all contracts to WBEs.

DBE Certification

Qualified DBE's are those that have been certified as an MBE or WBE with the Unified Certification Program (UCP) administered by the Ohio Department of Transportation (ODOT). The Ohio Unified DBE Directory can be found at http://www.ohioucp.org

DBE Qualifications

To qualify for MBE certification, businesses must be 51 percent owned and controlled by a U.S. citizen and Ohio resident belonging to an African American, Native American, Hispanic, or Asian American ethnic

group. In addition, the business must be in operation for at least one year prior to submitting an application. For DBE status, a business must be at least 51 percent owned by a socially and economically disadvantaged person who participates in the daily operations of the business. This person must be a woman or of African-American, Hispanic, Native American, Asian American ethnicity.

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

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

Required Contract Conditions

1. The prime contractor must pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the owner.
2. The prime contractor must notify the owner in writing prior to the termination of any Disadvantage Business Enterprise subcontractor for convenience by the prime contractor.
3. If a Disadvantage Business Enterprise contractor fails to complete work under the subcontract for any reason, the prime contractor must employ the six Good Faith Efforts (listed below) if soliciting a replacement contractor.
4. The prime contractor must employ the six Good Faith Efforts even if the prime contractor has achieved its fair share objectives.
5. An owner must ensure that each procurement contract it awards contains the following terms and conditions: *The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR Part 33 in the award and*

administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies.

In addition to the DBE goals established by the EPA, the City of Dayton Human Relations Council (HRC) has established a Procurement Enhancement Program (PEP) goal of 5% MBE participation. The HRC PEP goals can be obtained by utilizing the DBE firms certified by the UCP administered by ODOT or by the City of Dayton PEP Certification List. Note that 1.3% MBE and 1.0% WBE goals set by the EPA must be obtained from qualified DBE certified with the UCP, administered by ODOT.

In summary, the following participation goals are established for this project:

- 5% MBE (1.3% must be Certified with the UCP; 1.3% must be either Certified with the UCP; 3.7% must be either Certified with the UCP or be from the PEP Certification List)
- 1% WBE (all 1.0% must be Certified with the UCP)

The following forms are required to be submitted with the Bid Proposal:

- Form 6100-3, DBE Subcontractor Performance Form
- Form 6100-4, DBE Subcontractor Utilization Form
- HRC PEP Certified Participation Form
- PEP Participation commitment and/or Waiver Request Form

E. SC-104.22 Davis-Bacon Wage Rate Requirements

Add the following paragraph immediately after paragraph 104.21 in its entirety:

104.22 Davis-Bacon Wage Rate Requirements

Wage Rate Requirements

As used in these provisions "subrecipient" means City of Dayton

(a) The following applies to any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1.

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a

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

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

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

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

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

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

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

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the subrecipient(s) to the State award official. The State award official will transmit the report, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

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

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

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

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

(2) Withholding. The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the

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

(3) Payrolls and basic records.

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

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the subgrant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly

payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/esa/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

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

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

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

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

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

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

States Code.

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

(4) Apprentices and trainees --

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable

apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

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

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

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

responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

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

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

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

(10) Certification of eligibility.

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

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

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

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

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

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

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

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

F. SC-104.23 Build America, Buy America (BABA)Acknowledgement

Add the following paragraph immediately after paragraph 104.22 in its entirety:

104.23 Build America, Buy America (BABA) Acknowledgement. The Build America, Buy America (BABA) acknowledgement form must be completed and submitted with the bid proposal. The form is included as an attachment to this Section.

The Contractor is required to provide a project sign that will include Bipartisan Infrastructure Law (BIL) specific language.

G. SC-104.24 American Iron and Steel Acknowledgement Form

Add the following paragraph immediately after paragraph 104.23 in its entirety:

104.24 American Iron and Steel Acknowledgement. The American Iron and Steel acknowledge form must be completed and submitted with the bid proposal. The form is included as an attachment to this Section.

H. SC-104.25 Violating Facilities Clause

Add the following paragraph immediately after paragraph 104.24 in its entirety:

104.25 Violating Facilities Clause. The Contractor agrees to comply with all applicable standards, orders or requirements under Section 306 of the Clean Air Act, 42 USC 1857 (h), Section 508 of the Clean Water Act, 33 USC 1368, Executive Order 11738, and EPA regulations, 40 CFR Part 32, which prohibits the use under non-exempt Federal contracts, grants, or loans of facilities included on the EPA List of Violating Facilities.

I. SC-104.26 Small Businesses in Rural Areas (SBRA)

Add the following paragraph immediately after paragraph 104.25 in its entirety:

104.26 Small Businesses in Rural Areas (SBRA). This procurement is subject to the EPA policy of encouraging the participation of small businesses in rural areas. It is EPA policy that recipients of EPA financial assistance awards utilize the services of small businesses in rural areas (SBRAs), to the maximum extent practicable. The objective is to assure that such small business entities are **afforded** the maximum practicable opportunity to participate as subcontractors, suppliers and otherwise in EPA-awarded financial assistance programs. This policy applies to all contracts and subcontracts for supplies, construction, and services under EPA grants or cooperative agreements. Small purchases are also subject to this policy.

J. SC-104.27 Insurance Provisions

Add the following paragraph immediately after paragraph 104.26 in its entirety:

104.27 Insurance Provisions. The WPCLF/WSRLA Loan Agreement contains specific requirements regarding insurance for all contractors and all subcontractors for the life of the contract.

The Contractor shall, at his expense, furnish and maintain insurance in the form and amounts specified in subparagraphs 1 through 7 inclusive, of this section. Policies shall be with acceptable insurance companies authorized to do business in the State of Ohio.

The Contractor shall not commence Work nor shall he permit any of his Sub-contractors to commence Work until the insurance policies specified hereinafter, or otherwise required, have been submitted to, and approved by the Owner. Such insurance policies shall be kept in force until the Contractor

receives final payment.

Insurance shall be endorsed so that it cannot be changed or canceled in less than ten (10) days after receipt by the Contractor and the Owner of written notice of such proposed action from the Insurer.

The insurance specified in Subparagraphs 1, 2, 3 and 4 shall be written under the comprehensive general form of liability insurance contracts.

The Contractor shall furnish three (3) certificates or, whenever specifically requested by the Owner, three (3) certified copies of the insurance policies themselves and a receipt evidencing full payment of the premiums.

In addition to the insurance described hereinafter, the Contractor shall secure and maintain such other insurance as may be designated elsewhere in the Contract document.

If the Contractor is required to repair or perform Work after the completion of the Work involved under this Contract or obtain new policies in accordance with the requirements in this section.

1. *Builders Risk*: In addition to such fire and other physical damage insurance as the Contractor elects to carry for his own protection, he shall also secure and maintain in the name of the Owner, the government agency sponsoring the Project, Subcontractors, the Consulting Engineer and any other parties having an interest in the Project, as named insured as their interest may appear; a builders' risk policy for fire, extended coverage, vandalism and malicious mischief in the amount of one hundred (100) percent of the value of the complete parts of the Project and Materials in storage, except that such coverage shall not be required in connection with sewer, water main or paving construction. Pump or lift station construction shall not be considered sewer or water main construction for purposes of this paragraph.

2. *Workers Compensation*: The Contractor shall provide Workers Compensation Insurance for all employees engaged in *Work* who may come within the protection of the workers compensation law, and, where applicable, employer's General Liability Insurances for employees not so protected and shall require all Subcontractors to provide corresponding insurance.

3. The Contractor shall indemnify *the* Owner and the Consulting Engineer against any and all liabilities, cost and expenses due to accidents or other occurrences covered by the workers compensation law.

4. *Contractor's Motor Vehicle Bodily Injury and Property Damage Liability Insurance*: Insurance to cover liability arising from the use and operation of motor

vehicles in connection with the performance of the Contract (as customarily defined in liability insurance policies), whether they be owned, hired or non-owned by the Contractor, as follows:

a. Bodily Injury Liability: $500,000 for each person; limit of $1,000,000 for each occurrence.
b. Property Damage Liability: $500,000 for each occurrence.

5. *Contractor's Public Liability and Property Damage Liability Insurance*: Contractor's Public Liability Insurance providing a limit of not less than $500,000 for all damages arising out of bodily injuries, including accidental *death* to one person, and a total limit of $1,000,000 for all damages arising out of bodily injuries, including accidental death, to two or more persons in any one occurrence. Contractor's Property Damage Liability Insurance providing for a limit on not less than $500,000 for all damages to or destruction of property.

Coverage under this policy shall include, to the limits indicated above, the collapse or damage to any structure, building or its contents, public or private utility, or pavement during construction and for two (2) years thereafter.

Whenever Work under the Contract is to be done in the vicinity of existing underground utilities or structures, coverage under the policy shall also include, to the limits indicated, all damages to said underground utilities or structures during construction and for a period of two (2) years thereafter. Whenever Work under the Contract is to be done by blasting, coverage under the policy shall also include, to the limits indicated above, all damages of any kind whatsoever caused by blasting.

6. *Contractor's Protective Public Liability and Property Damage Liability Insurance*: Contractor's Protective Public Liability and Property Damage Liability Insurance for operations performed by Subcontractors providing for coverage and limits corresponding to those described in subparagraph 4.

7. *Owner's Protective Public Liability and Property Damage Liability Insurance*: Regular Owner's Protective Public Liability and Property Damage Liability Insurance for operations performed by the Contractor or any Sub-contractor providing for coverage and limits corresponding to those described in subparagraph 4.

This policy shall be written in the name of the Owner as a separate policy from those specified elsewhere herein.

8. *Railroad Protective Liability Insurance*: In any of the Work under this Contract is on railroad R/W, the Contractor shall at its sole cost and expense, procure and provide, for and in behalf of each railroad company. Protective Liability Insurance (AARAASHO form) with minimum limits per occurrence of not less than $2,000,000 for bodily injury, death and/or property damage, subject to an aggregate limit of $6,000,000 per annum. The policy shall name each railroad company as the insured and be issued to the Contractor. Each railroad company shall be provided with a copy of each policy of insurance prior to commencement of any work.

K. SC-104.28 Material Testing

Add the following paragraph immediately after paragraph 104.27 in its entirety:

104.28 Material Testing.

1. Contractor shall appoint, employ, and pay for specified services of an independent firm to perform testing.

2. The independent firm will perform tests and other services specified in individual specification sections and as required by the Architect/Engineer.

3. Testing and source quality control may occur on or off the project site. Perform offsite testing as required by the Architect/Engineer or the Owner.

4. Reports will be submitted by the independent firm to the Architect/Engineer and Contractor, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

5. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
   a. Notify Architect/Engineer and independent firm 24 hours prior to expected time for operations requiring services.
   b. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

6. Testing does not relieve Contractor to perform Work to contract requirements.

7. Re-testing required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Architect/Engineer. Payment for re-testing will be charged to the Contractor by deducting testing charges from the Contract Sum/Price.

L. SC-104.29 Continuous Service/Treatment Provisions

Add the following paragraph immediately after paragraph 104.28 in its entirety:

104.29 Continuous Service/Treatment Provisions. Construction activities must not result in any disruption of service. Unless otherwise previously or subsequently specified, the Contractor shall procure and pay for all permits, licenses, and approvals necessary for the execution of his Contract. The Contractor shall comply with all laws, ordinances, rules, order, and regulations relating to the performance of the work required to complete their Contract.

M. SC-104.30 WSRLA Change Order Form

Add the following paragraph immediately after paragraph 104.29 in its entirety:

104.30 WSRLA Change Order Form. All change orders related to this construction Contract shall be executed on the WPCLF/WSRLA change order form. The Change Order Form and Instructions is included as an attachment to this Section.

N. SC-803.06 Manhole Submittals

Add the following paragraph immediately after paragraph 104.29 in its entirety:

803.06 SUBMITTALS. Contractor shall submit descriptive literature, catalog cuts, parts lists, and dimensional prints clearly indicating all dimensions and materials of construction on all items aforementioned as well as manhole lids, frames, and steps as seen in City of Dayton Department of Water Drawing No. G-6 for Manhole Lid, Frame, and Steps.

O. Attachments

1. Contractor EEO Certification
2. Certification Regarding Debarment, Suspension, and other Responsibility Matters
3. DBE Subcontractor Performance Form 6100-3
4. DBE Subcontractor Utilization Form 6100-4
5. DBE Subcontractor Participation Form 6100-2
6. Build America, Buy America (BABA) Acknowledgement
7. American Iron and Steel Acknowledgement
8. Contract Change Order

END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. These Specifications and the accompanying Drawings describe the Work to be done and materials to be furnished for the Miami Well Field Expansion project.

B. Major Work items in this Contract include:

1. Proposed Pond Construction
   a. Bulk excavation and relocation of soil on-site to designated spoil areas
   b. Installation of new recharge line and tie-ins to existing recharge line
   c. Installation of monitoring manholes
   d. Filling of designated trench areas with stone as seen in the Details
   e. Installation of tapping sleeves and valve as necessary
   f. Installation of recharge valve vault, accompanying piping, and gate valves

2. Instrumentation and Control – Ponds
   a. The inlet valve to all ponds will be equipped with a modulating actuators with an Ethernet IP communication module.
   b. All ponds will be monitored and controlled via a new remote I/O panel. Monitoring signals will be sent to the pump station PLC and control commands will emanate from the pump station PLC.
   c. All ponds will be instrumented with a radar level sensor and capacitance level probe to indicate high-level shutoff.
   d. Both level measurements will be wired to the remote I/O panel. The valve actuator will be connected to the remote I/O panel via Ethernet Cat6 cable.
   e. Single-mode fiber optic cable will be installed to link the pond remote I/O panels to the PLC in the Recharge Pump Station.
   f. All programming and software configuration of remote I/O modules and switches will be the responsibility of the Owner's SCADA Services provider.

1.02 CONTINUOUS OPERATIONS

The existing system must be maintained in continuous operation in such a manner that it meets all local, state, and federal requirements. The Contractor is responsible not to deactivate any system until a temporary or new system has been installed and is operational. The Contractor is responsible for payment of all fines resulting from any action or inaction on his part or the part of his subcontractors during performance of the Work that is illegal.

1.03 PERMITS

Obtain any permits related or required by the Work in this Contract.

1.04 CODES

Comply with applicable codes and regulations of authorities having jurisdiction. Submit copies of inspection reports, notices, citations, and similar communication to the Owner.

1.05 EXISTING CONDITIONS AND DIMENSIONS

A. The Work in this Contract will primarily be performed in or around existing facilities of which a portion must remain functional. The Contractor must maintain the required items and/or systems functional without additional effort by the Owner's personnel and at no extra costs to the Owner.

B. The Contractor is responsible for verifying all existing conditions, elevations, dimensions, etc., and providing his finished Work to facilitate existing conditions.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END OF SECTION

SECTION 01270

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section defines the method that will be used to determine the quantities of Work performed or materials supplied and establish the basis upon which payment will be made for the Miami Well Field Expansion (Project).

1.02 ADMINISTRATIVE SUBMITTALS

A. Schedule of Values: Submit schedule on Contractor's standard form. (Refer to paragraph 1.05 of this for additional requirements.)

B. Schedule of Estimated Progress Payments (Refer to paragraph 1.06 of this Section for additional requirements):

1. Submit with initially acceptable Schedule of Values.
2. Submit adjustments thereto with Application for Payment.

C. Application for Payment

D. Final Application for Payment

1.03 RELATED WORK

A. City of Dayton Construction and Material Specifications, most recent edition.

1.04 PRICE

A. Required items of Work and incidentals necessary for the satisfactory completion of the Project shall be considered incidental to the specified Work required under this contract and shall be considered as included in the unit prices for the various proposal items. The Contractor shall prepare their Proposal accordingly to allow for such items:

1. Not specifically listed in the Proposal.
2. Not specified in this section to be measured or to be included in one of the items listed in the Proposal.
3. To include Contractor's overhead and profit.
4. To include any and all inflation or tariff cost associated with obtaining materials and equipment.

B. Work includes the furnishing of all labor, materials, equipment, tools, and related items for performing all operations required to complete the Project satisfactorily in place, as specified by the Contract Documents.

1.05 SCHEDULE OF VALUES

A. Prepare a separate Schedule of Values for each phase of Work under the Agreement.

B. Use line items in the proposal as line items in the Schedule. Provide adequate detail to allow easy determination of the percentage of work completed for each item.

C. Lump Sum Work.

1. Reflect Schedule of Values format included in conformed Bid Form, specified allowances, alternates, and equipment selected by Owner, as applicable.
2. List bonds and insurance premiums, mobilization, demobilization, facility startup, and contract closeout separately.
3. Separate product costs and installation costs. Break down by Division 2 through 17 for each of the Project facilities.
    a. Product costs include cost for product, delivery and unloading, royalties and patent fees, taxes, and other cost paid directly to the supplier or vendor.
    b. Installation costs include cost for the supervision, labor and supervision, labor and equipment for field fabrication, erection, installation, start-up, initial operation and Contractor's overhead and profit.
4. Divide principal subcontract amounts into an adequate number of line items to allow determination of the percentage of work completed for each item. These line items may be used to establish the value of work to be added or deleted from the project.

D. An unbalanced or front-end loaded schedule will not be acceptable.

E. Summation of the complete Schedule of Values representing all Work shall equal the Contract Price.

1.06 SCHEDULE OF ESTIMATED PROGRESS PAYMENTS

A. Show estimated payment requests throughout Contract Times aggregating initial Contract Price.

B. Base estimated progress payments on initially acceptable progress schedule. Adjust to reflect subsequent adjustments in progress schedule and Contract Price as reflected by modifications to the Contract Documents.

1.07 APPLICATION FOR PAYMENT

A. Reference Item 114 of the City of Dayton Construction and Material Specifications, most recent edition.

B. Transmittal Summary Form: Attach one Summary Form with each detailed Application for Payment for each schedule and include Request for Payment of Materials and Equipment on Hand as applicable. Execute certification by authorized officer of Contractor. Provide separate form for each schedule as applicable.

C. Preparation:

1. Round values to nearest dollar.
2. List each Change Order and Written Amendment executed prior to date of submission as separate line item. Totals to equal those shown on the Transmittal Summary Form for each schedule as applicable.

3. Submit Application for Payment, including a Transmittal Summary Form and detailed Application for Payment Form(s) for each schedule as applicable, a listing of materials on hand for each schedule as applicable and such supporting data as may be requested by Owner.

D. Include accepted Schedule of Values for each schedule or portion of Work, the unit price breakdown for Work to be paid on unit price basis, a listing of Owner-selected equipment if applicable, and allowances, as appropriate.

1.08 MEASUREMENT – GENERAL

A. Weighing, measuring, and metering devices used to measure quantity of materials for Work shall be suitable for purpose intended and conform to tolerances and specifications as specified in National Institute of Standards and Technology, Handbook 44.

B. Whenever pay quantities of material are determined by weight, the material shall be weighed on scales furnished by Contractor and certified accurate by the state agency responsible. A weight or load slip shall be obtained from the weigh facility and delivered to the Owner's representative at the point of delivery of the material.

C. If material is shipped by rail, the car weights will be accepted provided that actual weight of material only will be paid for and not minimum car weight used for assessing freight tariff and provided further that car weights will not be acceptable for material to be passed through mixing plants.

D. Vehicles used to haul material being paid for by weight shall be weighed empty daily and at such additional times as required by Owner. Each vehicle shall bear a plainly legible identification mark.

E. All materials that are specified for measurement by the cubic yard measured in the vehicle shall be hauled in vehicles of such type and size that the actual contents may be readily and accurately determined. Unless all vehicles are of uniform capacity, each vehicle must bear a plainly legible identification mark indicating its water level capacity. All vehicles shall be loaded to at least their water level capacity. Loads hauled in vehicles not meeting the above requirements or loads of a quantity less than the capacity of the vehicle, measured after being leveled off as above provided, will be subject to rejection, and no compensation will be allowed for such material.

F. Where measurement of quantities depends on elevation of existing ground, elevations obtained during construction will be compared with those shown on Drawings. Variations of 1 foot or less will be ignored, and profiles shown on Drawings will be used for determining quantities. Quantities will be based on ground profiles shown.

G. Units of measure shown on the Schedule of Values shall be as follows unless specified otherwise.

Item	Method of Measurement
AC	Acre-Field Measure by Owner
CY	Cubic Yard-Field Measure by Owner within the limits specified or shown
CY-VM	Cubic Yard-Measured in the Vehicle by Volume
EA	Each-Field Count by Owner
GAL	Gallon-Field Measure by Owner
HR	Hour
LB	Pound(s)-Weight Measure by Scale
LF	Linear Foot-Field Measure by Owner
LS	Lump Sum-Unit is one; no measurement will be made
MFBM	Thousand Foot Board Measure-Delivery Invoice
SF	Square Foot
SY	Square Yard
TON	Ton-Weight Measure by Scale (2,000 pounds)

1.09 PAYMENT

A. Reference Item 114 of the City of Dayton Construction and Material Specifications, most recent edition.

B. General:

1. The date for Contractor's submission of monthly Application for Payment shall be established at the Pre-Construction Conference.

C. Payment for all Work shown or specified in the Contract Documents is included in the Contract Price. No measurement or payment will be made for individual items.

D. The Owner will make payments for acceptable Work in place and materials properly stored on-site. The value of payment shall be as established on the approved construction schedule and Application for Payment, EXCEPT the Owner will retain ten percent (10%) of the Work in place and a percentage as hereinafter listed for items properly stored or untested. Quantities on plans are approximate.

E. No payment will be made for stored materials unless an invoice from the supplier is attached to the pay request. Furthermore, no payment for stored materials will be made if the value of the stored materials does not exceed $10,000.00.

F. Allowable Payments

1. Payment for all work will be based on the percent complete (as approved by the Engineer) at end of period for application for payment. Payment shall be limited to ninety percent (90%) of their scheduled value until they are ready for operation, have been certified by manufacturer, and accepted by the Engineer. Ninety percent (90%) payment shall be contingent on proper on-site storage and proper routine maintenance as recommended by manufacturer or Engineer.

2. No final payment will be made until materials, equipment, and installation have been tested and accepted by the Engineer.

G. Water Costs

1. Costs to the Owner of all water from the existing distribution system or other approved sources used in the process of testing, sterilizing, and flushing pipe shall be borne by the Owner. Water costs due to incorrect construction, taps, breaks, etc., caused by Contractor shall be borne by the Contractor.

H. The Owner may reduce the percent of retainage once the Project has achieved satisfactory progress and is at the fifty percent (50%) construction status. The dollar amount of retainage for work-in-place will not be reduced but will remain constant following the fifty percent (50%) constructed status.

I. Additionally, the Owner may reinstate the retainage to a full ten percent (10%) of the scheduled value of work-in-place should the Owner, at their discretion, determine that the Contractor is not making satisfactory progress or there is other specific cause for such withholding.

1.10 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

A. Payment will not be made for following:

1. Loading, hauling, and disposing of rejected material.
2. Quantities of material wasted or disposed of in manner not called for under Contract Documents.
3. Rejected loads of material, including material rejected after it has been placed by reason of failure of Contractor to conform to provisions of Contract Documents.
4. Material not unloaded from transporting vehicle.
5. Defective Work not accepted by Owner.
6. Material remaining on hand after completion of Work.

1.11 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

A. Partial payment for stored materials and equipment shall be in accordance with Item 114.05 of the City of Dayton Construction and Material Specifications, most recent edition.

1.12 ALLOWANCES

A. It is understood that Contractor shall include in the Contract Price all allowances so named in this Specification to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. Cash Allowances

1. Contractor agrees that:

i. Cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and,

ii. Contractor's costs for unloading and handling, labor, installation, overhead, profit, and other expenses incurrent for the cash allowances shall be included in the Contract Price and not in the allowances. Any requests for additional payment on any of the foregoing is not valid.

C. Prior to final payment, the Owner shall issue appropriate Change Order as recommended by Engineer to reflect actual amounts due to Contractor on account of Work covered by the allowances and shall correspondingly adjust the Contract Price.

1.13 PRICE PROPOSAL ITEMS

A. Respondent will complete the Work for the following listed Work items for the prices listed on the Price Proposal:

Item No. 1: Mobilization and Demobilization

1. Description – Work item shall include mobilization, demobilization, permitting, bonds, and insurance costs associated with the Project. This shall include furnishing all labor, materials, tools, equipment and incidentals required to mobilize, demobilize, bond and insure the Work for the Project in accordance with the Contract Documents, complete in place.

2. Measurement - Measurement of Item No.1 will be by lump sum.

3. Payment – Partial payments of the lump sum proposal for General Conditions will be as follows:

a. The Schedule of Values shall include separate line items for Mobilization, Insurance and Bonds, and Demobilization.

b. When 1% of the adjusted contract amount for construction items (which is defined as the total contract amount less the lump sum proposal for mobilization) is earned, 50% of the mobilization lump sum proposal will be paid.

c. When 5% of the adjusted contract amount for construction items is earned, 75% of the mobilization lump sum proposal or 10% of the total contract amount, whichever is less will be paid.

d. When 10% of the adjusted contract amount for construction items is earned, 75% of the mobilization lump sum proposal or 15% of the total contract amount, whichever is less will be paid.

e. Insurance and Bonds will be paid on the initial request for payment. Receipts or other proof of payment for the full amount of compensation requested for "Insurance and Bonds" shall be provided to the Owner with the request for payment.

f. No payments for this line item will be made until said documents are submitted and approved by the Owner:

i. Safety Plan,

ii. Quality Control / Quality Assurance Plan,

iii. Pre-Construction Video, and

iv. Construction Schedule

g. Upon completion of all work under this contract, payment for the remainder of the lump sum proposal for mobilization will be made.

Item No. 2: Construction of Pond P8

1. Description

a. This work item includes the construction of Pond P8, including but not limited to:

i. Bulk excavation of the trench and pond

ii. Relocation of excavated soil to designated spoil areas

iii. Installation of new monitoring manhole

iv. Installation of level control mechanisms including communications, wiring, cabling, terminations, equipment and instruments

v. Installation of new piping

vi. Filling of trench with stone as specified in the Details

vii. Installation of a tapping sleeve and valve

viii. Installation of new recharge valve vault and accessories

ix. Installation of the access ramps

x. Installation of headwalls/end treatments

xi. Installation of instrumentation conduit, wiring, control panel, and associated connections to equipment

xii. Calibration of installed instruments

xiii. Any associated electrical work

xiv. Collection of survey data and drawing markups for providing as-built Drawings.

b. Contractor is not to provide PLC or HMI programming services. All PLC and HMI programming shall be provided by the City of Dayton's SCADA Systems Integrator.

c. All other necessary appurtenances and connections for a complete and working installation, meeting specified Design Documents.

d. All excavation is unclassified.

2. Measurement – Measurement of Item No. 4 will be on a lump sum basis.

3. Payment of the full unit price shall be paid for the work performed and in accordance with the Schedule of Values. Payment shall constitute full compensation to the Contractor for furnishing all: labor, equipment, tools, and materials; and for performing all operations required to furnish to the Owner the project, complete in place, as specified and as indicated on the Contract Drawings and Specifications.

Item No. A-1: ALTERNATE #1: Pond P5

1. Description

a. Construction of pond P5, including but not limited to:

i. Bulk excavation of the trench and pond

ii. Relocation of excavated soil to designated spoil areas

iii. Installation of new monitoring manhole

iv. Installation of level control mechanisms including communications, wiring, cabling, terminations, equipment, and instruments

v. Installation of new piping

vi. Filling of trench with stone as specified in the Details

vii. Installation of a tapping sleeve and valve

viii. Installation of new recharge valve vault and accessories

ix. Installation of the access ramps

x. Installation of headwalls/end treatments

xi. Installation of instrumentation conduit, wiring, control panel, and associated connections to equipment

xii. Calibration of installed instruments

xiii. Any associated electrical work

xiv. Collection of survey data and drawing markups for providing as-built Drawings.

b. Contractor is NOT to provide PLC or HMI programming services. All PLC and HMI programming shall be provided by the City of Dayton's SCADA Systems Integrator.

c. All other necessary appurtenances and connections for a complete and working installation, meeting specified Design Documents.

d. All excavation is unclassified.

2. Measurement – Measurement of Item No. A-1 will be on a lump sum basis.

3. Payment of the full unit price shall be paid for the work performed and in accordance with the Schedule of Values. Payment shall constitute full compensation to the Contractor for furnishing all: labor, equipment, tools, and materials; and for performing all operations required to furnish to the Owner the project, complete in place, as specified and as indicated on the Contract Drawings and Specifications.

Item No. A-2: ALTERNATE #2: Pond P7

1. Description

a. Construction of pond P7, including but not limited to:

i. Bulk excavation of the trench and pond

ii. Relocation of excavated soil to designated spoil areas

iii. Installation of a new monitoring manhole

iv. Installation of level control mechanisms including communications, wiring, cabling, terminations, equipment, and instruments

v. Installation of new piping

vi. Filling of trench with stone as specified in the Details

vii. Installation of a tapping sleeve and valve

viii. Installation of new recharge valve vault and accessories

ix. Installation of the access ramps

x. Installation of headwalls/end treatments

xi. Installation of instrumentation conduit, wiring, control panel and associated connections to equipment

xii. Calibration of installed instruments

xiii. Any associated electrical work

xiv. Collection of survey data and drawing markups for providing as-built Drawings.

b. Contractor is NOT to provide PLC or HMI programming services. All PLC and HMI programming shall be provided by the City of Dayton's SCADA Systems Integrator.

c. All other necessary appurtenances and connections for a complete and working installation, meeting specified Design Documents.

d. All excavation is unclassified.

2. Measurement – Measurement of Item No. A-2 will be on a lump sum basis.

3. Payment of the full unit price shall be paid for the work performed and in accordance with the Schedule of Values. Payment shall constitute full compensation to the Contractor for furnishing all: labor, equipment, tools, and materials; and for performing all operations required to furnish to the Owner the project, complete in place, as specified and as indicated on the Contract Drawings and Specifications.

Item No. A-3: ALTERNATE #3: Pond P12

4. Description

a. Construction of pond P12, including but not limited to:

i. Bulk excavation of the trench and pond

ii. Relocation of excavated soil to designated spoil areas

iii. Installation of new monitoring manhole

iv. Installation of level control mechanisms including communications, wiring, cabling, terminations, equipment and instruments

v. Installation of new piping

vi. Filling of trench with stone as specified in the Details

vii. Installation of a tapping sleeve and valve

viii. Installation of new recharge valve vault and accessories

ix. Installation of the access ramps

x. Installation of headwalls/end treatments

xi. Installation of instrumentation conduit, wiring, control panel and associated connections to equipment

xii. Calibration of installed instruments

xiii. Any associated electrical work

xiv. Collection of survey data and markups for providing as-built Drawings.

e. Contractor is NOT to provide PLC or HMI programming services. All PLC and HMI programming shall be provided by the City of Dayton's SCADA Systems Integrator.

f. All other necessary appurtenances and connections for a complete and working installation, meeting specified Design Documents.

g. All excavation is unclassified.

5. Measurement – Measurement of Item No. A-3 will be on a lump sum basis.

6. Payment of the full unit price shall be paid for the work performed and in accordance with the Schedule of Values. Payment shall constitute full compensation to the Contractor for furnishing all: labor, equipment, tools, and materials; and for performing all operations required to furnish to the Owner the project, complete in place, as specified and as indicated on the Contract Drawings and Specifications.

Item No. A-4: ALTERNATE #4: Contingency Allowance (10%)

1. Description – This item shall be reserved as a contingency for use during construction of the Project. Use of the contingency allowance shall only be authorized by the Owner for the changes in the Work following the procedures for change orders in accordance with the City of Dayton Construction and Material Specifications, most recent edition. The contingency shall be applied to all base bid items as well as Alternate No.1, Alternate No.2, and Alternate No.3. For contractor award the amount of this "Contingency Allowance" shall be ten percent (10%) of the Contractor's total base bid including those alternates (Alternate No.1, Alternate No.2, Alternate No.3 and/or Alternate No.4) the City elects to include.

1.14 OWNER RESPONSE TO PRICE PROPOSAL

A. The Owner reserves the right to approve and deny work items based on what is deemed to be in the best interest of the Owner.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

DIVISION 02

SITE CONSTRUCTION

SECTION 02050

DEMOLITIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required for demolitions, removal and disposal Work.
2. Included, but not limited to, are demolition and removals of existing materials, equipment, or work necessary to install the new Work as shown and specified and to connect same with existing work in an approved manner. Demolition includes piping, electrical mechanical equipment, and similar existing facilities.
3. Demolitions and removals which may be specified under other Sections shall conform to requirements of this Section.
4. Dayton Water Supply and Treatment reserves the right of ownership of any and all materials.

B. Related Sections:
1. Section 01010, Summary of Work.
2. Section 02300, Earthwork.

1.02 SUBMITTALS

A. Schedule: Submit for approval proposed methods, equipment, and operating sequences. Include coordination for shut-off, capping, temporary services, continuation of utility services, and other applicable items to ensure no interruption of Dayton Water Supply and Treatment's operations.

1.03 JOB CONDITIONS

A. Protection:
1. Perform all demolition and removal Work to prevent damage or injury to structures and adjacent features which might result from falling debris or other causes, and so as not to interfere with the use, and free and safe passage to and from adjacent structures.
2. Closing or obstructing of roadways, sidewalks, and passageways adjacent to the Work by the placement or storage of materials will not be permitted, and all operations shall be conducted with a minimum interference to traffic on these ways.
3. Erect and maintain barriers, lights, sidewalk sheds, and other necessary protective devices.
4. Repair damage to facilities to remain, or to any property belonging to Dayton Water Supply and Treatment or occupants of the facilities.

B. Scheduling:
1. Carry out operations so as to avoid interference with Dayton Water Supply and

Treatment's operations and work in the existing facilities.

C. Notification:
   1. At least 48 hours prior to commencement of a demolition or removal, notify ENGINEER in writing of proposed schedule therefor. Dayton Water Supply and Treatment will inspect the existing equipment and mark for identification those items which are to remain the property of the Dayton Water Supply and Treatment. Do not start removals without the permission of the ENGINEER.

D. Explosives:
   1. Do not bring explosives on site nor use explosives for any demolition.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 GENERAL

A. All materials and equipment removed from existing work, shall become the property of CONTRACTOR, except for those which Dayton Water Supply and Treatment has identified and marked for its use. All materials and equipment as indicated by Dayton Water Supply and Treatment or on the Contract Drawings shall be carefully removed by the CONTRACTOR, so as not to be damaged, and shall be cleaned and transported as directed by Dayton Water Supply and Treatment.

B. CONTRACTOR shall dispose of all demolition materials, equipment, debris, and all other items, except for equipment or materials which are to remain the property of Dayton Water Supply and Treatment, off the site and in conformance with all existing applicable laws and regulations.

C. Surfaces of walls, floors, ceilings, or other areas which are exposed by any of the removals specified herein, and which will remain as architecturally finished surfaces shall be repaired and re-finished by the CONTRACTOR with the same or matching materials as the existing adjacent surface or as may be otherwise approved by the ENGINEER.

D. CONTRACTOR shall work closely with Dayton Water Supply and Treatment during completion of the Project to avoid disruptions to pump station operations.

E. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
   1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
   2. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the Work.

3.02 ELECTRICAL REMOVALS

A. CONTRACTOR shall be responsible for disconnecting wiring at equipment to be removed. CONTRACTOR shall be responsible for removing the disconnected conduit, disconnect switches, wiring, lighting fixtures, receptacles, and all other appurtenant electrical removals unless otherwise noted on the Drawings.

B. Electrical removals shall consist of the removal of existing transformers, distribution switchboards, control panels, motors, conduits and wires, poles and overhead wiring, panelboards, lighting fixtures, and miscellaneous electrical equipment all as shown, specified, or required to perform the Work.

C. All existing electrical equipment and fixtures to be removed shall be removed with such care as may be required to prevent unnecessary damage, to keep existing systems in operation and to keep the integrity of the grounding systems.

D. Distribution switchboards shall be removed or modified as shown. Switchboards to be removed shall be disconnected and dismantled, and all components shall be disposed of off the site. Circuit breakers and other control equipment on modified switchboards that will no longer be used shall be removed unless otherwise shown or specified. All new openings cut into the modified switchboard panels shall be cut square and dressed smooth to the dimensions required for the installation of the new equipment.

E. Motors shall be disconnected and removed where shown or specified. Motors not designated by the Dayton Water Supply and Treatment to be salvaged shall be removed from the site. Motors or other electrical gear designated for reuse shall be stored in enclosed, heated storage.

F. Conduits and wires shall be abandoned or removed where shown. All wires in abandoned conduits shall be removed, salvaged, and stored. Abandoned conduits concealed in floor or ceiling slabs, or in walls, shall be cut flush with the slab or wall at the point of entrance. The conduits shall be suitably plugged and the area repaired in a flush, smooth, approved manner. Exposed conduits and their supports shall be disassembled and removed from the site. Repair all areas of work to prevent rust spots on exposed surfaces.

G. Panelboards where shown shall be removed and disposed of off the site. Where shown or specified, they shall be replaced with new panelboards at the same or adjacent locations. All cutting and patching necessary for the removal and replacement of panelboards shall be performed.

H. Lighting fixtures shall be removed or relocated as shown. Fixtures not relocated shall be removed from the site. Relocated fixtures shall be carefully removed from their present location and rehung where shown.

I. Wall switches, receptacles, starters and other miscellaneous electrical equipment, shall be removed and disposed of off the site as required. Care shall be taken in removing all equipment so as to minimize damage to architectural and structural members. Any damage incurred shall be repaired.

3.03 ALTERATIONS AND CLOSURES

A. Alterations shall conform to all applicable Specifications, the Drawings, and the directions and approvals of the ENGINEER.

B. Where alterations require cutting or drilling into existing floors, walls, and roofs, the holes shall be repaired in an approved manner. CONTRACTOR shall repair such openings with the same or matching materials as the existing floor, wall, or roof or as otherwise approved by the ENGINEER. All repairs shall be smoothly finished unless otherwise approved by the ENGINEER.

C. Openings in existing concrete slabs, ceilings, masonry walls, floors and partitions shall be closed and sealed as shown or otherwise directed by the ENGINEER. New Work shall be keyed into the existing Work in an acceptable manner. New reinforcing steel shall be welded to the existing reinforcing. Welding shall conform to AWS D12.1, Reinforcing Steel Welding Code. In general, use the same or matching materials as the existing adjacent surface. The finished closure shall be a smooth, tight, sealed, permanent closure acceptable to the ENGINEER.

3.04 CLEAN-UP

A. CONTRACTOR shall remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the Work, all materials, equipment, waste, and debris of every sort shall be removed, and premises shall be left, clean, neat and orderly.

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Provide all materials, labor, equipment and services necessary to do all clearing and grubbing, excavation, backfilling, providing of additional fill material and topsoil, control of surface drainage and ground water, finished site grading and erosion control required to construct the work as shown.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- State and local code requirements shall control the disposal of trees and shrubs.
- All burning shall be controlled by applicable local regulations.
- City of Dayton Construction Materials and Specifications – Section 201 “Clearing and Grubbing”
- City of Dayton Construction Materials and Specifications – Section 207 “Temporary Soil Erosion and Sediment Control”
- City of Dayton Construction Materials and Specifications – Section 810 “Excavation and Backfill for City Owned Piping Systems”
- City of Dayton Construction and Materials Specifications – Section 847 “Cutting and Plugging (or Capping) Water Main”
- Recharge Trench Fill – Section 02050

1.03 SUBMITTALS

A. The following tests will be performed for each borrow area or each time the soil material changes significantly:
   1. Standard Proctor Compaction Test per ASTM D-698
   2. Classification of soils for engineering purposes per ASTM D-2487
   3. Shear strength per ASTM D-4767
   4. Particle size analysis per ASTM D-422
   5. Liquid limit, plastic limit, and plasticity index per ASTM D-4318
   6. Moisture content per ASTM D-2216

B. Survey data for locations of samples that were collected for testing.

1.04 JOB CONDITIONS

A. Weather: Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained on account of rain, snow, ice, drought or other adverse weather conditions.

B. Existing Utilities: Prior to commencement of work, the Contractor shall locate existing underground utilities in areas of the work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

C. Use of Explosives: Blasting is not permitted on this project. The Contractor (or any of his Subcontractors) shall not bring explosives onto site or use in work without prior written permission from the Owner. All activities involving explosives shall be in compliance with the rules and regulations of the State Department of Mines, and Minerals, Division of Explosives and Blasting. Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.

D. Protection of Persons and Property:
   1. Barricade open excavations occurring as part of this work and post with warning lights.
      a. Operate warning lights as recommended by authorities having jurisdiction.
      b. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

E. Dust Control: Use all means necessary to control dust on or near the project site where such dust is caused by the Contractor's operations or directly results from conditions left by the Contractor.

F. Safety: Contractor shall be responsible for
   1. Conforming to all federal, state, and local codes and regulations regarding safety.
   2. Protecting excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation. Trench boxes shall meet OSHA standards.
   3. Underpinning adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

A. Definitions:
   1. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, SP, GC, SC, ML, and CL.
   2. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups MH, CH, OL, OH and PT. The Contractor shall notify the Engineer if these soil materials are encountered.
   3. Backfill and Fill Materials: Satisfactory soil materials free of debris, waste, frozen materials, vegetable, and other deleterious matter.
   4. Riprap: Provide rock, broken concrete (if no reinforcing steel is present), or stone of sizes such that at least 85% of the total material weight is larger than a 6-inch, but less than an 18-inch square opening. The material smaller than a 6-inch square opening shall consist predominantly of rock and shall be free of soil.

PART 3 – EXECUTION

3.01 EROSION CONTROL

A. Temporary measures shall be applied throughout the construction period to control and to minimize siltation to adjacent properties and waterways. Such measures shall include, but not be limited to, the use of berms, silt barriers, gravel or crushed stone, mulch, slope drains and other methods.

B. These temporary measures shall be applied to erodible material exposed by any activity associated with the construction of this project.

C. Refer to City of Dayton Construction and Material Specifications Section 207, “Temporary Soil Erosion and Sediment Control”.

3.02 EXCAVATION

A. Excavation of every description and of whatever substances encountered within the grading limits of the project shall be performed to the lines and grades indicated on the Drawings. All excavation shall be performed in the manner and sequence as required for the work.

B. All excavated materials that meet the requirements for fill, subgrades or backfill shall be stockpiled within the site for use as fill or backfill, or for providing the final site grades. Where practicable, suitable excavated material shall be transported directly to any place in the fill areas within the limits of the work. All excavated materials that are not suitable for fill, and any surplus of excavated material that is not required for fill shall be disposed of by the Contractor as seen on the plans.

C. The site shall be kept free of surface water at all times. The Contractor shall install drainage ditches, dikes and shall perform all pumping and other work necessary to divert or remove rainfall and all other accumulations of surface water from the excavations. The diversion and removal of surface water shall be performed in a manner that will prevent flooding and/or damage to other locations within the construction area where it may be detrimental. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hose piping, well points, deep wells, etc., necessary to depress and maintain the ground water level at least two (2) feet below the base of the excavation during all stages of construction operations. The ground water table shall be lowered in advance of excavation and maintained a minimum of two (2) feet below the lowest excavation subgrade made until the excavation is backfilled or the structure has sufficient strength and weight to withstand horizontal and vertical soil and water pressures from natural ground water.

D. Excavations for the construction shall be carefully made to the depths required. Bottoms for footings and grade beams shall be level, clean and clear of loose material, the lower sections true to size. Bottoms of footings and grade beams, in all locations, shall be at a minimum depth of 30 inches below adjacent exterior finished grade or 30 inches below adjacent existing

grade, whichever is lower, whether so indicated or not. Footings and grade beam bottoms shall be inspected by the Engineer before any concrete is placed thereon.

E. In excavations for structures where, in the opinion of the Engineer, the ground is spongy or otherwise unsuitable for the contemplated foundation, the Contractor shall remove such unsuitable material and replace it with suitable material properly compacted.

F. Sheeting and shoring shall be provided as necessary for the protection of the work and for the safety of the personnel. The clearances and types of the temporary structures, insofar as they affect the character of the finished work, will be subject to the review of the Engineer, but the Contractor shall be responsible for the adequacy of all sheeting, bracing and coffer damming. All shoring, bracing and sheeting shall be removed as the excavations are backfilled in a manner such as to prevent injurious caving; or, if so directed by the Engineer, shall be left in place. Sheeting left in place shall be cut off 18 inches below the surface.

G. Excavation for structures which have been carried below the depths indicated without specific instructions shall be refilled to the proper grade with suitable material properly compacted, except that in excavation for columns, walls or footings, the concrete footings shall extend to this lower depth. All work of this nature shall be at the Contractor's expense.

3.03 FILL

A. All existing fill below structures and paved areas must be stripped. The upper six (6) inches of the natural subgrade below shall be scarified and recompacted at optimum moisture to at least ninety-five percent (95%) of Standard Proctor Density ASTM D 698 (latest revision).

B. All vegetation, such as roots, brush, heavy sods, heavy growth of grass and all decayed vegetable matter, rubbish and other unsuitable material within the area upon which fill is to be placed shall be stripped or otherwise removed before the fill is started. In no case will such objectionable material be allowed to remain in or under the fill area. Existing fill from excavated areas on site shall be used as fill for open and/or planted areas. Additional fill stockpiled at the site can be used for structural fill if approved by the Engineer. Any additional material necessary for establishing the indicated grades shall be furnished by the Contractor and approved by the Engineer. All fill material shall be free from trash, roots and other organic material. The best material to be used in fills shall be reserved for backfilling pipe lines and for finishing and dressing the surface. Material larger than 3 inches maximum dimension shall not be permitted in the upper 6 inches of the fill area. Fill material shall be placed in successive layers and thoroughly tamped or rolled in a manner approved by the Engineer, each layer being moistened or dried such that the specified degree of compaction shall be obtained. No fill shall be placed or compacted in a frozen condition or on top of frozen material. No fill material shall be placed when free water is standing on the surface of the area where the fill is to be placed and no compaction of fill will be permitted with free water on any point of the surface of the fill to be compacted.

C. Where concrete slabs are placed on earth, all loam and organic or other unsuitable material shall be removed. Where fill is required to raise the subgrade for concrete slabs to the elevations as indicated on the Drawings or as required by the Engineer, such fill shall consist

of suitable material and shall be placed in layers. Each layer shall be moistened or dried such that the specified degree of compaction shall be obtained. All compaction shall be accomplished in a manner and with equipment as approved by the Engineer. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for adjacent fill.

3.04 BACKFILLING

A. After completion of footings, grade beams and other construction below the elevation of the final grades and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all trash and debris. Material for backfilling shall be as specified for suitable material, placed and compacted as specified hereinafter. Backfill shall be placed in horizontal layers of the thickness specified and shall have a moisture content such that the required degree of compaction is obtained. Each layer shall be compacted by mechanical tampers or by other suitable equipment approved by the Engineer to the specified density. Special care shall be taken to prevent wedging action or eccentric loading upon or against the structure. Trucks and machinery used for grading shall not be allowed within 45 degrees above the bottom of the footings or grade beams.

B. The trenches shall be backfilled following visual inspection by the Engineer and prior to pressure testing. The trenches shall be carefully backfilled with the excavated materials approved for backfilling, or other suitable materials, free from large clods of earth or stones. Each layer shall be compacted to a density at least equal to that of the surrounding earth and in such a manner as to permit the rolling and compaction of the filled trench with the adjoining earth to provide the required bearing value, so that paving, if required, can proceed immediately after backfilling is completed.

3.05 COMPACTION

A. Suitable material as hereinbefore specified shall be placed in maximum 8" horizontal layers. Compaction shall be performed by rolling with approved tamping rollers, pneumatic-tired rollers, three wheel power rollers or other approved equipment. The degree of compaction required is expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D-698. Laboratory moisture density tests shall be performed on all fill material. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction. Compaction requirements shall be as specified below:

Fill Utilized	For Required Density (%)	Maximum Permissible Lift Thickness as Compacted, in.
Backfill & Utility Trenches Under Foundations & Pavements	95-100	8
Backfill Around Structures	95-100	8
Field and Utility Trench Backfill Under Sidewalks and Open Areas	90-100	8

B. Field density tests shall be performed in sufficient number to ensure that the specified density is being obtained. Tests shall be in accordance with ASTM Standards D 1556 or D 2922/D 3017 and shall be performed as authorized by the Engineer. Payment for field density tests shall be by the OWNER. Contractor shall provide suitable notification for coordination of testing. Delays due to the lack of adequate advance notification shall be the responsibility of the Contractor.

3.06 SITE GRADING

A. Where indicated or directed, topsoil shall be removed without contamination with subsoil and spread on areas already graded and prepared for topsoil, or transported and stockpiled convenient to areas for later application, or at locations specified. Topsoil shall be stripped to full depth and, when stored, shall be kept separate from other excavated materials and piled free of roots, stones, and other undesirable materials.

B. Following stripping, fill areas shall be scarified to a minimum depth of six (6) inches to provide bond between existing ground and the fill material. Material should be placed in successive horizontal layers not exceeding twelve (12) inches uncompacted thickness. In general, layers shall be placed approximately parallel to the finished grade line.

C. In general and unless otherwise specified, the Contractor may use any type of earth moving equipment he has at his disposal, provided such equipment is in satisfactory condition and of such type and capacity that the work may be accomplished properly and the grading schedule maintained. During construction, the Contractor shall route equipment at all times, both when loaded and empty, over the layers as they are placed, and shall distribute the travel evenly over the entire area.

D. The material in the layers shall be of the proper moisture content before rolling or tamping to obtain the prescribed compaction. Wetting or drying throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on the fill thus affected shall be delayed until the material has dried to the required moisture content. If the material is too dry, it shall be sprinkled with water and manipulated to obtain the uniform moisture content required throughout a layer before it is compacted.

E. Each layer of the fill shall be compacted by rolling or tamping to the standard specified in Paragraph 3.06 and not less than 90% maximum density at optimum moisture content as determined by field density tests made by the Standard Proctor method. In general and unless otherwise specified, the Contractor may use any type of compaction equipment such as sheepsfoot rollers, pneumatic rollers, smooth rollers and other such equipment he has at his disposal, provided such equipment is in satisfactory condition and is of such design, type, size, weight, and quantity to obtain the required density in the embankment. If at any time the required density is not being obtained with the equipment then in use by the Contractor, the Engineer may require that different and/or additional compaction equipment be obtained and placed in use at once to obtain the required compaction.

F. The Contractor shall be responsible for the stability of all embankments and shall replace any portion which, in the opinion of the Engineer, has become displaced due to carelessness or negligence on the part of the Contractor.

3.07 TOPSOIL

A. Provide all labor, materials, equipment and services required for furnishing and placing topsoil. Samples of topsoil shall be submitted to the Engineer for review before topsoil is placed. The material shall be good quality loam and shall be fertile, friable, mellow; free from stones larger than one (1) inch, excessive gravel, junk metal, glass, wood, plastic articles, roots and shall have a liberal amount of organic matter. Light sand loam or heavy clay loam will not be acceptable.

B. The topsoil shall be 3 inches thick in all areas to be seeded. No topsoil shall be placed until the area to be covered is excavated or filled to the required grade. Imported backfill material will be stockpiled on site for structure backfilling and top soiling.

END OF SECTION

SECTION 02302

RECHARGE TRENCH FILL

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Provide all materials, labor, equipment and services necessary to perform the filling of recharge trenches and construct the work as shown.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02300 – "Earthwork"

B. City of Dayton Construction and Material Specifications – Section 207 "Temporary Soil Erosion and Sediment Control"

1.03 JOB CONDITIONS

A. Weather: Fill operations shall be suspended at any time when satisfactory results cannot be obtained on account of rain, snow, ice, drought or other adverse weather conditions.

B. Protection of Persons and Property:
   1. Barricade open excavations occurring as part of this work and post with warning lights.
      a. Operate warning lights as recommended by authorities having jurisdiction.
      b. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

C. Dust Control: Use all means necessary to control dust on or near the project site where such dust is caused by the Contractor's operations or directly results from conditions left by the Contractor.

D. Safety: Contractor shall be responsible for
   1. Conforming to all federal, state, and local codes and regulations regarding safety.
   2. Protecting excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation. Trench boxes shall meet OSHA standards.
   3. Underpinning adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

1.04 SUBMITTALS

A. Gradation of stone as performed in accordance with ASTM C-136.

B. Delivery tickets of haul trucks including amount, in tons, of crushed stone delivered to the site.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

A. Definitions:
   1. Recharge Trench Fill Materials: Satisfactory crushed stone free of debris, waste, frozen materials, vegetative, and other deleterious matter conforming to AASHTO M 43 size specifications. Recharge trench fill will be comprised of #4, #8, and #57 crushed stone. All crushed stone will be washed. Trench dimensions and layers are seen on plans.
      i. #4 crushed stone will consist of an evenly graded mixture of crushed stone with 100 percent passing a 2-inch sieve and not more than 5 percent passing a 3/8-inch sieve.

      ii. #8 crushed stone will consist of an evenly graded mixture of crushed stone with 100 percent passing a 1/2-inch sieve and not more than 5 percent passing a No. 16 sieve.

      iii. #57 crushed stone will consist of an evenly graded mixture of crushed stone with 100 percent passing a 1 1/2-inch sieve and not more than 5 percent passing a No. 4 sieve.

PART 3 – EXECUTION

3.01 EROSION CONTROL

A. Temporary measures shall be applied throughout the construction period to control and to minimize siltation to adjacent properties and waterways. Such measures shall include, but not be limited to, the use of berms, silt barriers, gravel or crushed stone, mulch, slope drains and other methods.

B. These temporary measures shall be applied to erodible material exposed by any activity associated with the construction of this project.

C. Refer to City of Dayton “Construction Materials and Specifications” Section 202 “Temporary Soil Erosion and Sediment Control” for requirements.

3.02 GENERAL RQUIREMENTS FOR FILLING

A. The recharge trenches shall be filled following inspection by the Engineer. The trenches shall be carefully filled with the crushed stone approved for recharge trench backfill prior to this section. See plans for breakdown of fill materials.

B. After preparing the trench, aggregate will be placed in loose layers not exceeding 12 inches in depth, and firmly compacted using a mechanical tamper, roller or other suitable equipment approved by the Engineer. Care shall be taken by the Contractor to NOT intermit the aggregate with earthen material.

C. Keep excavations dry during backfilling operations.

D. Recharge trenches are to be filled in accordance with Drawings.

END OF SECTION

SECTION 02610

PVC PRESSURE PIPE – (Non-Potable)

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish all labor, material, and equipment necessary to install water piping and appurtenances as shown on the drawings and specified herein.

B. This section describes PVC pipe which may or may not apply to the current project. Pipe materials will be identified either on the drawings or the bid form.

1.02 RELATED SECTIONS

A. Section 810 of City of Dayton Construction Materials and Specifications, “Excavation and Backfill for City Owned Piping”

B. Section 201 of City of Dayton Construction Materials and Specifications, “Clearing and Grubbing”

C. Section 02300 - Earthwork

D. Section 02642 – Recharge Line Tapping Sleeves

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with these Specifications.

B. Descriptive literature, catalog cut sheets, parts lists, and dimensional prints clearly indicating all dimensions and materials of construction shall be submitted on all items specified herein to the Engineer for review prior to ordering.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Pipe and accessories shall be unloaded at the point of delivery, hauled to, and distributed at the site of the project by Contractor in such a manner to avoid damage to the materials. Whether moved by hand, skidways, or hoists, materials shall not be dropped or bumped against pipe or accessories already on the ground or against any other object.

B. In distributing material at the construction site, each piece shall be unloaded as near the installation point as possible.

C. Pipe shall be handled in such a manner as to avoid damage to the ends. When such damaged pipe cannot be repaired to the Engineer's satisfaction, it shall be replaced at the Contractor's expense. The interior of all pipe and accessories shall be kept free from dirt and foreign matter at all times. The interior of all pipe and accessories shall be checked for dirt and debris and, if necessary, thoroughly cleaned before use in the project.

PART 2 - PRODUCTS

2.01 PVC (POLYVINYL CHLORIDE) PIPE

A. Scope

This article covers the design and manufacture of PVC 1120 manufactured of CLASS 12454-B or CLASS 12454-C (cell classification) resin material with a hydrostatic-design-basis (HDB) rating of 4,000 psi at 73.4º F (23º C).

B. Specific Requirements

PVC pressure pipe shall be furnished, constructed of materials and to the specifications of this section. The types of PVC pipe permitted for use on the project will be as noted on the drawings or bid form. The selected pipe will be designated either as PVC (ASTM) or PVC (AWWA) followed by an appropriate pressure rating or dimension ratio (DR or SDR).

1. PVC (ASTM) Pipe

a. PVC (ASTM) pipe shall be designed, manufactured, and tested to conform with the latest revision of ASTM D-2241.

b. Rubber gasketed joints shall conform to ASTM D-3139. The gaskets for the PVC pipe joint shall conform to ASTM F-477 and D-1869. Gaskets shall be twin gasket joints or integral bell joints with rubber O-ring seals.

c. PVC (ASTM) pipe shall be furnished as SDR 21 for Class 200 psi.

2. PVC (AWWA) Pipe

a. PVC (AWWA) pipe shall be designed, manufactured, and tested to conform with the latest revision of AWWA C900 for pipes sizes 4-inch to 60-inch.

b. Pipe shall have cast iron pipe equivalent ODs.

c. Rubber gasketed joints shall conform to ASTM D-3139. The gaskets for the PVC pipe joint shall conform to ASTM F-477 and D-1869.

d. PVC (AWWA) pipe shall be furnished as DR 14 for Class 200 psi respectively.

C. Rubber gasket joints shall provide adequate expansion to allow for a 50° change in temperature on one length of pipe. Lubrication for rubber connected couplings shall be water soluble, non-toxic, be non-objectionable in taste and odor and have no deteriorating affect on the PVC or rubber gaskets and shall be as supplied by the pipe manufacturer.

D. Standard laying lengths shall be 20 feet ± for all sizes. At least 85 percent of the total footage of pipe of any class and size shall be furnished in standard lengths, the remaining 15 percent in random lengths. Random lengths shall not be less than 10 feet long. Each standard and random length of pipe shall be tested to four times the class pressure of the pipe for a minimum of five (5) seconds. The integral bell shall be tested with the pipe.

F. All pipe and couplings shall bear identification markings that will remain legible during normal handling, storage, and installation, which have been applied in a manner what will not reduce the strength of the pipe or the coupling or otherwise damage them. Pipe and coupling markings shall include the nominal size and OD base, material code designation, dimension ratio number, ASTM or AWWA Pressure Class, ASTM or AWWA designation number for this standard, manufacturer's name or trademark seal (mark) of the testing agency that verified the suitability of the pipe material for potable-water service. Each marking shall be applied at intervals of not more than five (5) feet for the pipe and shall be marked on each coupling.

G. Fittings shall be ductile iron in accordance with Article 824 of the City of Dayton Construction and Material Specifications.

2.02 RESTRAINT DEVICES FOR PVC PIPE

A. Each restraint system shall be manufactured of ductile iron conforming to ASTM A536. A backup ring shall be utilized behind the PVC Bell. A restraint ring incorporating a plurality of individually actuating gripping surfaces shall be used to grip the pipe then bolted to the backup ring. The restraint shall be the Series 2000PV (mechanical joint restraint to fittings) or 2800 (pipe harness) as manufactured by EBAA Iron, Inc. or approved equal.

B. Restraint devices for mechanical joint fittings and appurtenances shall conform to either AWWA C111, or AWWA C153. The working pressure for the restraint shall equal that of the pipe on which it is used.

C. Mechanical joint restraints, 4” through 24”, shall meet or exceed the requirements of ASTM F1674.

D. Mechanical joint retainer glands and pipe bell harnesses shall receive corrosion protective coating (EBAA Iron Mega-Bond or equal).

2.03 COUPLINGS AND ADAPTERS

A. Flexible couplings shall be of the sleeve type with a middle ring, two round-wedge shaped rubber gaskets at each end, two following rings together, and compress the gasket against the pipe. Flexible couplings shall be steel with minimum wall thickness of the middle ring or sleeve installed on pipe being 5/16-inch for pipe smaller than 10 inches, 3/8-inch pipe for 10 inches or larger. The minimum length of the middle ring shall be 5 inches for pipe sizes up to 10 inches and 7 inches for pipe 10 inches to 30 inches. The pipe stop shall be removed. Gaskets shall be suitable for 250 psi pressure rating or at rated working pressure of the connecting pipe. Couplings shall be harnessed and be designed for 250 psi.

B. Flanged adapters shall have one end suitable for bolting to a pipe flange and the other end of flexible coupling similar to that described hereinbefore. The adapters shall be furnished with bolts of an approved corrosion resistant steel alloy, extending to the adjacent pipe flanges. Flanges on flanged adapter (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 Class 125. Locking pins shall be provided.

C. Flexible couplings and flanged adapters shall be as manufactured by Dresser, Rockwell, or equal, per the following, unless otherwise specified and/or noted on the Drawings.

1. Steel couplings for joining same size, plain-end, steel, cast iron, and PVC plastic pipe shall be Dresser style 38, Rockwell 411, or equal.

2. Transition couplings for joining pipe of different outside diameters:

Dresser	Rockwell
Style 162 (4" – 12")	413 steel (2" – 24")
Style 62 (2" – 24")	415 steel (6" – 48")
	433 cast (2" – 16")
	435 cast (2" – 12")

3. Flanged adapters for joining plain-end pipe to flanged pipe, fittings, valves, and equipment:

Style 127 cast (3" – 12")	912 cast (3" – 12")
Style 128 steel (3" – 48" C.I. pipe)	913 steel (3" and larger)
Style 128 steel (2" – 96" steel pipe)	

2.04 WALL PIPE AND SLEEVES

A. All wall pipe shall be furnished with cast or welded collar water stops in the positions shown on the Drawings. Welding of water stop collars on pipe shall be accomplished by the wall pipe manufacturer in their shop. All centrifugally cast wall pipe shall be ductile iron meeting the requirements of AWWA C151 for the pipe barrel, conforming to the pressure rating of the pipeline in which installed, and in no case be lighter than Class 53. All statically cast wall pipe shall be ductile iron meeting the requirements of AWWA C110 for fittings. Mechanical joint end and cast-on flange end wall pipe shall conform to AWWA C110, and threaded flange wall pipe shall conform to AWWA C115. Where flanged or mechanical joint bell ends are flush with the wall, they shall be drilled and tapped for stud bolts which are to be of 300 Series stainless steel. The length of all wall pipe shall be not less than the thickness of the wall in which installed. Wall pipe shall have the same pressure rating as connecting pipe. All wall pipe shall be cement-mortar lined per AWWA C104. The outside of wall pipes shall be left uncoated and shall be field primed for painting on the portion exposed, uncoated where embedded, and field coated with standard bituminous coated where buried.

B. Contractor may have the option to install wall pipe flush face-face of wall, in lieu of the dimensioned length wall pipe shown on the Drawings, in order to eliminate form penetrations. This option will be subject to Engineer's review at each wall pipe location and covers both flanged and mechanical-joint bell-end wall pipe. Embedded flanged and

M.J. bell-end bolt holes shall be tapped for stud bolts; tapped bolt holes in embedded flanges shall be plugged for protection during concrete pouring.

C. All pipe wall sleeves shall be plain end galvanized steel pipe of diameter noted on Drawings and length to fit flush face-to-face of wall.

2.05 INTERLOCKING LINK PIPE SEALS

A. In all locations indicated on the Drawings, interlocking link pipe seals shall be used. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall sleeve. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely watertight seal between the pipe and wall sleeve. Seals shall be "Link-Seal" as manufactured by Thunderline Corporation, Wayne, Michigan, or approved equal.

B. The Contractor shall determine the required diameter of each individual wall opening according to the manufacturer's recommendations before ordering and installing the seal. Pipe shall be accurately centered in the sleeve and the link seals shall be sized, installed, and tightened in accordance with the manufacturer's instructions.

PART 3 - EXECUTION

3.01 LAYING DEPTHS

Pipe shall be laid with a minimum cover as noted on the Drawings.

3.02 THRUST BLOCKING

A. Concrete

Concrete thrust blocking (3500 psi) shall be installed as shown on drawings.

B. Fittings

All plugs, caps, tees, and bends, unless otherwise specified, shall be provided with thrust blocking. Other restraint materials such as metal rods, clamps, or restrained joints shall not be used unless specifically authorized by Engineer in writing.

C. Restraint Materials

1. Thrust Blocking: Vertical and horizontal thrust blocking shall be made of concrete having a compressive strength of not less than 3,500 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground in each instance shall be that shown or directed by the Engineer. The blocking shall, unless otherwise shown or directed,

be so located as to contain the resultant thrust force and so that the pipe and fitting joints will be accessible for repair.

2. Restrained Joints: Restrained push-on joints, mechanical joints utilizing set-screw retainer glands or metal harness of tie-rods, or clamps may only be used instead of concrete blocking if specifically authorized by Engineer. Tie rods, clamps, or other components of dissimilar metal shall be protected against corrosion by hand application of a bituminous coating or by encasement of the entire assembly with eight (8) millimeter thick, loose polyethylene film in accordance with AWWA C105.

3.03 PIPE INSTALLATION

A. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, valves, and hydrants shall be lowered carefully into the trench by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to water line materials and protective coatings and linings. Under no circumstances shall water line materials be dropped or dumped into the trench. The trench should be dewatered prior to installation of the pipe.

B. The Contractor shall secure from the manufacturer an installation guide for the pipe being used. The Contractor shall in all cases adhere to the recommended installation procedures of the manufacturer except where those given herein are more stringent. The more stringent requirements shall be met.

1. Examination of Material - All pipe fittings, valves, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Engineer who may prescribe corrective repairs or reject the materials.

2. Pipe Ends - All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign material before the pipe is laid.

3. Pipe Cleanliness - Foreign material shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

4. Pipe Placement - As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

5. Pipe Plugs - At times when pipe laying is not in progress, the open ends of pipe shall be closed by a water tight plug or other means approved by the Engineer. The plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe floatation should the trench fill with water.

3.04 JOINT ASSEMBLY

A. Push-On Joints

Push-on joints are to be assembled as follows:

1. Thoroughly clean the groove and bell socket and insert the gasket, making sure that it faces the proper direction and that it is correctly seated.

2. After cleaning dirt or foreign material from the plain end, apply lubricant in accordance with the pipe manufacturer's recommendations. The lubricant is supplied in sterile cans and every effort should be made to keep it sterile.

3. Be sure that the plain end is beveled; square or sharp edges may damage or dislodge the gasket and cause a leak. When pipe is cut in the field, bevel the plain end with a heavy file or grinder to remove all sharp edges. Push the plain end into the bell of the pipe. Keep the joint straight while pushing. Make deflection after the joint is assembled.

4. Small pipe can be pushed into the bell socket with a long bar. Large pipe requires additional power, such as a jack, lever puller, or backhoe. The supplier may provide a jack or lever pullers on a rental basis. A timber header should be used between the pipe and jack or backhoe bucket to avoid damage to the pipe.

B. Mechanical Joints

Mechanical joints are to be assembled as follows:

1. Wipe clean the socket and plain end. The plain end, socket, and gasket should be washed with a soap solution to improve gasket seating.

2. Place the gland on the plain end with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end of the pipe.

3. Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during assembly.

4. Push the gland toward the bell and center it around the pipe with the gland lip against the gasket.

5. Align bolt holes and insert bolts with bolt heads behind the bell flange and tighten opposite nuts to keep the gland square with the socket. Make deflection after joint assembly but before tightening the bolts.

6. Tighten the nuts in accordance with the following table:

MECHANICAL JOINTS - BOLT TORQUES	
Bolt Diameter (inches)	**Torque (feet - pound)**
5/8	45 - 60
3/4	75 - 90
1	86 - 100
1¼	105 - 120

3.05 PIPE CUTTING

Cutting of pipe for the insertion of valves, fittings or closure pieces shall be done in a neat workmanlike manner without creating damage to the pipe, linings, or coatings and in strict accordance to manufacturer's recommendation.

3.06 TESTING

A. After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure test of at least 1.5 times the working pressure of the pipe at the point of testing, but in no case less than that required by other sections herein. In addition, a leakage test shall be conducted concurrently with the pressure test.

B. Pressure Test

1. Test Pressure Shall:

a. Not be less than 1.25 times the working pressure at the highest point along the test section.

b. Not to exceed pipe or thrust restraint design pressures at the lowest point along the test section.

c. Be of at least two (2) hour duration.

d. Not vary by more than plus or minus 5 psi.

e. Not exceed twice the rated pressure of the valves or hydrants when the pressure of the test section includes closed gate valves or hydrants.

f. Not to exceed the rated pressure of resilient seat butterfly valves when used.

2. Each valved section of pipe shall be filled with water slowly and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer.

3. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged, or left in place at the discretion of the Engineer.

4. All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory to the Engineer.

C. Leakage Test

1. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

2. The pipe shall be tested in accordance with AWWA C600 concurrently with the pressure test. No pipe installation will be accepted if the leakage is greater than that allowed in the following formula:

$$L = (S \times D \times (P)^{½}) \div 133{,}200$$

Where:

L = the allowable leakage (gallons per hour)
S = length of pipe tested, in feet
D = nominal diameter of the pipe (inches)
P = test pressure (psig)

a. When hydrants are in the test section, the test shall be made against the closed hydrant.

3. Acceptance shall be determined on the basis of allowable leakage. If any pipe has leakage greater than allowed, the Contractor shall, at his own expense, locate and repair the defective material until the leakage is within the specified allowance.

a. All visible leaks are to be repaired regardless of the amount of leakage.

3.07 UNDERGROUND IDENTIFICATION TAPE

A. Detectable underground marking tape shall be installed over all utility lines. Care shall be taken to ensure that the buried marking tape is not broken when installed. Detectable underground marking tape shall be encased aluminum foil, Type III.

B. The identification tape shall bear the printed identification of the plastic utility line below it, such as "Caution - Buried Below." Tape shall be reverse printed; surface printing will not be acceptable. The tape shall be visible in all types and colors of soil and provide maximum color contrast to the soil. The tape shall meet the APWA color code and shall be two (2) inches in width. Colors are: yellow - gas, green - sewer, red - electric, blue - water, orange - telephone, and brown - force main.

END OF SECTION

SECTION 02642

TAPPING SLEEVES – RECHARGE LINE

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Provide all materials, labor, equipment and services necessary to perform the tapping of existing recharge lines to feed proposed ponds.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. City of Dayton Construction and Material Specifications – Section 108 “Subcontractors and Material Suppliers”

B. City of Dayton Construction and Material Specifications – Section 810 “Excavation and Backfill for City Owned Piping Systems”

1.03 SUBMITTALS

A. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering.

B. At the time of submission, the Contractor shall, in writing, call Engineer’s attention to any deviations that the submittals may have from the requirements of the Engineer’s Contract Drawings and Specifications.

PART 2 – PRODUCTS

2.01 TAPPING SLEEVE MATERIALS

A. Prestressed Concrete Pipe:
   1. Tapping sleeves shall conform to AWWA C223 and Manual M9 – Concrete Pressure Pipe:
   2. All steel plates comprising the body shall be ASTM A 36 steel.
   3. All assemblies shall be high strength low alloy steel studs and nuts conforming to AWWA C111 standards.
   4. All straps shall be ASTM A 36 steel.
   5. All gaskets shall be made of Styrene Butadiene Rubber (SBR) compounded for water and sewer service in accordance with ASTM D 2000 3 BA715.
   6. AWWA C207 Class D steel ring flanges compatible with ANSI Class 125 and 150 bolt circles.
   7. Corrosion Protection – Fusion bonded epoxy in accordance with AWWA C213.

8. The counterbored is to fit the tapping valve lip per MSS SP-60 where applicable.
9. Tapping sleeves shall be as manufactured by Romac Industries (FTS 435) or approved equal.

B. Ductile Iron and PVC Pipe Tapping Sleeves:
1. Tapping sleeves shall conform to AWWA C223:
2. All steel plating comprising the body shall be ASTM A 36 steel.
3. All bolts and nuts shall be high strength low alloy. Steel shall meet AWWA standard C111.
4. All gaskets shall be made of Styrene Butadiene Rubber (SBR) compounded for water and sewer service in accordance with ASTM D 2000 3 BA715.
5. Corrosion Protection – Fusion bonded epoxy in accordance with AWWA C213.
6. Tapping sleeves shall be as manufactured by Romac Industries (FTS419) or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Contractor is responsible for the installation of all tapping sleeves. Contractor shall verify through the manufacturer that the tapping sleeve is approved for the pipe material to be tapped.

B. The Contractor shall secure from the manufacturer an installation guide for the tapping sleeves being used. The Contractor shall in all cases adhere to the recommended installation procedures of the manufacturer.

C. Contractor shall refer to section 810 “Excavation and Backfill for City Owned Piping Systems” for bedding, trenching, and backfill requirements.

END OF SECTION

SECTION 02652

ELECTROMAGNETIC FLOW METERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment and incidentals required to completely install and put into operation an electromagnetic meter suitable for water transmission as specified herein and shown on the drawings.

1.02 REFERENCES

A. Reference standards cited in this specification refer to the current reference standard published at the time of the latest revision date logged at the end of this specification, unless a date is specifically cited.
   1. American Society of Mechanical Engineers (ASME)
      a. ASME/ANSI B16.5 Pipe Flanges and Flanged Fittings

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 1.2 - Submittals.

B. All submittals shall be approved by the Owner prior to delivery and/or fabrication for specials.

C. Submit Product Data:
   1. Technical bulletins and brochures on electromagnetic flow meters.

D. Submit Shop Drawings
   1. Project specific electrical diagram
   2. Certification letter
      a. Manufacturer shall certify that proposed meter will meet required accuracy per this Specification given this specific project piping configuration.

E. Operation and Maintenance Data

1.04 QUALITY ASSURANCE

A. Qualifications
   1. Manufacturers
      a. The Contractor shall cause all equipment specified under this section to be furnished by the meter manufacturer who shall be responsible for the adequacy and compatibility of all components. Any component of each complete unit not provided by the meter manufacturer shall be designed, fabricated, tested, and installed by factory-authorized representatives experienced in the design and manufacture of the meter equipment. This requirement, however, shall not be construed as relieving the Contractor of the overall responsibility for this portion of the work.

B. Preconstruction Testing

1. Volumetric testing of all meters must be performed and approved prior to shipment. The complete meter assembly and converter must be wet accuracy test and calibrated as a unit at near minimum, intermediate, and maximum manufacturer's specified flow ranges of the meter. The amount of water used to conduct the test must be shown on a shipping tag attached to the meter. The test facility must be verified annually and be traceable to the National Institute of Standards and Technology.
    a. Accuracies shall be as described in Paragraph 2.1.C below.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements
1. All equipment and parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
2. The finished surfaces of all exposed flanges shall be protected by wooden blank flanges, strongly built and securely bolted thereto.
3. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
4. Take special care to prevent plastic and similar brittle items from being directly exposed to the sun, or exposed to extremes in temperature, preventing any deformation.

1.06 WARRANTY

A. Manufacturer Warranty
1. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced, and the unit(s) restored to service at no expense to the Owner. Warranty shall be for a period of two years and begin on the Date of Final Acceptance.

PART 2 PRODUCTS

2.01 ELECTROMAGNETIC FLOW METER

A. Manufacturers
1. Manufacturer List
    a. Emerson
        1) Rosemount 8705
    b. Or Approved Equal.

2. The list above does not imply that the manufacturer's standard product is acceptable. The successful manufacturer will be required to conform to all specifications and will be required to submit a statement stating the meter is appropriate giving the provided upstream and downstream straight run of pipe length shown in the plans.

B. Description
1. The meter shall be a velocity sensing electromagnetic type, microprocessor-based signal converter, sealed housing, flanged tube meter for 150 psi working pressure.
2. Meter shall have the ability for external flow verification.

C. Performance / Design Criteria
   1. Output shall be 4-20 ma DC.
   2. Meter shall be accurate to within 0.2% of actual flow reading.
   3. Transmitter
      a. Transmitter enclosure shall be NEMA 4X
      b. Electrical classification rating shall be FM approved for the location shown on the Drawings.
      c. Transmitter shall be mounted remotely.
   4. Sensor
      a. Sensor shall be suitable for continuous submergence (10 mH2O). Sensor shall be NEMA 6P/IP68.
      b. The sensor cables shall be attached and potted to IP68 with cable lengths as required to reach the separately mounted transmitter in the location shown on the drawings.
   5. Power Requirements
      a. As shown on the Drawings
   6. Options/Accessories
      a. Grounding: Meter shall be grounded with rings. Provide 316 stainless steel ground rings, ground wires, and gaskets, etc. All materials shall be suitable for the liquid being measured.
      b. Electrode cleaning: Where listed on the instrument device schedules, or shown on the Drawings, provide an electrode cleaning system. The cleaning system electronics shall be housed in a NEMA 4X wall mounted panel. Provide all necessary cable and connectors. The system shall be powered through the special cables to the magnetic flow meter.
      c. Provide a hand-held programmer for each transmitter where full setup is not available for the instrument directly.
   7. Joint Type
      a. Meter shall be provided with flanged end unless otherwise specified.
         1) Flanges shall be ANSI/ASME B16.5, Class 250.

D. Materials
   1. Sensor Housing
      a. Carbon Steel per ASTM A105
   2. Measuring Tube
      a. 304 Stainless Steel
   3. Liner
      a. Liner shall be appropriate for water transmission. Liner shall be Ebonite Hard Rubber or approved equal.

E. Finishes
   1. Sensor housing shall have two part epoxy coating per Manufacturer's recommendations. Color to be selected by the Owner.

PART 3 EXECUTION

3.01 INSTALLATION

A. The electromagnetic meter and converter shall be installed in accordance with the instructions of the manufacturer and as shown on the drawings.

B. Installation and calibration shall be checked and approved by a manufacturer's factory representative.
   1. After acceptance, the representative shall address a letter to the Engineer outlining all installation and start up procedures. The letter shall include a certification that the meter is installed per the manufacturer's recommendations and meets the required accuracy.

C. Meter installation and calibration procedures shall also meet the requirements listed in Section 1.2 - Submittals.

3.02 CLOSEOUT ACTIVITIES

A. Training
   1. A factory representative of all major components, who has complete knowledge of proper operation and maintenance, shall be provided for one day to instruct representatives of the Owner on proper operation and maintenance. If there are difficulties in operation of the equipment during instruction sessions, additional sessions shall be provided at no cost to the Owner.
   2. Prior to scheduling instructions, submit outline of instructions to Engineer for approval.
   3. Operating and maintenance manual shall be explained during these instructions.

END OF SECTION

DIVISION 03

CONCRETE

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

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

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, 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.

1.04 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.
2. Water/cement ratio (total gallons of water per cubic yard).
3. Brand, type, and quantity of cement.
4. Type and quantity of aggregates.
5. Type and quantity of admixtures.
6. Type, composition, and quantity of fly ash, or silica fume.
7. Unit weight (wet density).
8. Composition strength based on 28-day compression test.

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 ENGINEER.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer manufacturer 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. 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. Submit laboratory test reports for concrete mix design, aggregates (particularly deleterious materials in coarse aggregate) and fly ash, slag (GGBFS) and silica fume (if used) 4 weeks before scheduled pouring.

E. Field quality-control reports.

1.06 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.

1.07 PRECONSTRUCTION TESTING

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

1.08 DELIVERY, STORAGE, AND HANDLING

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

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

1.09 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 for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
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

2.01 CONCRETE, GENERAL

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

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

2.02 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, and as follows:

    a. High-density overlay, Class 1 or better.
    b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    c. Structural 1, B-B or better; mill oiled and edge sealed.
    d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

3. Overlaid Finnish birch plywood.

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. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

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.

F. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.03 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.

C. Deformed-Steel Wire: ASTM A 1064/A 1064M.

2.04 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.05 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, gray, Type I, except use Type III where applications require high-early-strength or Type II where required by ENGINEER for corrosive environments. Use one brand of cement throughout Project, unless otherwise acceptable to ENGINEER.
2. Fly Ash: ASTM C 618, Type C or Type F (corrosive environments) with loss on ignition not more than 6 percent.
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 3M 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 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.

G. Potable Water Structures: For surfaces in contact with potable water, use only materials approved by Department of Public Health of the state that has jurisdiction.

2.06 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Profile: As indicated on the structural drawings.
2. Dimensions: As indicated on the structural drawings.

2.07 CURING MATERIALS

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

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation; Construction Systems.
b. Bon Tool Co.
c. Brickform; a division of Solomon Colors.
d. ChemMasters, Inc.
e. Dayton Superior.
f. Euclid Chemical Company (The); an RPM company.
g. Kaufman Products, Inc.
h. L&M Construction Chemicals, Inc.
i. Lambert Corporation.
j. Metalcrete Industries.
k. Nox-Crete Products Group.
l. Sika Corporation.
m. SpecChem, LLC.
n. TK Products.

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

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

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.08 CONCRETE MIXTURES, GENERAL

A. Prepare design mixes for each concrete class and strength by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method is used, use independent testing facilities acceptable to ENGINEER for preparing and reporting proposed mix designs. Testing facility shall not be identical to that used for field quality control testing.

B. Fly ash shall be used to partially supplant cement content in Class A concrete, unless noted otherwise, and is optional in other classes. Replacement quantity of cement content by weight shall be not less than 15 percent for Class A concrete or more than 25 percent for all classes except Class F.

C. For concrete Class A, concrete mix design with fly ash and silica fume shall be maximum 30 percent of cement content by weight, and shall constitute no more than 20 and 10 percent, respectively, of the total weight of cementitious materials.

D. Coarse aggregate shall be 1-1/2” top size, except for Class G concrete which shall be 3/8” top size.

E. Design mixes to provide normal weight concrete for following classes and properties:

1. Locations for concrete classes are as follows:
   a. Class A Structural concrete (slabs, walls, mat foundations, pump base, & pipe supports).
   b. Class G Grout fill for use in sweeping in final surfaces in sanitary structures and slab toppings less than 2 inches in thickness.
   c. Class P Exterior pavements (unless otherwise indicated on Drawings).
   d. Class B Sidewalks and manhole bases (unless otherwise indicated on Drawings).
   e. Class C Fill within manholes, mud mats, fill under structures, encasement for piping below or adjacent to structures and encasement for floor drains, sewer inlets and similar items.
   f. Class F Flowable fill for filling spaces as permitted and directed by ENGINEER.

2. Properties for concrete classes are as follows:

Concrete Class		A	G	P	B	C	F
28-Day* Compressive Strength (f'c), psi		4,500	4,000	3,500	3,000	2,000	50-100
Cement Content per cubic yard of concrete, sacks minimum **		6	6	5.5	5	4	0.4-3.0
Water/Cement Ratio by weight, maximum		0.44	0.44	0.44	0.58	0.75	0.40-0.75
Air Content, percent by volume		5±1	5±1	6.5+1.5	6.5±1.5	NA	NA
Slump at point of placement, inches.	WR***	2-4	2-4	2-4	3-5	3-6	NA
	MRWR	4-6	4-6	4-6	NA	NA	NA
	HRWR	6-8	6-8	6-8	NA	NA	NA
Monofilament Polypropylene, Type F1		Yes	Yes	NA	NA	NA	NA

* 7-day compressive strength for high-early-strength concrete.
** For concrete with fly ash, values are total of cement plus fly ash (except Class F concrete).
*** Slump prior to the addition of mid-range or high-range water reducers.

3. Adjustment of Concrete Mixes: Mix designs may be adjusted when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, when approved by ENGINEER, at no additional cost to OWNER. Submit laboratory test data for revised mix design and strength results to ENGINEER before using in work.
4. Admixtures:
   a. Use water-reducing admixture or high range water-reducing admixture (superplasticizer) in concrete for placement and workability.
   b. Air-entraining admixture:
      1) Add air-entraining admixture at manufacturer's prescribed rate to result in placed concrete having total air content specified.

2.09 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.10 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, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMWORK INSTALLATION

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

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

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch 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. Do not use rust-stained steel form-facing material.

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

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

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

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

3.02 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.03 REMOVING AND REUSING FORMS

A. Vertical Forms not supporting concrete weight may be removed when concrete has sufficiently set to resist damage from removal operation.

B. Other forms shall be left in place until concrete has attained strength to support its own weight and construction live loads, unless removed in sections, and each structural section immediately reshored.

C. Time Periods: Forms remain in place as shown in table below. If form removal occurs before time shown in the table, apply curing procedures previously specified.

Minimum Time Forms are to Remain in Place:

	Average Air Temperature* During Period	
Part of Structure	40 - 50 degrees F	50 degrees F
Walls, columns and sides of beam (hours)	72	24
Bottom forms for slabs, beams arches not reshored (days)	12	7
Bottom forms for slabs, beams and arches if reshored (days)	7	4

* Air temperature near form.

D. 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.

E. 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 ENGINEER.

3.04 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.05 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Field bending of reinforcement:
   1. Field bending of plain reinforcement shall be performed using an approved and appropriate sized portable hydraulic device that makes ACI-approved radius bends. No other field bending method shall be permitted.

3.06 JOINTS

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

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

   1. Place joints perpendicular to main reinforcement. 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 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. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   6. 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: Construct control (contraction) joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 3/16 inch by 1/4 slab depth or inserts 1/4-inch wide by 1/4 of slab depth unless otherwise noted.

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 or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07920 "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.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.07 WATERSTOP INSTALLATION

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.08 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 ENGINEER.

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

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.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

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.

3.09 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
1. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 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. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

C. Broom Finish: Apply a light broom finish to exterior concrete slabs indicated on Drawings.
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 ENGINEER before application.

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-

place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
3. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to 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 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, 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. 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.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by ENGINEER. Remove and replace concrete that cannot be repaired and patched to ENGINEER's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by ENGINEER.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to ENGINEER's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to ENGINEER's approval.

3.14 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. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. 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., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete 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 and below or 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. 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.

8. 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.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
11. Test results shall be reported in writing to ENGINEER, 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.

12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by ENGINEER but will not be used as sole basis for approval or rejection of concrete.
13. 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 ENGINEER. 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 ENGINEER.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION

DIVISION 05

METALS

SECTION 05010

METAL MATERIALS

PART 1 - GENERAL

1.01 REQUIREMENTS

A. Metal materials not otherwise specified shall conform to the requirements of this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Requirements for specific products made from the materials specified herein are included in other sections of the Specifications. See the section for the specific item in question.

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. ASTM A36 Standard Specification for Structural Steel

B. ASTM A47 Standard Specification for Malleable Iron Castings

C. ASTM A48 Standard Specification for Gray Iron Castings

D. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

E. ASTM A123 Standard Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip

F. ASTM A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

G. ASTM A167 Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

H. ASTM A276 Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes

I. ASTM A307 Standard Specification for Carbon Steel Externally Threaded Standard Fasteners

J. ASTM A446 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) quality

K. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

L. ASTM A501 Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

M. ASTM A529 Standard Specification for Structural Steel with 42 000 psi (290 Mpa) Minimum Yield Point (1/2 in. (12.7 mm) Maximum Thickness)

N. ASTM A536 Standard Specification for Ductile Iron Castings

O. ASTM A570 Standard Specification for Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality

P. ASTM A572 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

Q. ASTM A780 Standard Practice of Repair of Damaged Hot-Dip Galvanized Coatings

R. ASTM A924 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

S. ASTM A992 Standard Specification for Structural Steel Shapes

T. ASTM A666 Standard Specification for Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar for Structural Applications

U. ASTM B26 Standard Specification for Aluminum-Alloy Sand Castings

V. ASTM B85 Standard Specification for Aluminum-Alloy Die Castings

W. ASTM B108 Standard Specification for Aluminum-Alloy Permanent Mold Castings

X. ASTM B138 Standard Specification for Manganese Bronze Rod, Bar, and Shapes

Y. ASTM B209 Standard Specification for Aluminum-Alloy Sheet and Plate

Z. ASTM B221 Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

AA. ASTM B308 Standard Specification for Aluminum-Alloy Standard Structural Shapes, Rolled or Extruded

AB. ASTM B574 Standard Specification for Nickel-Molybdenum-Chromium Alloy Rod

AC. ASTM F468 Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use

AD. ASTM F593 Standard Specification for Stainless Steel Fasteners

1.04 SUBMITTALS

A. Material certifications shall be submitted along with any shop drawings for metal products and fabrications required by other sections of the Specifications.

1.05 QUALITY ASSURANCE

A. Owner may engage the services of a testing agency to test any metal materials for conformance with the material requirements herein. If the material is found to be in conformance with Specifications the cost of testing will be borne by the Owner. If the material does not conform to the Specifications, the cost of testing shall be paid by the Contractor and all materials not in conformance as determined by the Engineer shall be replaced by the Contractor at no additional cost to the Owner. In lieu of replacing materials, the Contractor may request further testing to determine conformance, but any such testing shall be paid for by the Contractor regardless of outcome of such testing.

PART 2 - PRODUCTS

2.01 CARBON AND LOW ALLOY STEEL

A. Material types and ASTM designations shall be as listed below:

1.	Structural Fabrications	A992, A572 Grade 50, or A36
2.	Sheet Steel	A 570 Grade C
3.	Steel Angles and Plates	A36
4.	Bars and Rods	A 36 or A307 Grade A
5.	Pipe - Structural Use	A53 Type E or S, Grade B
6.	Tubes	A500 Grade B or A501
7.	Cold-Formed Structural Studs and Joists (18-22 gauge)	A 446 Grade C
	Cold-Formed Structural Studs and Joists (12-16 gauge)	A 446 Grade D

B. Steel shapes, plates and bars which are to be galvanized shall be galvanized in accordance with ASTM A123. Iron and steel sheet which are to be galvanized shall be galvanized in accordance with ASTM A924. All connections for galvanized members shall use fasteners galvanized in accordance with ASTM A153 unless noted otherwise.

2.02 STAINLESS STEEL

A. All stainless steel fabrications exposed to underwater service shall be Type 316. All other stainless steel fabrications shall be Type 304, unless noted otherwise. All connections for stainless steel fabrications shall use Type 304 or 316 stainless steel fasteners. Fasteners shall be of the same alloy type as the structural members.

B. Material types and ASTM designations are listed below:

1.	Plates and Sheets	ASTM A167 or A666 Grade A
2.	Structural Shapes	ASTM A276
3.	Fasteners (Bolts, etc.)	ASTM F593

2.03 ALUMINUM

A. All aluminum shall be alloy 6061-T6, unless otherwise noted or specified herein.

B. Material types and ASTM designations are listed below:

1.	Structural Shapes	ASTM B308
2.	Castings	ASTM B26, B85, or B108
3.	Extruded Bars	ASTM B221 - Alloy 6061
4.	Extruded Rods, Shapes and Tubes	ASTM B221 - Alloy 6063
5.	Plates	ASTM B209 - Alloy 6061
6.	Sheets	ASTM B221 - Alloy 3003

C. All aluminum shall be provided with mill finish unless otherwise noted.

D. Where bolted connections are indicated, aluminum shall be fastened with Type 304 stainless steel bolts unless noted otherwise.

E. Aluminum in contact with dissimilar materials shall be insulated with an approved dielectric.

2.04 CAST IRON

A. Material types and ASTM designations are listed below:

1.	Gray	ASTM A48 Class 30B
2.	Malleable	ASTM A47
3.	Ductile	ASTM A536 Grade 60-40-18

2.05 BRONZE

A. Material types and ASTM designations are listed below:

1.	Rods, Bars and Sheets	ASTM B138 - Alloy B Soft

2.06 HASTELLOY

A. All Hastelloy shall be Alloy C-276.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

DIVISION 08

DOORS AND WINDOWS

SECTION 08370

ACCESS HATCHES

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all labor, materials, equipment, and service required for complete installation of the access hatches as specified herein and shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03300 “Cast-in-Place Concrete”

1.03 SUBMITTALS

A. Product Data: Submit manufacturer’s product data.

B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.

C. Warranty: Submit executed copy of manufacturer’s standard warranty.

1.04 WARRANTY

A. Manufacturer’s Warranty: Provide manufacturer’s standard warranty. Materials shall be free of defects in material and workmanship for a period of twenty-five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the complete requirements of these Specifications, manufacturers offering products which may be incorporated into the work include:

1. Bilco Company,
2. Halliday Products,
3. Or approved equal.

B. Some standard equipment of these manufacturers may have to be modified to meet requirements of these Specifications.

C. The cost of modifications to other equipment or facilities required to accommodate a manufacturer’s equipment shall be included in the Contractor’s bid.

2.02 ACCESS HATCH

A. Access hatch shall be double leaf or single leaf, as indicated on the Contract Drawings or by the Engineer, aluminum, gutter type, watertight, exterior, flush floor hatch design. Door leaves shall be 1/4-inch aluminum diamond pattern plate to withstand a live load of 300 pounds per sq. ft. Channel frames shall be 1/4 inches aluminum with an anchor flange around the perimeter. Provide 1-1/2 inch female NPT threaded aluminum drainage coupling welded under frame at right front corner for connection of drain pipe.

B. Door shall be equipped with 316 stainless steel hinges, a lockable hasp for use with a padlock, stainless steel pins, spring operator for easy operation and an automatic hold-open arm with release handle. Provide inside stainless-steel snap locks with removable wrench lift handle outside. Furnish threaded aluminum plug to seal lock aperture. Hardware shall be cadmium plated.

C. Doors and frames shall be mill finish with bituminous coating applied to the exterior of the frame. Hatches shall have an odor resistant gasket.

D. Access hatches shall be furnished with a factory installed fall protection grating system, Safety grate shall be constructed of 6061-T6 aluminum and designed to withstand a live load of 300 pounds per sq. ft. and painted with a bright safety orange color. The grating shall completely cover the opening and be in conformance with OSHA Standard 1910.23 and controlled space entry per OSHA Standard 1910.146.

E. Hatch shall have a minimum clear opening as shown on the contract drawings.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer’s written instructions for installation.

3.03 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installation to determine if replaced or repaired door assembly installations comply with specified requirements.

3.04 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operations. Repeat adjustment of doors and hardware six months after installation, for proper operations.

END OF SECTION

DIVISION 09

PAINTING

SECTION 09900

PAINTING

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install all painting Work.
   a. CONTRACTOR is responsible for all surface preparation and painting Work for all new and existing interior and exterior items and surfaces throughout the Project areas included under this and other Sections.
2. Extent of painting Work is shown and specified. Painting Work shown in schedules on Drawings does not provide CONTRACTOR with complete indication of all painting Work. CONTRACTOR is directed to Section 2.04 herein where all surfaces of the generic types specified in Section 2.04 shall be prepared and painted according to their status, intended function and location in the Work, using the painting system for that surface, function and location as specified, whether or not indicated on any schedule or Drawing.
3. Types of painting Work required include, but are not necessarily limited to, the following:
   a. Surface preparation and painting of all new and specifically identified existing items, both interior and exterior, and other surfaces, including items furnished by OWNER, are included in the Work, except as otherwise shown or specified.
   b. Removal of all substances, topcoats, primers, and all intermediate coats of paint and other protective or decorative toppings on those items and surfaces to remain which are identified to receive a painting system under this Section, in order to provide surfaces acceptable for application of painting system specified.
4. The term "paint" in this Section includes pretreatment and all painting system materials, such as primer, emulsion, enamel, organic/inorganic polymer coating, stain sealer and filler, and other applied materials whether used as prime, filler, intermediate or finish coats.
5. Paint all new and specifically identified existing surfaces and items except where the natural finish of the material is specified as a corrosion-resistant material not requiring paint; or is specifically shown as indicated by written note or specified as a surface not to be painted. The term "exposed" in this Section means all items not covered with cement plaster, concrete or fireproofing. Items covered with these materials shall be provided with specified primer only, except where specified as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint them the same as adjacent similar materials or areas.

B. Coordination:
1. Review installation, removal and demolition procedures under other Sections and coordinate them with the Work specified herein.
2. Coordinate the painting of areas that will become inaccessible once equipment has been installed.
3. Coordinate primers with finish paint materials in order to provide primers which are compatible with finish paint materials used. Review other Sections and other Contracts in which primed surfaces are to be provided in order to ensure compatibility of the total

painting system for the various surfaces. CONTRACTOR shall be responsible for coordinating the compatibility of all shop-primed and field-painted items in other Sections.

4. Furnish information to ENGINEER on the characteristics of the finish materials proposed for use, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and repaint as required. Notify ENGINEER in writing of anticipated problems using the specified painting systems with surfaces primed by others. Reprime all factory-primed equipment and other factory-primed items that are damaged or scratched.

C. Related Sections:
   1. City of Dayton Construction Materials and Specifications, Item 824 "Ductile Iron Water Pipe"
   2. Section 05010, Metal Materials
   3. Division 15, Mechanical.
   4. Division 16, Electrical.

D. Work Not Included: The following categories of Work are not included as part of the painting Work, or are included in other Sections:
   1. Shop-Priming: Shop-priming of structural metal, miscellaneous metal fabrications, other metal items and fabricated components such as shop-fabricated or factory-built heating and ventilating and electrical equipment or accessories shall conform to applicable requirements of this Section but are included under other Sections.
   2. Pre-finished Items:
      a. Items furnished with such finishes as baked-on enamel, porcelain and polyvinylidene fluoride shall only be touched up in the field by CONTRACTOR using Supplier's recommended compatible field-applied touch up paint.
      b. Items furnished with such finishes as chrome plating, anodizing, or where the natural oxide of the item forms a barrier to corrosion, whether factory or Site formed, such as copper, bronze or muntz metal.
   3. Concealed Surfaces: Nonmetallic wall or ceiling surfaces in areas concealed from view and generally inaccessible areas such as furred spaces, pipe chases and duct and elevator shafts.
   4. Concrete surfaces, unless otherwise shown or specified.
   5. Concrete floors.
   6. Corrosion-Resistant Metal Surfaces: Surfaces of terne metal, stainless steel, and galvanized steel and FRP grating.
   7. Operating Parts and Labels:
      a. Do not paint moving parts of operating units, mechanical and electrical parts such as valve and damper operators, linkages, sensing devices, interior of motors and fan shafts.
      b. Do not paint over labels required by building code or other governing authority, such as Factory Mutual, Underwriters' Laboratory, or any equipment identification, performance rating, name, or nomenclature plates.
      c. Cover moving parts and labels during the painting Work with protective masking. Remove all protective masking upon completion of Work. Remove all paint, coatings or splatter which comes in contact with such labels.
   8. Structural and miscellaneous metals covered with concrete, shall not receive intermediate or finish coats of paint.

1.02 QUALITY ASSURANCE

A. Applicator Qualifications:
   1. When requested by the ENGINEER, submit the name and experience record of the applicator. Include a list of utility or industrial installations. Provide ENGINEER with names and telephone numbers of owners, architects, or engineers responsible for the projects listed and the approximate contract prices.
   2. Applicators who have not had the type of successful experience required to perform the kinds of Work specified will not be approved.

B. Source Quality Control:
   Obtain materials only from Suppliers who will:
   1. Provide the services of a qualified Supplier's representative at the Site at the commencement of painting Work to advise on materials, installation and finishing techniques, at the completion of the Work to advise ENGINEER on the acceptability of completed Work, and during the course of the Work as may be requested by ENGINEER.
   2. Certify long term compatibility of all coatings with surfaces.

C. Requirements of Regulatory Agencies:
   1. Comply with governing regulations for air quality and material disposal regulations. Revise painting systems specified herein in order to provide Supplier's regulatory agency approved coating systems where required.
   2. Comply with governing regulations for blast cleaning operations, confined space entry and disposition of spent abrasive and debris.

D. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. ASTM D 4258, Surface Cleaning Concrete for Coating.
   2. ASTM D 4259, Abrading Concrete.
   3. ASTM D 4263, Indicating Moisture in Concrete by the Plastic Sheet Method.
   4. ASTM D 4285, Indicating Oil or Water in Compressed Air.
   5. ASTM D 4417, Field Measurement of Surface Profile of Blast Cleaned Steel.
   6. ANSI A13.1: Scheme for the Identification of Piping Systems.
   7. ANSI Z535.1: Safety Color Code.
   8. Steel Structures Painting Council, SSPC - Volume 2, Systems and Specifications.
   9. Steel Structures Painting Council, SSPC - VIS 1, Visual Standard for Abrasive Blast Cleaned Steel.
   10. Steel Structures Painting Council, SSPC - VIS 2, Visual Standard for Evaluating Degree of Rusting on Painted Steel Surfaces.
   11. Code of Federal Regulations, 29 CFR 1910.144: Safety Color Code for Marking Physical Hazards.

1.03 SUBMITTALS

A. Samples: Submit for approval the following:
   1. Samples for ENGINEER's review of copies of Supplier's complete color charts for each coating system.
   2. Cards approximately 4-inches by 8-inches accurately representative of colors, selected by ENGINEER for use in the painting Work, shall be provided for ENGINEER's final review and approval.

B. Shop Drawings: Submit for approval the following:
   1. Copies of Supplier's technical information and test performance data, including paint analysis, VOC content in comparison to maximum allowed by Specifications, and application instructions for each material proposed for use.
   2. Submit proof of acceptability of proposed application techniques by the paint Supplier selected.
   3. Copies of CONTRACTOR's proposed protection procedures in each area of Work explaining methods of protecting adjacent surfaces from splatter, for confining application procedures in a manner which allows other work adjacent to surface preparation and painting Work to proceed safely and without interruption, and for maintaining acceptable application, curing and environmental conditions during and after painting system(s) application.
   4. List each material and cross-reference to the specific painting system and application. Identify by Supplier's catalog number and general classification.
   5. Identify maximum exposure times allowable for each paint system component before the next coat of paint must be applied. Submit proposed methods for preparing surfaces for subsequent coats if maximum exposure times are exceeded.
   6. Information on curing times and environmental conditions which will affect the curing time of each system component and proposed methods for accommodating variations in curing time. Identify this information for each painting system used in the Work.
   7. Specification for spray equipment with cross-reference to paint Supplier's recommended equipment requirements.
   8. Maintenance Manual: Upon completion of the painting Work, furnish ENGINEER copies of detailed maintenance manual including the following information:
      a. Complete and updated product catalog of paint Suppliers currently available products including complete technical information on each product. Identify product names and numbers of each product used in the painting Work.
      b. Name, address and telephone number of Supplier, local distributor, applicator, and technical representative.
      c. Detailed procedures for routine maintenance and cleaning.
      d. Detailed procedures for light repairs such as dents, scratches, and staining.

C. Certificates: Submit for approval the following:
   1. Certificate stating that materials meet or exceed Specification requirements.
   2. CONTRACTOR shall provide notarized statement verifying that all painting systems are compatible with surfaces specified. All painting systems' components shall have been reviewed by an authorized technical representative of the paint Supplier for use as a compatible system. Verify that all painting systems are acceptable for the exposures specified and that the Supplier is in agreement that the selected systems are proper, compatible and are not in conflict with the paint Supplier's recommended specifications.

Show by copy of transmittal form that a copy of the letter has been transmitted to the paint applicator.

D. Statement of Application: Upon completion of the painting Work, submit a notarized statement to ENGINEER signed by CONTRACTOR and painting applicator stating that the Work complies with the requirements of these Specifications, and that application methods, equipment and temperatures were proper and adequate for the conditions of installation and use. Test Reports: Submit for approval certified laboratory test reports for required performance and analysis testing.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Deliver all materials to the Site in original, new, and unopened packages and containers bearing Supplier's name and label, and the following information:
   1. Name and title of material.
   2. Supplier's stock number and date of manufacture.
   3. Contents by volume, for major pigment and vehicle constituents.
   4. Thinning instructions where recommended.
   5. Application instructions.
   6. Color name and number.

B. Storage of Materials:
   1. Store only acceptable painting system components at the Site.
   2. Store in an environmentally controlled location as recommended by paint Supplier's written product information guidelines. Keep area clean and accessible.
   3. Store materials not in actual use in tightly covered containers.
   4. Comply with governing health and fire regulations.

C. Handling of Materials:
   1. Handle materials in a manner which precludes the possibility of contamination, or incorrect product catalyzation.
   2. Do not open containers or mix components until necessary preparatory Work has been completed and approved by ENGINEER and painting Work will start immediately.
   3. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.

1.05 JOB CONDITIONS

A. Site Facilities:
   1. Supplemental heat sources, as may be required to maintain both ambient and surface temperatures within the range recommended by the Supplier for paint system applications, are not available at the Site.
   2. The provision of all supplemental heat energy sources and equipment is the responsibility of CONTRACTOR.
   3. Do not use heat sources which emit carbon dioxide or carbon monoxide into areas being painted. Properly locate and vent all such heat sources to the exterior such that paint systems are unaffected by exhaust products.

B. Environmental Requirements:

1. Apply water-base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 55°F and 90°F, unless otherwise permitted or restricted by the paint Supplier's printed instructions.
2. Surfaces to be painted shall be at least 5°F above the dew point temperature and shall be dry to the touch. Apply paints only when the temperature of surfaces to be painted, paint material, and the surrounding air temperatures are between 65°F and 95°F, unless otherwise permitted or restricted by the paint Supplier's printed instructions.
3. Apply paint system within the shortest possible time consistent with Supplier's recommended curing instructions for each coat. If chemical, salt, or other contamination contacts paint film between coats, it shall be removed in accordance with SSPC-SP 1 Solvent Cleaning, and the surface restored before applying remainder of painting system.
4. Tanks containing water shall not be painted without specific permission of ENGINEER, and only under conditions where "sweating" of the tank outside surface is not likely to occur within 24 hours of application.
5. Epoxy paints shall not be applied if ambient temperature is expected to go below 50°F within 12 hours of application. Where Supplier's printed recommendations require a higher minimum ambient temperature, this shall be followed.
6. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; to damp or wet surfaces or when surfaces will reach dew point due to falling or rising temperatures and humidity conditions during the course of the paint application, unless otherwise permitted by the paint Supplier's printed instructions.
7. Do not paint pipelines and other unacceptably hot or cold surfaces until such surfaces can be maintained within temperature and dew point ranges acceptable to Supplier. CONTRACTOR shall arrange for such surfaces to be brought within acceptable temperature and dew point ranges as part of the painting Work.
8. Moisture content of surfaces shall be verified to ENGINEER as acceptable to permit the commencement of the painting Work using methods recommended by the specified Supplier.
9. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint Supplier during application and drying periods.
10. Provide adequate illumination and ventilation in all areas where painting operations are in progress.
11. Comply with applicable governing code requirements for air quality and material disposal regulations.

C. Protection:
1. Cover or otherwise protect finished Work of other trades and surfaces not being painted concurrently or not to be painted.
2. During the surface preparation and painting Work, the facility shall remain in operation. Employ procedures which prevent contamination of the process or cause facility shutdown due to the Work of this Section.
3. Coordinate and schedule surface preparation and painting Work to avoid exposing employees of CONTRACTOR, OWNER, ENGINEER, and others who are not involved with the surface preparation and painting Work to the Work of this Section. Provide required personnel safety equipment in compliance with governing authorities.
4. Submit protection procedures to be employed by CONTRACTOR to ENGINEER. Do not begin surface preparation and painting Work in any area until ENGINEER approves protection techniques proposed by CONTRACTOR.

5. Provide fire extinguishers and post caution signs warning against smoking and open flame when working with flammable materials.

PART 2 – PRODUCTS

2.01 MATERIAL QUALITY

A. Manufacturer: Provide products of one of the following:
   1. Tnemec Company, Incorporated.
   2. Sherwin Williams Company.
   3. Or OWNER approved equal

B. The use of catalog numbers and the specific requirements set forth in the Specifications, are not intended to preclude the use of any other acceptable Supplier's products which may be equivalent but are given for the purpose of establishing a standard of design and quality of materials, application, and workmanship.

C. Where catalog numbers are out of date at time of bidding, provide products equal in quality to those specified.

2.02 SUBSTITUTIONS

A. No substitutions shall be considered that decrease the number of coats, the film thickness, the surface preparation or the generic type, solids content by volume, and formulation of coating(s) specified. Products exceeding VOC limits specified will not be approved.

B. ENGINEER may review Suppliers' recommendations concerning methods of installation and number of coats of paint for each painting system. CONTRACTOR shall prepare construction cost estimates based on painting systems, number of coats, coverages and installation methods specified.

C. All proposed "or equal" products shall be submitted with direct comparison to products specified including information on durability, adhesion, color and gloss retention, percent solids, VOCs per gallon and recoat ability after curing.

D. Approved Suppliers shall furnish the same color selection as the Supplier specified, including intense Chroma and custom pigmented colors in all painting systems.

2.03 COLORS AND FINISHES

A. Color Selection:
   1. A maximum of 15 different colors shall be selected for the painting Work, in addition to color coding of all pipelines, valves, equipment, ducts and electrical conduit.
   2. ENGINEER reserves the right to select all non-standard colors for all paint systems specified within the ability of the Supplier to produce such non-standard colors. CONTRACTOR shall supply such colors at no additional expense to OWNER.

B. Color Coding of Pipelines, Valves, and Equipment:

1. In general, all color coding of pipelines, valves, and equipment shall comply with applicable standards of ANSI A13.1, ANSI Z535.1 and OSHA 1910.144.
2. Color Coding of Pipelines and Equipment:
   a. Finish coats of paint for pipelines and equipment shall be coded in basic colors. Colors shall be brilliant, distinctive shades matching the following safety colors in accordance with ANSI Z535.1 color specifications for safety colors and other basic colors:
3. The color of the final coats shall match as closely as possible, without custom blending, the color tabulated under the specific pipeline service.

C. After approval by ENGINEER of colors and Shop Drawing submittals and prior to beginning painting Work, ENGINEER will furnish color schedules for surfaces to be painted listed in paragraph 2.04, Painting Systems below.

D. Color Pigments: Provide pure, nonfading, applicable types to suit the surfaces and services indicated. Comply with the following:
1. Lead and Chromate: Lead and chromate content shall not exceed amount permitted by Laws and Regulations.
2. Comply with Suppliers' recommendations on preventing coating contact with levels of carbon dioxide and carbon monoxide which could cause yellowing during application and initial stages of curing of paint coatings.

2.04 PAINTING SYSTEMS

A. New and existing ferrous metals, interior and exterior, non-submerged including piping, structural steel, and miscellaneous steel.
1. Surface Preparation: SSPC-SP6 Commercial Blast Cleaning as specified in 3.2B.
2. Shop Primer:
   a. Generic Description: Polyamide Epoxy.
   b. Product and Manufacturer:
      1) Tnemec: 66-1211 H.B. Epoxoline, 3.0-5.0 dry mils.
      2) Sherwin Williams: Copoxy Shop Primer, 3.0-5.0 dry mils.
      3) Or equal.
3. Field Preparation: SSPC-SP11 Power Tool Cleaning.
4. Field Spot Intermediate:
   a. Generic Description: Polyamide Epoxy.
   b. Product and Manufacturer:
      1) Tnemec: 66-Color H.B. Epoxoline 4.0-6.0 dry mils.
      2) Sherwin Williams: Epolon II multi mill epoxy 4.0-6.0 dry mils.
      3) Or equal.
5. Finish Coat Interior:
   a. Generic Description: Polyamide Epoxy.
   b. Product and Manufacturer:
      1) Tnemec: 66-Color H.B. Epoxoline 4.0-6.0 dry mils.
      2) Sherwin Williams: Tile-Clad High Solids 4.0-6.0 dry mils.
      3) Or equal.
6. Finish Coat Exterior:
   a. Generic Description: Aliphatic Acrylic Polyurethane.
   b. Product and Manufacturer:
      1) Tnemec:
         i. Gloss-Endura-Shield 74, 3.0-5.0 dry mils.

ii. Semi-Gloss-Endura-Shield 75, 3.0-5.0 dry mils.
2) Sherwin Williams:
i. Gloss-Hi Solids Polyurethane, 3.0-5.0 dry mils.
ii. Semi-Gloss-Corothanell, 3.0-5.0 dry mils.
3) Or equal.

B. Galvanized, Aluminum and Non-Ferrous Metals: (non-submerged)
1. Surface Preparation: SSPC-SP3 Power Tool Clean.
2. Shop Primer:
a. Generic Description: Polyamide Epoxy.
b. Product and Manufacturer:
1) Tnemec: 66 H.B. Epoxoline, 2.0-3.0 dry mils.
2) Sherwin Williams: Macropoxy 646, 2.0-3.0 dry mils.
3) Or equal.
3. Field Preparation: SSPC-SP-3 Power Tool Clean.
4. Finish Coat Interior:
a. Generic Description: Polyamide Epoxy.
b. Product and Manufacturer:
1) Tnemec: 66 H.B. Epoxoline, 2.0-4.0 dry mils.
2) Sherwin Williams: Tile Clad High Solids Epoxy, 2.0-4.0 dry mils.
3) Or equal.
5. Finish Coat Exterior:
a. Generic Description: Aliphatic Acrylic Polyurethane.
b. Product and Manufacturer:
1) Tnemec: Semi Gloss-74 Endura-Shield, 2.0-4.0 dry mils.
2) Sherwin Williams: Semi Gloss-Corothan II, 2.0-4.0 dry mils.
3) Or equal.

C. Aluminum in Contact with Dissimilar Materials:
1. Surface Preparation: Solvent clean.
2. Shop Prime:
a. Generic Description: Polyamide Epoxy.
b. Product and Manufacturer:
1) Tnemec: 66 Hi-Build Epoxoline, 2.0-3.0 dry mils.
2) Sherwin Williams: Macropoxy 646, 2.0-3.0 dry mils.
3) Or equal.
3. Finish Coat:
a. Generic Description: Polyamide Epoxy.
b. Product and Manufacturer:
1) Tnemec: 66 Hi-Build Epoxoline, 2.0-3.0 dry mils.
2) Sherwin Williams: Macropoxy 646, 2.0-3.0 dry mils.
3) Or equal.

PART 3 – EXECUTION

3.01 INSPECTION

A. CONTRACTOR and his applicator shall examine the areas and conditions under which painting Work is to be performed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film capable of performing in accordance with claims made in Supplier's product literature for the surfaces and conditions encountered.

C. Do not paint over existing paint where there is no assurance that existing paint will provide an acceptable surface for the long term adherence and durability of painting systems specified or where the Supplier requires removal of all existing paint in order to recommend the use of the specified painting system.

3.02 SURFACE PREPARATION

A. General:
1. Test for moisture content of surfaces before commencement of painting Work. Test for moisture in concrete in compliance with ASTM D 4263. Report results to ENGINEER before commencing Work.
2. Prepare existing surfaces required to be painted as specified for new surfaces. Where CONTRACTOR proposes other methods of preparing existing surfaces they shall be submitted to ENGINEER for approval at time of Shop Drawing submittal. ENGINEER's approval of alternative surface preparation methods shall not relieve CONTRACTOR of performance required under this Section.
3. Perform all preparation and cleaning procedures as specified herein and in strict accordance with paint Supplier's instructions for each particular surface and atmospheric condition.
4. CONTRACTOR shall remove, as necessary, items which must be field-painted where adjacent surfaces cannot be completely protected from splatter or overspray. Following completion of painting of each space or area, the removed items shall be reinstalled by workers skilled in the trades involved.
5. Clean surfaces to be painted before applying any painting system components. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning.
6. Prepare all surfaces which were improperly shop-painted, and all abraided or rusted shop-painted surfaces, as specified.

B. Ferrous Metals:
1. Comply with Supplier's recommendations for type and size of abrasive in order to provide a surface profile meeting Supplier's painting system requirements for type, function and location of surface. Verify that Supplier recommended profiles have been achieved on prepared surfaces. Report profiles to ENGINEER using Test Method C in compliance with ASTM D 4417.
2. Clean non-submerged ferrous surfaces including structural steel and miscellaneous metal to be shop-primed, of all oil, grease, dirt, mill scale and all other contamination by commercial blast cleaning complying with SSPC-SP6, at the time of paint system application, using SSPC VIS 1 as a standard of comparison.
3. Clean non-submerged, ferrous surfaces that have not been shop- coated of all oil, grease, dirt, loose mill scale and all other contamination by commercial blasting complying with SSPC-SP6, at the time of painting system application, using SSPC VIS 1 as a standard of comparison.
4. Touch-up shop-applied prime coats which have damaged or have bare areas, with primer recommended by Supplier after commercial blasting complying with SSPC-SP6, at the time of painting system application, using SSPC VIS 1 as a standard of comparison, to provide a surface profile of not less than 1 mil.

5. Power tool clean, complying with SSPC-SP3, in order to remove welding splatter and slag.
6. Remove all rust and contamination on existing ferrous metals to sound surfaces by power tool cleaning complying with SSPC SP11 to provide a surface profile of not less than 1 mil.

C. Non-Ferrous Metal Surfaces: Prepare all non-ferrous metal surfaces for painting by light whip-blasting or by lightly sanding with 60-80 mesh sandpaper.

D. Galvanized (Zinc-Coated) Surfaces: Prepare all galvanized surfaces for painting by lightly sanding with 60-80 mesh sandpaper or by light whip-blasting.

3.03 MATERIALS PREPARATION

A. General:
1. Mix and prepare painting materials in strict accordance with Supplier's product literature.
2. Do not mix painting materials produced by different Suppliers unless otherwise permitted by Supplier's instructions.
3. Where thinners are required in the Work, they shall be produced by the paint system Supplier, unless otherwise permitted by the Supplier's product literature, submitted to ENGINEER at the time of Shop Drawing approval.

B. Tinting:
1. Tint each undercoat a lighter shade to facilitate identification of each coat of paint where multiple coats of the same material are to be applied.
2. Tint undercoats to match the color of the finish coat of paint but provide sufficient difference in shade of undercoats to distinguish each separate coat. Provide a code number to identify material tinted by the Supplier.

C. Mixing:
1. For those products requiring constant agitation use methods in compliance with Supplier's product literature, to prevent settling during paint application.
2. Mix only in containers placed in suitably sized non-ferrous or oxide resistant metal pans to protect concrete floors from slashes or spills which could stain exposed concrete or react with subsequent finish floor material.
3. Mix and apply paint only in containers bearing accurate product name of material being mixed or applied.
4. Stir all materials before application to produce a mixture of uniform density, and as required during the application of the materials. Do not stir any film which may form on the surface into the material. Remove the film and, if necessary, strain the material before using.
5. Strain products requiring such mixing procedures. After adjusting mixer speed to break up lumps and after components are thoroughly blended, strain through 35 to 50 mesh screen before application.

3.04 APPLICATION

A. General:
1. Apply paint systems by brush, roller, or airless spray in accordance with Supplier's recommendations and in compliance with Paint Application Specifications No. 1 in

SSPC Vol. 2, where applicable. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by Supplier for material and texture required. Use air spray and airless spray equipment recommended by Supplier for specific painting systems specified. Submit a list of application methods proposed, listing paint systems and location.

2. Paint dry film thicknesses required are the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried.
3. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color, and appearance. This is of particular importance regarding intense chroma primary colors. Ensure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent to that of flat surfaces.
4. Surfaces of items not normally exposed-to-view do not require the same color as other components of the system of which they are a part but require the same painting system specified for exposed surfaces of the system.
    a. "Exposed-to-view surfaces" is defined as those areas visible when permanent or built-in fixtures, convector covers, ceiling tile, covers for finned tube radiation, grilles, etc. are in-place in areas scheduled to be painted.
5. Paint aluminum parts in contact with dissimilar materials with specified paint system.
6. Omit field-primer on metal surfaces which have been shop-primed. Touch-up paint shop-primed coats and pre-finished items only when approved by ENGINEER using compatible primers and Supplier's recommended compatible field-applied finishes.
7. Welds shall be stripe-coated with intermediate or finish coat of paint after application of prime coat.

B. Minimum/Maximum Paint Film Thickness:
    1. Apply each material at not less than, nor more than, Supplier's recommended spreading rate, and provide total dry film thickness as specified.
    2. Apply additional coats of paint if required to obtain specified total dry film thickness.
    3. Maximum dry film thickness shall not exceed twice the minimum dry film thickness, except where more stringent limitations are recommended by the paint Supplier for a specific product.

C. Scheduling Surface Preparation and Painting:
    1. Apply the first-coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration in consideration of the atmospheric conditions existing at the time of surface preparation and painting. Surfaces that have started to rust before first-coat application is complete shall be brought back to required standard by abrasive blasting.
    2. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform, or feel sticky under moderate thumb pressure, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
    3. Scarify primers and other painting system components by brush-blasting if paint has been exposed for lengths of time or under conditions beyond Supplier's written recommendations for the painting systems involved, the intended use, or the method of application proposed for subsequent coats of paint.
    4. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

D. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage.

E. Brush Application:
   1. Brush-out and work all brush coats onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable. Neatly draw all glass and color break lines.
   2. Brush-apply all primer or first coats, unless otherwise permitted to use mechanical applicators.

F. Mechanical Applicators:
   1. Use mechanical methods for paint application when permitted by governing ordinances, Supplier, and approved by ENGINEER.
   2. Limit roller applications, if approved by ENGINEER, to interior wall finishes for second and third coats. Apply each roller coat to provide the equivalent hiding as brush-applied coats.
   3. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment for the purpose of building up film thickness of two coats in one pass.

G. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint Work not in compliance with specified requirements as required by ENGINEER.

3.05 FIELD QUALITY CONTROL

A. The right is reserved by ENGINEER to invoke the following material testing procedure at any time, and any number of times, during the period of field painting:
   1. Engage the service of an independent testing laboratory to sample any of the paints being used. Samples of materials delivered to the Site will be taken, identified, and sealed, and certified as to being the material actually applied to the surfaces in each area, in the presence of CONTRACTOR.
   2. A testing laboratory, selected by OWNER, will perform appropriate tests for any or all the following characteristics:
      a. Abrasion resistance.
      b. Apparent reflectivity.
      c. Flexibility.
      d. Washability.
      e. Absorption.
      f. Accelerated weathering.
      g. Dry opacity.
      h. Accelerated yellowness.
      i. Recoating.
      j. Skinning.
      k. Color retention.
      l. Alkali resistance.
      m. Quantitative materials analysis.
   3. If the test results show that the material being used does not comply with the specified requirements, CONTRACTOR may be directed to stop painting and remove non-complying paint; pay for testing; and prepare and repaint surfaces painted with the rejected paint with material complying with the Specifications.

B. Notify ENGINEER after completion of each coat of paint. After inspection and checking of film thickness, and for other imperfections, and after approval by ENGINEER, proceed with the succeeding coat. Purchase for OWNER two new dry-film thickness gages for checking the film thickness and one set of visual standards to check surface preparation. Calibrate dry film thickness gage at the Site using Bureau of Standards standard shim blocks. Provide one holiday detector for holiday testing. The holiday detector will remain the property of CONTRACTOR.
   1. Product and Supplier: Provide the following:
      a. Film Thickness Tester: Model FM-III as manufactured by Mikrotest, (Furnish Two).
      b. Holiday Detector: Model M-1 as manufactured by Tinker & Rasor.
      c. Visual Standards - ASTM D 2200, Swedish Standards, SSPC (VIS 1).
   2. ENGINEER shall witness all holiday testing and shall be notified of all scheduled testing 24 hours in advance.
   3. Additional coats shall be applied, if required, to produce the specified film thickness and to correct holidays and to completely fill all surface air holes.
   4. Holiday testing shall be performed by CONTRACTOR.

3.06 PROTECTION

A. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove all temporary protective wrappings provided for protection of this Work.

3.07 ADJUSTMENT AND CLEAN-UP

A. Correct all damages to the work of other trades by cleaning, repairing, or replacing, and repainting, as acceptable to ENGINEER.

B. During the progress of the Work, remove from the Site all discarded paint materials, rubbish, cans and rags at the end of each workday.

C. Upon completion of painting, clean all paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

D. At the completion of Work of other trades, touch-up and restore all damaged or defaced painted surfaces as determined by ENGINEER.

END OF SECTION

DIVISION 13

SPECIAL CONSTRUCTION

SECTION 13400

MEASUREMENT AND CONTROL INSTRUMENTATION

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Field Mounted Flow Monitoring Instruments and Devices

B. Field Mounted Level Monitoring Instruments and Devices

1.02 WORK INCLUDED:

A. The work of this section is coordinated with Section 13430, Boxes, Panels and Control Centers, and consists of furnishing instrument enclosures as indicated on the Contract Drawings and field mounted devices as indicated in the attached Instrument List.

1.03 RELATED SECTIONS:

A. Section 13430 – Boxes, Panels and Control Centers

B. Section 16050 – Basic Electrical Requirements

1.04 REFERENCES:

A. ISA S5.1—Instrumentation symbols

B. ISA S5.4—Instrument Loop Diagrams

C. ISA RP7.1—Color Code for panel tubing

D. IEEE—All applicable standards

E. NEMA ICS1—General Standards for Industrial Controls and Systems

F. NEMA 2—Industrial Control Devices, Controllers and Assemblies

G. NEMA 3—Industrial Systems

H. NEMA ICS6—Enclosures for Industrial Control and Systems

I. NEMA 250—Enclosures for Electrical Equipment

J. UL—All applicable sections

K. NFPA 70—National Electrical Code

1.05 DESIGN REQUIREMENTS:

A. Equipment Interfacing:

1. Analog signals to equipment by others or provided under other Sections: 4 to 20 milliamperes direct current (DC), negative ground for a total loop impedance of 0 to 500 ohms.

2. Analog signals from equipment by others or provided under other Sections: 4 to 20 milliamperes DC, negative ground, suitable for 100 to 500 ohms loop impedance.

3. Provide all required buffers, isolators, signal converters, and amplifiers for coordination with existing equipment, equipment furnished under another Section, and between items of equipment furnished hereunder, whether or not indicated on the Drawings or detailed Specifications.

B. Power Supply:

1. Provide all required power conversion equipment for operation of all electric and electronic items from a 120 volt alternating current (AC) plus or minus 12 volts AC power supply source.

2. Provide isolation transformers in each instrument panel to supply all panel loads except lighting.

1.06 PERFORMANCE REQUIREMENTS:

A. General:

1. Items will perform to limits of Manufacturer's published accuracy.

B. Metering Accuracy:

1. Pressure: Error within 1 percent of the total head imposed on the measuring element.

2. Level: Error within 1 percent of the measured range.

3. Flow: Agreement of the measuring system with the flowhead curves of the different producers within 2 percent over a 5-to-1 range for control and 8-to-1 range for instrumentation.

1.07 ENVIRONMENTAL REQUIREMENTS:

A. Do not install instruments until spaces are suitably protected from weather, moisture, and damage from other trades.

B. Maintain protection of instruments during and after installation.

C. Any items damaged during construction will be repaired or replaced at the Engineer's discretion.

1.08 SUBMITTALS:

A. Comply with requirements of and submit in accordance with the City of Dayton Construction and Material Specifications, most recent edition.

B. Shop Drawings:

1. Complete fabrication, assembly and installation drawings

2. Schematic, wiring, and connection diagrams

3. Dimension and outline drawings

4. All field measurements are to be verified and indicated on shop Drawings

C. Product Data: Details, specifications, and data describing instruments, materials, devices, and accessories, including:

1. Environmental requirements:

a. Temperature

b. Minimum and maximum flow or pressures

2. Accuracy and repeatability:

a. Individual components

b. Total system

3. Calibration requirements:

a. Initial

b. Periodic

4. Power requirements

5. Differential producers:

a. Certified standard calibration curve

b. Cover the entire specified range

c. Calibration curve legible to 0.5 percent of flow

D. Test Reports: Field test procedures

1.09 RECORD DRAWINGS:

A. As specified in City of Dayton Construction and Material Specifications, most recent edition.

B. Field Test reports, following submitted and approved field test procedures.

C. As-built vendor drawings:

1. Hard-copy

2. AutoCAD® Release 14 drawing files or more recent release

D. Red-lined Contract Drawings

E. Operation Data: Complete and detailed instruction manual, including all manufacturer's instructions.

F. Maintenance Data:

1. Recommended spare parts list

2. Preventative maintenance schedule

3. Calibration schedule and detailed calibration instructions

PART 2 – PRODUCTS

2.01 INSTRUMENT ENCLOSURES:

A. As specified in Section 13430, Boxes, Panels and Control Centers, and as indicated on the Contract Drawings.

2.02 FIELD MOUNTED FLOW MONITORING INSTRUMENTS AND DEVICES:

A. Magnetic Flow Meter:

1. Indicator/Transmitter:

a. Integrally mounted

b. All solid state circuitry

c. Except for indicating scale and totalizer, interchangeable between magnetic flow meters

d. Indicator and totalizer visible without opening enclosure

e. Display: 4-1/2 digits

f. Self-contained zero return which sets flow meter output to zero when flow through meter is minimal

g. Enclosure: NEMA 4X

h. One Analog output: 4-to-20 mA with HART

i. Accuracy: ± 0.5 percent

j. Stability: 0.5 percent of full scale

k. Response time: 20 ms max

l. Power: 120 VAC

2. Element:

a. Magnetic flow meter tube

b. 150 lb flanges, or as shown on Contract Drawings

c. Suitable for 250 psi working pressure

d. Capable of standing empty for extended periods of time without damage

e. No constriction in or obstruction of flow through meter

f. Enclosure: NEMA 4X, or as shown on instrument list

g. Encapsulated characterized field coils

h. Range: As shown on instrument list

i. Accuracy: ± 0.1 percent of actual flow

j. Repeatability: ± 0.1 percent

k. Temperature Range: -20 degrees F to 140 degrees F

l. Provide spare flanged spool piece of exact laying length for each size meter provided

3. Provided with all communication and power supply interconnecting cables for complete operating system

4. Manufacturers:

a. Rosemount: 8700M

b. SITRANS FM

c. Or engineer approved equal

2.03 FIELD MOUNTED LEVEL MONITORING INSTRUMENTS AND DEVICES:

A. Radar Level Meter:

1. Indicator/Transmitter:

a. Type: Integral with sensor

b. Remote Display: Provide remote display for inaccessible areas

c. Temperature Range: –40 degrees F to 120 degrees F

d. Display: 4 1/2 digits

e. Enclosure: NEMA 4X

f. Analog output: 4-to-20 mA, output proportional to level; HART

g. Accuracy: ± 0.5 percent

h. Power: 24VDC, loop-powered

2. Element:

   a. Mounting: 3” 150 lb FF flange

   b. Range: As shown on instrument list

   c. Accuracy: ± 2.0 percent of reading

   d. Temperature Range: –10 degrees F to 120 degrees F

3. Provide steel wedge and bracket for mounting instrument in manhole, as shown on the Contract Drawings

4. Provided with all communication and power supply interconnecting cables for complete operating system

5. Cable type over 6 feet with cable separators equally spaced at 16 inch intervals

6. Manufacturers:

   a. Vega: Vegapuls 11

   b. Endress+Hauser: Micropilot with RIA

   c. Or engineer approved equal

B. Level Switch:

1. Capacitance Level Switch:

   a. Probe: Capacitance based on dielectric constant of liquid

   b. Enclosure: NEMA 4X

   c. Installation: Vertical, with probe extending down into wetwell

   d. Mounting: Class 150 flange

   e. Temperature Range: –40 degrees F to 185 degrees F

   f. Contact: SPDT, 8A, 250 VAC

   g. Setpoint: As shown on instrument list

   h. Hazardous Area Rating: N/A

2. Provide steel wedge and bracket for mounting instrument in manhole, as shown on the Contract Drawings

3. Provided with all communication and power supply interconnecting cables for complete operating system

4. Manufacturers:

a. Vega: Vegapoint 23
b. Endress+Hauser: Solicap FTI55

c. Siemens: Pointek CLS

d. Or engineer approved equal

2.04 SPARE PARTS:

A. Provide spare parts:

a. 25 percent replacement bulbs for indicator pilot lamps

b. 100 percent replacement fuses

PART 3 - EXECUTION

3.01 SOURCE QUALITY CONTROL AND TESTS:

A. Provide shop inspection and testing of instrument panels and panel-mounted devices.

B. Notify Engineer two weeks prior to shipment of each panel.

C. Make corrections as identified by Engineer prior to shipment.

3.02 DELIVERY, STORAGE, AND HANDLING:

A. Deliver products to site under City of Dayton Construction and Material Specifications, most recent edition.

B. Store and protect products under City of Dayton Construction and Material Specifications, most recent edition.

C. Accept products on site in factory containers and verify condition of product.

3.03 INSTALLATION:

A. Install all field mounted instruments per Manufacturer's recommendations and the Contract Drawings.

B. Provide signal converters and boosters as required.

C. Panels:

1. Install freestanding enclosures on 4-inch concrete housekeeping pads.

2. Install level and plumb.

3.04 INSTRUMENTATION AND CONTROL SYSTEM TESTING:

A. Supplier to provide instrument calibration:

1. Notify the Engineer two weeks prior to calibrating instruments.

2. The Engineer shall determine if calibration procedures will be witnessed.

3. Perform calibration exactly as outlined in Manufacturer's printed instructions.

4. Check calibration at several points along instrument range.

5. Submit calibration reports per Section 13490, System Testing and Quality Control.

B. Supplier will be available onsite to assist Engineer in Control Loop Checkout.

C. Comprehensive system testing will be conducted by the Engineer, per Section 13490, System Testing and Quality Control.

3.05 WARRANTY:

A. Instruments shall be warranted against manufacturing defects for a period of at least three (3) years from date of delivery.

END OF SECTION

SECTION 13430

BOXES, PANELS AND CONTROL CENTER

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Contractor shall install components in the existing control panel located in the Recharge Pump Station and in the new control panels and enclosures at the well field ponds based on this and related Specifications and the Contract Drawings. Contractor shall maintain updated as-built drawings and furnish to the Engineer upon panel acceptance.

B. The Contractor shall furnish all necessary control panels and other enclosures complete, assembled, tested and ready for use including all necessary components, wiring, interconnecting cables, all accessories, and all appurtenances as indicated herein, on the Contract Drawings, or as required for proper operation of the system.

C. Control panels and enclosures shall be provided as specified herein and as indicated on the Contract Drawings. New panels, if required, shall be fabricated in a UL certified facility and all finished control panels shall bear a UL 508 label.

D. Where indicated, control panels and enclosures shall be provided with all required taps, fittings, conduit entries, control wiring and alarm interlocks. Dimensions shall be in accordance with manufacturer's requirements. Elevations and horizontal spacing shall be subject to the Engineer’s approval.

E. Panels shall be fabricated, assembled, piped and wired by fully qualified workers who are properly trained, experienced and supervised.

F. Panel-mounted instruments shall have matching style and general appearance. Instruments performing similar functions shall be of the same type, model, or class, and shall be of one manufacturer.

G. List of panels to modify:

1. Pump Station Instrumentation Panel #1

H. List of enclosures and back panels to provide:

2. Eagle pond control panels (10):
   a. E1, E2-E3, E4, E5, E6, E7, E8-E11, E9, E10, E12.
3. Hawk pond control panels (11):
   a. H1-H2, H3, H4, H5, H6, H7-H8, H9, H10-H11, H12, H13, H16.
4. Kitty pond control panels (6):
   a. K1, K2, K3, K4, K5, K6.
5. New pond control panels (12):
   a. P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P12.

1.02 RELATED WORK IN OTHER SECTIONS:

A. Division 01 – General Requirements

B. Division 16 – Electrical

1.03 REFERENCE CODES AND STANDARDS:

A. IS—All applicable standards

B. IEEE—All applicable standards

C. NEMA—All applicable standards

D. UL—All applicable sections

E. NFPA 70—National Electrical Code

F. ECMA—Standards for Information and Communications Systems

G. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 SUBMITTALS:

A. Submittals shall be provided as specified in the City of Dayton Construction and Material Specifications, most recent edition.

B. Include a copy of this specification section; pertinent Contract Drawings; other relevant specification sections as noted above; and all addendum updates with each specification paragraph and Contract Drawing clearly check-marked to indicate compliance with specification and drawing requirements or marked to indicate requested deviations/substitutions from the specification requirements.

C. Shop Drawings:

1. Contract Drawings supplied by the Engineer shall be redlined and returned upon acceptance of equipment.

2. Include drawings as follows

a. Panel Layout Drawings:

1) Include a complete Bill of Materials for each individual control panel furnished.

2) Include manufacturer literature for each item in the Bill of Materials with markings clearly indicating any versions, options, etc. Indicate compliance

with specification requirements. Manufacturer literature for common components need only be included once, for the first panel in the submittal with references to this literature included as applicable thereafter in submittal.

3) Drawings shall be furnished for all panels, consoles, and equipment enclosures, including modifications of existing panels. Panel assembly and elevation drawings shall detail all equipment in or on the panel. The assembly drawing shall include a bill of material on the drawing with each panel component clearly defined. The bill of material shall be cross-referenced to the assembly drawing so that a non-technical person can readily identify any component of the assembly by manufacturer and model number.

b. Panel drawings shall be 11" x 17" minimum in size. As a minimum, the panel drawings shall include the following:

1) Interior and exterior panel elevation drawings to scale

2) Nameplate schedule

3) Conduit access locations

4) Panel construction details

c. Submit construction details, NEMA ratings, intrinsically-safe barrier information, gas sealing recommendations, purging system details, etc. for panels located in hazardous locations or interfacing to equipment located in hazardous areas.

d. Heating and cooling calculations for each new panel supplied indicating conformance of the supplied equipment with heating/cooling requirements for the environmental conditions of the installed area. Calculations shall include the recommended equipment required for both heating and cooling.

3. Panel Wiring Diagrams:

a. Panel wiring diagrams shall include power and signal connections, UPS and normal power sources, all panel ancillary equipment, protective devices, wiring and wire numbers, and terminal blocks and numbering.

b. Panel wiring diagrams shall be 11" x 17" minimum in size.

D. Test Reports: Field test procedures

1.05 ENVIRONMENTAL:

A. New control panels shall be rated for continuous operation under ambient environmental conditions of 0°C to 40°C dry bulb and 5 to 95 percent relative humidity, noncondensing. Instrumentation and control elements shall be rated for continuous operation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified or normally encountered for the installed location.

B. Where required, new control panels shall be environmentally controlled with the use of exhaust fans, heaters and AC units as required to maintain the environmental conditions specified. The heating/cooling equipment shall be sized to maintain the temperature below a maximum of 122 degrees F and above a minimum of 38 degrees F within the control panel. Heating and cooling load calculations shall be provided for review and approval. Calculations shall utilize a maximum ambient temperature of 90 degrees F for indoor application and 120 degrees F for outdoor applications. Calculations shall include watt losses for all components and solar heat gain for the area of installation.

C. Where required, intake louvers shall be mounted on the lower side, rear or front section of an unobstructed panel face. Louvers shall be provided with removable and washable filter grills mounted on the interior side of the louver. Forced ventilation exhaust fans, where used, shall be provided at an opposing elevated location from the intake louvers. Unless otherwise indicated, fan motors shall operate on 120-volt, 60-Hz power. For control panels located in control rooms, the total audible sound level of the fans shall be less than 45 dB(A).

1.06 PANEL ASSEMBLY:

A. Panel mounted equipment shall be installed with due regard to commissioning adjustments, servicing requirements and cover removal. Components, terminal blocks and equipment items shall be mounted at least 9” above the base of the control panel and a minimum of 6” below the top of the enclosure.

B. Control panel components shall be arranged within the panel to optimize weight distribution, heat dissipation and component spacing for wiring and maintenance. Components and terminal strips shall be vertically and horizontally segregated with wire ducts utilizing a 2.0” minimum spacing between the wire ducts and component terminal connections.

C. All fixed position components shall be mounted utilizing stainless steel screws, brackets and fasteners such that no exterior panel protrusions occur. Screws shall be threaded into panels. Rivets or back-of-panel nuts shall not be allowed. Back panel components shall be individually identified with a unique identifier per IEEE and ISA recommended practices.

D. Component DIN rails, where applicable, shall be provided for mounting of panel components such as terminal blocks, fuse blocks, relays, timers, and signal conditioners. DIN rail shall be zinc plated, yellow chromate steel. Twenty five percent additional rail space shall be provided to allow for system expansion. Din rails shall be mounted on manufactured standoffs raised a minimum of 1.5” from the surface of the back panel.

E. Nameplates for panel-mounted devices shall be laminated plastic, black on white, with engraving through the black surface to form 3/16” high white letters. Relays and other devices mounted inside the control panels shall be identified with permanent nonferrous tags. All tags shall match device numbers shown on Contract Drawings.

F. Front panel components shall be arranged by function and group with a 2” minimum spacing for panel-mounted devices. Operator switches and pilot lights shall utilize a 2.5” on

center minimum spacing for wire connections. Where future provisions are indicated on the Drawings, switch and pilot light positions shall be pre-punched and plugged with removeable knockout covers for easy modification and expansion. All front panel mounted components shall be provided with neoprene gasket seals to maintain the overall NEMA rating of the enclosure.

G. To ensure proper grounding within the control panel a copper ground bus bar shall be provided. All grounding terminal blocks, equipment chassis and source grounds shall be connected to the ground bus bar to provide a common ground reference within the control panel. A separate ground bar shall be supplied for analog cable shield connections.

H. All panels shall be protected from internal corrosion by employing the use of corrosion inhibiting vapor capsules and shall be manufactured by Northern Instruments Model Zerust VC, Hoffman Engineering Model A-HCI, or equal.

I. Freestanding and wall mount panels shall be provided with louvers and/or forced ventilation as required to prevent temperature buildup due to operation of electrical devices mounted in or on the panel.

J. Intake louvers shall be mounted on the lower side, rear or front section of an unobstructed panel face. Louvers shall be provided with removable and washable filter grills mounted on the interior side of the louver. Forced-ventilation exhaust fans, where used, shall be provided at an opposing elevated location from the intake louvers. Unless otherwise indicated, fan motors shall operate on 120-volt, 60-Hz power. For control panels located in control rooms, the total audible sound level of the fans shall be less than 45 dB(A).

K. Minimum wire bending space at terminals and minimum width of wiring gutters shall comply with latest revision of the NEC.

L. Future device and component mounting space shall be provided on the door, back panel, and subpanel where detailed on the Contract Drawings. Where no detail is shown, provide a minimum of 15 percent usable future space.

M. Equipment provided with status and diagnostic displays, LED’s, programming pads, buttons, dials or UPS units shall be mounted with the display and keypad facing the panel front. Shelving, brackets and associated mounting hardware shall be provided to mount the equipment in readily accessible and viewable location within the panel.

N. Provide protected dedicated branch circuits for PLC control components. Control circuits shall be segregated from branch circuits for accessory components such as lights, heaters, fans and receptacles. PLC circuits shall be fed by uninterrupted power supply.

1.07 PANEL WIRING:

A. Control panel shall be wired per the latest revision of NEC, NEMA, IEEE and UL-508 standard wiring guidelines for electrical systems.

B. Wire Marking:

1. Each signal, control, alarm, and accessory circuit conductor shall be designated by a single unique number which shall be shown on all shop drawings. These numbers shall be marked on all conductors at every termination point using machine printed wire markers which shall be permanently marked heat shrink plastic. Markings shall be black letters on white background.

C. Control Panel Wire:

1. Panel wire size shall conform to the latest requirements of NEC and UL standards or the Specification, whichever is the most stringent. Unless otherwise specified, typical panel wire size shall be:

   a. PLC Input/Output wiring: 16 AWG minimum

   b. AC and DC Control wiring: 16 AWG minimum

   c. Panel and equipment power: 12 AWG minimum

   d. DC analog signals: 18 AWG twisted-shielded pair (TSP)

2. Control panel wiring shall be THHN or MTW.

3. Instrumentation signal cables shall be of the type used for process control with shielded pairs or triads with PVC jacket and overall shield over the multiple pairs or triads. The instrumentation cable shall be rated 300 volts at 90°C or better. The size of the instrumentation cable shall be AWG No. 18 minimum, unless otherwise specified. All instrumentation cables shall meet all the requirements of IPCEA S-61-402 and shall be UL listed.

D. Wire Color Code:

1. Wires shall be color coded in accordance with the following table:

a.	BLACK	120 VAC power circuits
b.	WHITE	120 VAC neutral
c.	RED	AC control circuits
d.	BLUE	DC Control
e.	BLUE/WHITE	DC Common
f.	YELLOW	Interlock control circuits, Foreign Voltage
g.	GREEN	Equipment ground

E. Wire Routing and Termination:

1. All internal wiring shall be routed through plastic wire duct and spiral wrapped when transitions to front panels or additional sections are required. Wire routing shall be separated and grouped by function, voltage and signal type to minimize noise and maximize maintainability.

2. A 60 percent wire duct fill, as allowable by the NEC, shall be maintained to allow for future expansion and panel modification. A minimum 1.5-inch clearance shall be maintained in front of each wire duct cover to allow for easy access to panel wiring.

3. Wiring between components on a swing-out panel to other components on a fixed panel shall be made up in tied bundles with a “service loop” of sufficient length to allow the panel to swing without friction on the wire bundles. These shall be tied with plastic spiral wrap and shall be secured to panels at both ends of the "service loop" so that conductors are not strained at terminals or hinge points.

4. Wiring run to control devices on door panels shall be made up in tied bundles with a “service loop” of sufficient length to allow the door to swing fully open and closed without friction on the wire bundles. These shall be tied with plastic spiral wrap and shall be secured to panels at both ends of the "service loop" so that conductors are not strained at terminals or hinge points. Wiring to rear terminals on panel-mount instruments shall be run in plastic wire ducts secured to horizontal brackets run above or below the instruments in about the same plane as the rear of the instruments.

F. Wire Termination:

1. All interfacing between the control panels and the field devices shall be accomplished at a field connection terminal strip. The terminal strip shall have a dedicated field wiring side. No internal panel wiring shall be connected to terminals on the "field side" of the terminal strip. Likewise, no field wiring shall be connected to terminals on the "panel side" of the terminal strip.

2. Terminal strips or groups shall be arranged by signal type and voltage AC and DC signals shall not terminate on the same terminal strip or group.

3. No more than two conductors shall be terminated at a single termination point. A common terminal block shall be provided for every two common or neutral conductors contained within the panel.

4. In addition to the spare power termination capacity, each panel shall be provided with two spare fused AC power and DC power terminations of each voltage type to power future equipment items and field devices.

1.08 QUALITY ASSURANCE:

A. The manufacturer of this equipment shall have produced similar equipment for a minimum period of five years. When requested by the Owner and/or Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

PART 2 – PRODUCTS

2.01 GENERAL:

A. Equipment and materials shall be products of reputable, experienced manufacturers. All equipment shall be of industrial grade, shall be of sturdy design and manufacture, and shall be capable of long, reliable, trouble-free service. Unless otherwise indicated, all components shall be of the most recent field-proven models marketed by their manufacturers at the time of submittal of the shop drawings. Unless specifically indicated, all materials and components used in panel fabrication shall be new, of current manufacture, and shall not have been in prior service.

2.02 PROCESS INDICATORS:

A. Process indicators shall be provided as indicated on the Contract Drawings. Process indicator shall display the process variable in engineering units proportional to a variable input signal (4-20 mA - VDC). The indicator shall be provided with 5-digit backlit LCD display with adjustable zero and span calibration.

B. The display shall be panel mounted with a NEMA 4X/IP65 rated bezel. The process display shall meet the following:

1. Accuracy: +/- 0.25%

2. Power: 24 VDC

3. Operating Temperature: 0 – 150 degrees F

4. Retransmission Output: 4 – 20 mA (Isolated)

C. Process indicators shall be Action Instruments, Red Lion, Newport or approved equal.

2.03 CIRCUIT BREAKERS:

A. Equipment circuit protection shall be provided as indicated on the Contract Drawings. Circuit breakers shall be sized in accordance with NEC and UL

B. Molded Case Circuit Breakers:

1. Internal control panel feeder or distribution circuits above 120VAC shall be protected by UL 489 listed, current-limiting circuit breakers. Circuit breaker shall be a fully assembled unit rated for an operating environment of 140 deg. F without derating and have a mechanical life of at least 10,000 operations. In addition to short-circuit protection, circuit breaker shall have thermal or electronic over-current protection. Interrupting capacity shall be 25kA – 65kA.

2. The circuit breaker shall have clearly-marked ON, OFF, and tripped positions, and a test button for initiating an alarm trip.

3. Circuit breaker shall be surface- or DIN-rail mounted and have IP2X finger-safe terminals and manufactured by Square D or approved equal.

C. Miniature Circuit Breakers:

1. Internal control panel branch circuits 120VAC and below shall be protected by UL 489 or UL 1077 listed thermal/magnetic, current-limiting circuit breakers. Trip curve shall be Type C or Type D as required. Circuit breaker shall be a fully assembled unit rated for an operating environment of 140 deg. F without derating and have a mechanical life of at least 8,000 operations. Interrupting capacity shall be 10kA.

2. The circuit breaker shall have clearly-marked ON, OFF, and tripped positions.

3. Circuit breaker shall be DIN-rail mounted and have IP2X finger-safe, screw-clamp terminals.

2.04 TERMINAL BLOCKS:

A. General: Terminal blocks, fuse blocks and disconnects shall be specially designed for safety, installation ease, and ruggedness. Features shall include the following:

1. Nickel-plated terminals and stainless-steel screws

2. High copper content copper-alloy

3. Four-sided wire funnel guides for easy wire insertion

4. Finger-safe housings to prevent accidental contact with live circuits

B. DIN rail mount shall allow terminal blocks to be placed on the same mounting rail as relays, timers, disconnects, signal conditioners and other DIN rail-mounted control devices.

C. Terminal Blocks:

1. Terminal blocks shall be DIN-rail mounted, compression clamp style, UL rated for 30 amps at 600 volts. Terminal blocks shall be high-density type molded plastic with barriers and box lug terminals. Terminal marking method shall be white marking strips fastened securely to the molded sections and shall be provided with clearly legible, printed wire numbers or circuit identifications.

D. Fuse blocks for circuits 250 Volts and below, shall be DIN rail mounted, compression clamp style, rated for 15 amps at 300 VAC. Fuse blocks shall be provided to accept 5 x 20 mm fuses. Fuse blocks shall be provided with a swing arm fuse holder for easy removal of fuses. The fuse block shall be provided with blown fuse indication.

E. Ground termination blocks shall be provided for all signal grounding and shield connections. Ground terminals shall be DIN rail mounted, compression clamp style, rated for 20 amps at 600 volts. Terminal blocks shall be high-density type molded plastic with

barriers and box lug terminals. Ground terminals shall be color-coded green/yellow for grounding identification.

F. DC Signal and control circuits shall be supplied with pull-apart disconnect fuse plug component terminal blocks, rated for 20 amps at 600 volts. Disconnect terminals shall be DIN rail mounted, compression clamp style, rated for 20 amps at 600 volts. Fuse plug shall accept 5 x 20 mm fuses and shall be provided with blown fuse indication. .Fuse blocks shall be high-density type molded plastic with barriers and box lug terminals.

G. Terminal and fuse block manufacturer shall be Square D, Phoenix Contact or approved equal.

2.05 CONTROL RELAYS:

A. Control relays shall be plug-in type general purpose relays utilizing contacts rated at 10 amps at the specified control voltage. Relay base configurations shall be DIN rail mount and selected such that AC and DC control relays are not interchangeable, thereby preventing accidental damage to relay coils resulting from incompatible voltages. Each relay shall be provided with one spare Form C contact. Relays shall be provided with an operational status LED, providing positive status of relay energization. In installations where vibration exists, hold-down wires shall be installed. Relays shall be IDEC or approved equal.

B. Control timers shall be solid state adjustable timer relays supplied as time delay on energize, or time delay on de-energize, as indicated on the drawings. Timer control voltages shall be as indicated on the drawings and shall be provided with DPDT. 10A. 240VAC contacts. Timers shall be blade style, plug-in type with dust cover and DIN rail mount sockets. Timers shall have an adjustable time range and time setting with indication of the full time range and of the time setting. Time delays shall be provided with LED status indicators for energization and timer function status. In installations where vibration exists, hold-down wires shall be installed. Solid-state timers shall be IDEC or approved equal.

C. Industrial Control Relays (ICR) shall be provided as indicated on the Contract Drawings and for loads that exceed the normal contact inrush and constant current capacity rating for plug-in type relays. Relays shall be provided with convertible cartridges for NO/NC configuration and shall be stackable to a maximum of eight (8) contacts with the addition of a top mounted expansion module. Contacts shall be 20 amp rated bifurcated spanner and nickel-silver plated. Industrial control relays shall be IDEC RJ/SJ, Square D, or approved equal.

D. PLC control relays shall be provided as indicated on the Contract Drawings. Interposing relays shall be 24 VDC and provide a SPDT output rated at 5 amps at 120 VAC. The relay shall be provided with a DIN rail mounted terminal base utilizing compression clamp style terminals with wire terminal labeling provisions. In installations where vibration exists, hold-down wires shall be installed. Interposing relay shall be Phoenix PLC-RSC, or equal.

2.06 SIGNAL ISOLATORS AND CONVERTERS:

A. Provide signal isolators or converters where indicated on the Drawings or where necessary for proper, accurate system operation.

B. Signal isolators shall be provided in each measurement and/or control loop where multiple equipment grounding points exist with a potential to form a ground loop. An isolator may also be required to maintain loop integrity when the removal of a component of a loop is required. The isolator shall accept a 4-20mA process input signal and produce an isolated, proportional 4-20mA current output signal. The isolator shall provide a minimum of 1500V input-to-output isolation and have full three-way isolation when external power is used. The isolator must be resistant to RFI and EMI interference per IEC EN50081. The isolator shall have an accuracy of at least 0.1% of full span, including resolution and hysteresis, and have a response time of 200ms minimum.

C. Signal converters shall be provided in each measurement and/or control loop to interface between PLCs and/or controllers and field instruments and devices where field instrumentation or device signals are not directly compatible with PLC or controller inputs or outputs. The signal converter shall accept a process signal from a field device or controller and convert that signal to a proportional output signal usable by the controller or field device connected to the output. Signal converters shall have isolated outputs with a minimum of 1500V input-to-output isolation and have full three-way isolation when external power is used. Signal converter accuracy shall be at least 0.1% of full span with a response time of 800ms or less.

D. Signal isolators and signal conditioners shall be DIN rail mount. Provide signal power supplies where needed.

E. Modules shall be Acromag, Action Instruments, Moore Industries CPT Series, or approved equal.

2.07 OPERATOR CONTROLS AND INDICATORS:

A. Operator controls and indicators, including switches, pushbuttons, and pilot lights, shall be 30 mm, NEMA 4/4X rated:

1. Pushbuttons, selector switches, and indicating lights shall be heavy duty oil-tight, manufactured to the requirements of NEMA ICS.

2. Contacts, operator types, and lamp lens colors shall be provided as indicated on the contract drawings.

3. Labels and legend plates shall be provided as indicated on the Contract Drawings.

4. Provide push-to-test type LED lamps, 120 VAC or 24 VDC LED lamps with individual transformers or resistors.

5. Contact blocks shall be rated 10 amps at 120 VAC.

6. Emergency Stop pushbuttons shall be provided with a push-pull red mushroom head operator.

7. Pushbuttons, selector switches and indicating lights shall be Square D or approved equal.

B. Operator controls and indicators shall be supplied and installed with index tabbed thrust washers to prevent switch rotation.

2.08 EMI LINE FILTER AND SURGE SUPPRESSION:

A. Power Surge Protection:

1. Surge protection shall be provided at the power input of the control panel.

2. The surge protectors shall be tested in accordance with the requirements of ANSI/IEEE C62.41 standards for Categories A, B, and C environments and shall be a UL 1449 type 2/3 component.

3. Surge protection components shall be as manufactured by Square D or approved equal.

B. Data Communications Line Surge Protection:

1. Surge protection devices shall be supplied for the protection of all communications circuits from the effects of lightning induced currents, substation switching transients and internally generated transients resulting from inductive and/or capacitive load switching.

2. Communication line surge protection shall be UL-497 Listed. The surge protection device shall be sized for voltage, current and frequency requirements listed on the Contract Documents and shall provide independent conductor-ground surge protection. Surge protection shall be installed on the incoming communications for the control panel.

3. The protector module shall be failsafe and contain a three-electrode Maximum Duty gas tube, a fail short mechanism, and an air gap backup device which converts the gas tube protector to an air gap protector in the unlikely event that the gas tube vents.

4. The surge protection shall be Phoenix Contact, TII or equal.

C. Signal Surge Protection (4-20 mA):

1. Surge protection devices shall be supplied for the protection of all externally derived signal circuits from the effects of lightning induced currents, substation switching transients and internally generated transients resulting from inductive and/or capacitive load switching.

2. Communication line surge protection shall be UL-497B Listed. The surge protection device shall be sized for voltage, current and frequency requirements listed on the contract plans and shall provide independent conductor-ground surge protection.

3. Signal surge suppressors shall be Acromag 611T, Leviton 3420-9, or equal.

2.09 POWER SUPPLIES:

A. DC Power Supply:

1. Control panel shall utilize NEC Class 2 DC switching power supplies for primary control power. Power supplies shall be industrial-grade with integrated current-limiting, power factor correction and indefinite automatic short-circuit, overvoltage and overtemperature protection. Power supply shall provide consistent power to high-inrush devices without shutdown or foldback and include a lighted visual indicator for power ON. Power supply shall have line and load regulation of 0.5% or less. Power supply wiring connections shall be via finger safe screw terminals.

2. Power supplies shall be DIN rail mounted and sized to power equipment as shown on Contract Drawings at maximum load with an additional 50 percent power capacity.

3. Power supply voltages shall be as required to power control panel equipment at their stated voltage and as indicated on the Contract Drawings.

4. Power supplies shall be Sola, Phoenix Contact or approved equal.

2.10 EQUIPMENT ENCLOSURES (CONTROL PANELS):

A. New control panel enclosures shall be wall mounted or free standing as indicated on the Contract Drawings. All enclosures shall be UL Listed manufactured items.

B. Access door(s) shall have continuous hinges and an integral neoprene gasket that provides a seal to a flanged trough around the perimeter of the door opening. Free-standing enclosures shall have three-point door hardware with key-locking handle(s) and have integral lifting eyes. Wall-mounted enclosures shall have tamper-proof screws or fasteners, integral mounting tabs, and a hasp/staple for fitting a standard 5/16” shackle padlock. The cabinet shall be constructed from formed 12-gauge steel minimum. All exposed edges and welds on the enclosure shall be ground smooth.

1. Padlock Models
   a. Master Lock Pro Series Weather Tough Laminated Steel Re-Keyable Pin Tumbler Padlock, 2-1/8 in wide.
   b. Engineer approved equal.

C. Panel ratings shall be based on NEMA standards for the location and environment in which the panel is installed. Panel materials shall be selected for corrosive environments based on standard chemical compatibility charts. Unless otherwise indicated on the Contract Drawings, control panels shall be rated as follows:

1. Indoor: NEMA 4

2. Electrical and control rooms: NEMA 12

3. Outdoor, non-corrosive: NEMA 4

4. Indoor/outdoor corrosive, NEMA 4X, 316 SS

5. Chemical rooms, NEMA 4X, FRP

6. Partial submergence, NEMA 6

7. Hazardous environment: NEMA 7

D. The exterior of NEMA 4 enclosures shall be painted ANSI grey with a rust-inhibiting primer and two coats of powder-coat paint.

E. The interior shall be provided with a formed 12-gauge steel subpanel for attaching surface-mounted components. All components shall be attached to the subpanel with screws threaded into the subpanel. Rivets or back of panel nuts shall not be allowed. The subpanel shall be painted with two coats of white powder-coat paint.

F. Enclosure shall be a manufactured item supplied by Hoffman, Saginaw or approved equal.

2.11 MOTOR CONTROL AND POWER DISTRIBUTION:

A. General:

1. Each panel shall be provided with a molded case circuit breaker fitted with a handle mechanism that is readily accessible to the operator. The handle mechanism shall be a manufactured accessory provided by the same manufacturer as the circuit breaker.

2. The handle shall be interlocked to the section door or dead-front panel and be clearly labeled as the control panel disconnect. The handle shall include an integral locking mechanism that accommodates a standard padlock. The handle shall be UL Listed.

B. Power Distribution:

1. Circuit Breakers:

a. Molded case circuit breakers shall be sized per the Drawing and/or load requirements. Refer to section 2.5 in this specification for additional requirements.

2. Power Distribution Blocks

a. Power distribution blocks shall be provided to support conductor cable entry, cable reduction and cable fan-out as required to provide for power distribution within the control panel. Power distribution blocks shall be UL Listed and have copper or aluminum connectors. Blocks shall be rated at 600V.

b. Distribution blocks shall be sized such that no more than one (1) wire is attached to any connection point. Connection points shall be sized for the wire gage appropriate for the connected load per NEC and UL.

c. Connection points shall be IP2X finger-safe or be supplied with manufacturer's covers.

3. Control Power Transformers:

a. Control power transformers shall be dry-type, step-down transformers used to reduce supply voltage to 120VAC for use in the operation of devices such as power supplies, contactors, relays and other inductive loads. The transformer should be designed and sized to accommodate momentary inrush currents produced by these devices without compromising secondary voltage stability. Control power transformers shall be UL Listed and have integral terminals. Terminals shall be IP2X finger-safe or be supplied with manufacturer's terminal covers.

b. Control power transformers shall be sized per the load requirements plus 50 percent.

c. Control power transformers shall be Square D or approved equal.

C. Motor Control for Existing and New Pump Station Pump Motors:

1. Provide for each of the existing pump motors:

a. 120V AC Control Module

1) Allen-Bradley E300

2) Model 193-EIO-63-120

b. 200 AMP Overload

1) Allen-Bradley E300

2) Model 193-ESM-VIG-200A-T

c. HMI module for local control

1) Allen-Bradley E300

2) Model 193-EOS-SCS

d. Ethernet I/O module

1) Allen-Bradley E300

2) Model 193-ECM-ETR

e. I/O Power Supply

1) Allen-Bradley E300

2) Model 193-EXP-PS-AC

2. All of the components listed above shall be Allen-Bradley E300. No exceptions are permitted.

3. Provide terminal covers per the Contract Drawings.

4. Install and wire per the Contract Drawings.

1. All of the components listed above shall be the manufacturer and model stated. No exceptions are permitted.

2. Install and wire per the Contract Drawings.

D. At each existing well cabinet, existing signals for level, flow and pressure shall be wired as inputs to the Analog I/O module.

2.12 PANEL INTRUSION SWITCH:

A. Intrusion switches shall be provided for all control panels. Each panel compartment shall be provided with a panel intrusion switch that provides entry notification to the PLC and intrusion notification system.

B. The switch shall activate whenever entry to the panel is made. The switch shall be mounted to maintain NEMA rating integrity of the enclosure. Provide normally-open switch contacts wired for “fail-safe” operation.

2.13 UNINTERRUPTIBLE POWER SUPPLY:

A. This specification defines the electrical and mechanical characteristics and requirements for a continuous-duty single-phase, solid state, uninterruptible power supply. The uninterruptible power supply, hereafter referred to as the UPS, shall provide regulated AC power for electronic equipment loads.

B. The UPS and battery storage shall be din rail mounted and sized to power the full electrical load for a minimum of 30 minutes after power loss.

C. The UPS shall utilize a microprocessor-based control and monitoring system. Battery charging shall occur automatically when AC power is applied without need to reset or switch ON the UPS. The UPS shall include an automatic self-test feature to test the UPS function and battery condition. When the battery is not suitable for proper system operation, the UPS will sound an audible alarm and provide visual indication of alarm.

D. The UPS shall be designed to operate as a line interactive system in the following modes:

1. Normal - The critical AC load is continuously supplied with filtered power. The battery charger shall maintain a float-charge on the battery.
2. Battery - When the input power source exceeds the power rating of the UPS, the critical AC load shall be supplied power by the inverter, which obtains its power from the battery.
3. Recharge - Upon restoration of utility the input power source within specified parameters, the critical AC load shall be supplied with filtered power and the battery charger shall simultaneously recharge the battery.
4. Automatic Restart- Upon restoration of the input power source, after a complete battery discharge, the UPS shall automatically restart and supply filtered power to the critical load. The bi-directional converter shall simultaneously recharge the battery.
5. The UPS shall contain front panel mounted main On/Off and alarm silence/manual battery test switches. The UPS shall also contain microcontroller-based monitoring and controls for reliable operation.
6. In the battery mode of operation, the bi-directional converter shall convert DC power from the battery to regulated and conditioned sine wave AC power for supporting the critical load.

E. The UPS shall provide front-panel visual indication of operational mode status of the UPS. At minimum, the following conditions shall be indicated:

1. UPS is operating on line power and functioning normally.
2. UPS overload or faulted condition.
3. UPS is operating on battery power.
4. Battery low or failed.
5. An audible alarm shall be used in conjunction with the visual indicators to indicate to the operator a change in UPS operating status.

F. The UPS shall include dry contact outputs or communications interface to provide UPS status to the facility control system. The communications interface, if provided, shall be Ethernet/IP. At minimum, the statuses to be made available are:

1. UPS is operating on line power and functioning normally.
2. UPS overload or faulted condition.

G. Provided with maintenance bypass switch.

H. UPS shall be APC SRT5KRMXLT-5KTF with integral 208V-120V transformer and 120V PDU, no substitutes.

2.14 FIBER NETWORK SWITCH:

A. The fiber network switch shall be 48-fiber-port Cisco 9300-48S series, no substitutes.

2.15 ETHERNET SWITCH WITH FIBER PORTS:

A. The Ethernet switches shall be manufactured with a ruggedized industrial case; 24VDC powered, and DIN rail mountable.

B. The Ethernet switch shall have the following capabilities:

1. Operating temperature: 32 to 158 Deg F.
2. Shock and Vibration: 200g @ 10ms, 1g, 10-500Hz, 3 axis.
3. 10/100/1000BaseTx Auto Sense/Configure, plug and play with auto MDIX/port.
4. Switch shall be managed.

C. Each switch shall be configured with a minimum of 2 SFP slots. The number of Ethernet 10/100/1000BaseT Ports shall accommodate all the network connections shown in the Contract Drawings plus a minimum of 2 spare ports.

D. The ethernet switch shall be Allen Bradley Stratix 5200, Allen Bradley Stratix 5400, or Allen Bradely Stratix 5800, no substitutes.

2.16 SMALL FORM-FACTOR PLUGGABLE (SFP):

A. Operating Temperature: -40 to 185 Deg F

B. Fiber Optic Compatibility: 1000BASE-LX/LH single mode fiber

C. Interface Connector: Dual LC

D. Switch Compatibility: Supported by Cisco 9300-48S, Allen Bradley Stratix 5200, Stratix 5400, and Stratix 5800.

E. SFPs shall be Cisco GLC-LX-SM-RGD-TAA or approved equal.

2.17 NETWORK RACK:

A. Network rack shall be APC AR203A or approved equal.

2.18 SPARE PARTS, CONSUMABLE ITEMS, AND TOOLS:

A. Allen-Bradley E300 components: Provide twelve (12) spares for each type.

B. Fuses: Provide 20 percent of each size and type used rounded to the next whole number, but no less than five of each size and type.

C. Spare contact blocks 5 spare NO and NC for each type of switch contact block utilized.

D. Corrosion-Inhibiting Vapor Capsules: Two-year supply.

E. Two of each type of relay.

PART 3 - EXECUTION

3.01 GENERAL:

A. The Contractor shall provide installation materials, labor, wiring, cabling, and terminations required for the complete installation and operation of the control panels.

B. Craftspeople skilled in the appropriate trade shall perform assembly, wire and fabrication in a workmanlike manner. Work shall be performed in accordance with the Specifications, Contract Drawings, manufacturers' recommendations, and the best practice of the trade. Completed work shall present a neat and finished appearance.

C. Qualified, experienced personnel who are technically skilled in their trades, are thoroughly instructed, and are competently supervised shall do all work including installation, connection, calibration, testing and adjustment. The resulting complete installation shall reflect professional quality work, employing industrial standards and methods. Any, and all defective material or inferior workmanship shall be corrected immediately to the satisfaction of the Owner’s representative at no additional cost to the Owner.

D. Control panel modifications and additions shall conform to the control panel assembly and wiring specifications of this section.

E. Prior to jobsite delivery, the Contractor shall have successfully completed all submittal and documentation requirements and shall present to the Engineer an approved copy of all such submittals.

3.02 INSTALLATION:

A. Equipment shall be installed in control panels in accordance with the Contract Drawings, manufacturer’s requirements, and all related electrical equipment installation specifications and requirements.

B. Inspect each component for damage and defects before installation. Replace deficient items.

3.03 COMMISSIONING:

A. All modified control panels shall be field tested and commissioned in accordance with Section 13490, Testing and the City of Dayton Construction and Material Specifications, most recent edition.

3.04 WARRANTY:

A. In addition to the warranty requirements listed elsewhere in the specifications, all necessary packaged control system devices, components, parts, and vendor service support shall be provided for a minimum of one year after the date of project acceptance.

END OF SECTION

SECTION 13450

PROGRAMMABLE LOGIC CONTROLLERS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Programmable logic controllers.

B. Input/output assemblies.

C. Data communication modules.

D. Remote input/output units.

E. Programming software.

1.02 SYSTEM DESCRIPTION:

A. Drawings: The Contract Drawings of this Specification indicate the number and sizes of PLCs, remote I/O, and network devices, as well as additional I/O modules and hardware to be added to existing PLC control panels if necessary. All hardware, including power supplies, special cables, and other appurtenant equipment, shall be provided to meet the functional requirements described herein and indicated on the drawings. The Contractor will “red mark” Engineer-provided enclosure electrical schematics and module termination drawings showing interconnection of Programmable Control System equipment and field devices.

1.03 RELATED SECTIONS:

A. Division 16 – Electrical

B. Section 13400 – Measurement and Controls Instrumentation

C. Section 13430 – Boxes, Panels and Control Centers

D. Section 13490 – System Testing and Quality Control

1.04 REFERENCED STANDARDS:

A. National Electrical Manufacturers Association (NEMA):

1. NEMA ICS 1 - General Standards for Industrial Control and Systems

2. NEMA ICS 2 - Standards for Industrial Control and Systems: Controllers, Contactors and Overload Relays, Rated 600 Volts

3. NEMA ICS 3- Industrial Control and Systems: Factory Built Assemblies

4. NEMA ICS 6 - Enclosures for Industrial Controls and Systems

B. National Fire Protection Association (NFPA):

1. National Electrical Code (NEC)

C. Underwriters Laboratories (UL)

1. UL 508A, the Standard of Safety for Industrial Control Equipment

1.05 HARDWARE PROCURMENT REFERENCES:

A. Rockwell Automation Publications

1. PlantPAx Distributed Control System Hardware Certifications and Specifications: PROCES-SR027D-EN-E – January 2020.

2. PlantPAx Distributed Control System: PROCES-SG001R-EN-P – December 2022

1.06 SUBMITTALS:

A. Comply with requirements of and submit in accordance with the City of Dayton Construction and Material Specifications, most recent edition.

B. Shop Drawings: Indicate electrical characteristics and connection requirements, including layout of completed assemblies, interconnecting cabling, dimensions, weights, and external power requirements if different than Engineer-supplied Drawings:

C. Product Data: For each component specified, show electrical characteristics and connections requirements.

D. Manufacturer’s Certificates: Provide under provisions of Division 01 that products meet or exceed specified requirements.

E. Manufacturer’s Installation Instructions: Provide for each component.

1.07 QUALITY ASSURANCE:

A. The manufacturer of this equipment shall have produced similar equipment for a minimum period of five years. When requested by the Owner and/or Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.08 COMMUNICATIONS PROTOCOL:

A. The PLC System shall communicate utilizing Ethernet/IP Protocol with the following as minimum capabilities:

1. Transfer of basic I/O data via User Datagram Protocol (UDP)-based implicit messaging.

2. Uploading and downloading of parameters, set points, programs and recipes via TCP (i.e., explicit messaging).

3. Polled, cyclic and change-of-state monitoring via UDP, such as RPI and COS in the control systems.

4. One-to-one (unicast), one-to-many (multicast), and one-to-all (broadcast) communication via TCP.

5. Use of well-known TCP port number 44818 for explicit messaging and UDP port number 2222 for implicit messaging.

B. The PLC and all field-mounted controllers shall be capable of peer-to-peer communications that provide for the direct transfer of process data to and from those controllers on demand, without the use of intermediate controllers, gateways, or servers.

C. Variable frequency drives (VFDs) shall include all additional hardware and software necessary to enable direct control and monitoring of the VFD from the PLC via Ethernet/IP protocol.

1.09 PROJECT RECORD DOCUMENTS:

A. Provide under provisions of Division 01.

B. Record actual locations of controller cabinets and input and output devices connected to system. Include interconnection wiring and cabling information, and terminal block layouts in controller cabinets.

C. Operations and Maintenance Documents: Submit bound copies of operating and programming instructions. Include module replacement, adjustments, and preventive maintenance procedures and materials.

PART 2 – PRODUCTS

2.01 GENERAL

A. The PLC system shall operate in ambient conditions of 32 to 140°F temperature and 5 to 95 percent relative humidity without the need for purging or air conditioning.

B. Access to the PLC program, downloading, uploading and diagnostic functions shall incorporate password protection or key lock operation.

C. PLC system shall be designed with high noise immunity to prevent occurrence of false logic signals resulting from switching transients, relay and circuit breaker noise or conducted and radiated radio frequency interference.

D. The controller shall be grounded to the panel ground bus with a separate ground conductor sized per the manufacturer's grounding requirements. The minimum ground connection shall be #12 AWG.

2.02 PROGRAMMABLE LOGIC CONTROLLERS (PLC)

A. Manufacturers:

1. Allen-Bradley
2. Substitutions: Not Permitted

B. Vendor control panels shall comply with the listed specifications herein listed in this document. No exception is authorized.

C. Contractors shall confirm PLC chassis layout using Rockwell Automation software Integrated Architecture Builder.

D. The PLC chassis shall contain all I/O modules, communications equipment, and power supplies required to provide the specified functions. PLC chassis shall be sized to house the required PLC modules plus additional slots as indicated on the Contract Drawings.

E. PLC Power Supply: The PLC power supplies shall be sized to provide power at the maximum total module load plus an additional 50 percent for future expansion. The PLC power supply shall provide AC power.

1. PLC Power Supply Models:
   a. Allen-Bradley ControlLogix 1756-PB72 – 120VDC, 75 W

F. Central Processing Unit:

1. Memory: Minimum 3 MB

2. Communications Ports: One integral Ethernet/IP and one interface port.

3. PLC Processor Modules:
   a. Allen-Bradley ControlLogix 1756-L83EP – 10 MB user memory, 1GB Ethernet port, 100 Ethernet/IP devices
   b. Allen-Bradley ControlLogix 1756-EN2T – Ethernet/IP bridge, 10/100/1000 Mbps, 256 TCP connections, 512 CIP connections

4. Firmware:
   a. Version 35.11 for ControlLogix

G. Pump Station Input/Output Modules

1. Discrete Input Modules:
   a. Input voltage: 24 VDC
   b. Quantity: 32 points per module
      1) All channels to be individually fused.
   c. Provide isolated card or interposing relays if discrete status contacts are wetted by field (foreign) power.
   d. Spare: 20% spare points at each I/O rack wired to terminal; ten (10) points minimum
   e. Models:
      1) Allen-Bradley ControlLogix 1756-IB32

2. Analog Input Modules:
   a. Quantity: 16 channels per module
      1) All channels to be individually fused.
   b. Minimum resolution: 16 bits
   c. Each analog input shall be isolated from common.
   d. Spare: 20% spare points pre-wired in I/O rack; two (2) points minimum
   e. Models:
      1) Allen-Bradley ControlLogix 1756-IF16

2)

3. Remote Input/Output (RIO) Communications: The PLC shall communicate with remote chassis utilizing TCP/IP or scanner adapter modules as indicated on the Contract Drawings.

H. Pond Control Panel Input/Output Modules
1. Discrete Input Modules:
   a. Allen-Bradley Point I/O 1734-IB8
2. Analog Input Modules:
   a. Allen-Bradley Point I/O 1734-IE4C

I. Communications: Additional communications modules shall be provided as indicated on the Contract Drawings and as needed to meet the specified communications requirements.

1. Pond Control Panel Communication Modules:
   a. Allen-Bradley Point I/O 1734-AENTR – Ethernet bridge module

J. Rack Configuration

1. Racks to have 7 slots to fit in cabinets.
2. PLC with Remote I/O Configuration

PLC Slot	Cards
Slot 0	CPU
Slot 1-2	Communication Cards/Spare
Slot 3-5	Analog Cards
Slot 6-9	Discrete Cards

Remote Rack Slot	Cards
Slot 0	Remote I/O Ethernet Card
Slot 1-3	Analog Cards
Slot 4-9	Discrete Cards

2.03 REMOTE I/O

A. Remote I/O (RIO) shall be provided as indicated on the Contract Drawings.

2.04 PROGRAMMING SOFTWARE

A. No programming software is required to be supplied.

2.05 CABLING AND CONNECTORS

A. Cables and connectors shall be supplied by the PLC manufacturer and fabricated for the required interface connection. Cables shall be fabricated at the required length, un-spliced with factory installed terminations at both ends.

B. Termination, Data segment and Tee boxes shall be certified by the manufacturer and installed in accordance with the manufacturer's requirements.

C. Connectors and terminators shall be provided with the correct connection interface without the use of additional adapters or fittings. Terminators shall be installed by the factory at the appropriate cable ends.

D. All terminations shall be provided with screw type terminal connectors.

E. Common Bus Bar connectors shall be utilized for ground and common connections for system power and grounding. Common bus bar shall be screw terminal series with number of rows to match the I/O base configuration.

F. The PLC system Contractor shall furnish all communications connectors, adapters, terminating resistors as required to provide a complete communication cabling system. The Contractor shall coordinate installation and terminate the Ethernet communications cables.

2.06 SPARE PARTS

A. Contractor to provide one of each I/O card used.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall furnish all labor, communications wiring, cabling, terminations, equipment, modules, converters, and interface components to provide for a complete and operational Programmable Control System.

B. All unused module inputs and outputs shall be wired to field terminal blocks.

3.02 PROGRAMMING

A. Except where this section is applied to Vendor Control Panels, the Contractor is NOT to provide PLC or OIT programming services. PLC and OIT programming for all PLCs, as well as any modifications to existing PLCs, shall be provided by the Owner's SCADA Systems Integrator.

B. The Programmer shall follow the City of Dayton's programming standards, covered in the City of Dayton's PlantPAx Programming Guide document.

3.03 FACTORY TESTING

A. Factory testing shall be conducted with all Programmable Control System components mounted in their associated control panels and fabricated in accordance with other sections. The Programmable Control System will be constructed as a complete system for comprehensive factory testing.

B. The Contractor shall construct and wire all control panels and operator interface terminals as indicated in the Contract Drawings. This work shall be complete prior to factory testing.

C. System Integrator is responsible for point-by-point I/O systems testing and testing communication interfaces between PLCs.

D. The Contractor is responsible for correcting all construction, wiring, or cabling errors discovered during Factory Testing.

E. Reference Section 13490, System Testing and Quality Control, for additional requirements.

3.04 INSTALLATION AND COMMISSIONING

A. Installation shall be the responsibility of the Contractor. All commissioning, including system I/O and PLC communications verification and control loop testing, shall be the responsibility of the System Integrator.

B. Testing to be witnessed at the Owner's discretion.

3.05 TRAINING

A. Not applicable.

3.06 WARRANTY AND CUSTOMER SUPPORT

A. All PLC hardware, switches, shall be provided with a one (1) year replacement warranty from date of project acceptance or as defined in Division 0.

B. The Contractor shall provide one year of warranty service for the correction of operational errors resulting from hardware failures.

END OF SECTION

SECTION 13490

SYSTEM TESTING AND QUALITY CONTROL

PART 1 - GENERAL

1.01 REQUIREMENTS:

A. The Owner's designated SCADA Systems Integrator shall fully commission and test the entire SCADA, Instrumentation and Control System.

B. Factory, functional and operational testing shall be a collaborative effort between the Engineer, Integrator, and Operations staff to verify all system operations related to the Instrumentation, SCADA, and PLC control systems.

C. The Integrator shall coordinate and schedule system testing and implementation. The Integrator's assigned control systems project manager shall be the single point of contact for all start-up and commissioning efforts related to the instrumentation and control systems.

1.02 COORDINATION:

A. The Integrator shall coordinate all testing with the existing control systems, plant staff, and Contractor, to verify operation between all systems.

1.03 RELATED WORK IN OTHER SECTIONS:

A. Division 16 – Electrical

B. Section 13400 – Measurement and Controls Instrumentation

C. Section 13430 – Boxes, Panels and Control Centers

D. Section 13450 – Programmable Logic Controllers

E. Section 16760 – Fiber Optic Cable System

1.04 SUBMITTALS:

A. Comply with requirements of and submit in accordance with the City of Dayton Construction and Material Specifications, most recent edition.

B. The Integrator shall prepare testing and quality control submittals specific for the project, including testing procedures, checklists and sign-off sheets. The Integrator shall submit the following:

1. Instrument Calibration Forms

2. Loop Commissioning Forms

3. PLC Point Testing Forms

4. Testing Procedures

5. Test Reports

6. Checklists and Sign-Off Sheets

7. Equipment Set-up and Test Configuration

C. Factory Acceptance Test Procedure:

1. The Integrator shall submit comprehensive-testing procedures, forms, and reports. Testing submittals shall address all the factory testing requirements.
2. Factory test forms shall be submitted as follows:
   a. Point I/O Testing Forms

   b. Analog Loop Testing Forms

   c. Communications Testing Forms

D. Commissioning Test Plan

1. The Integrator shall develop and submit for Owner approval a Commissioning Test plan which describes detailed test procedures, checklists, blank forms, and data to be recorded, including test equipment to be used with calculated tolerance limits.
2. Testing plan shall be broken out per the various test sequences to address:

   a. Digital Point Testing

   b. Analog Loop Testing

   c. Instrument and Equipment Calibration Forms

   d. Functional Equipment Testing

   e. Communications System Testing

   f. Operational Readiness Testing

   g. Operational Testing

E. Commissioning Schedule
1. A system commissioning schedule shall be provided. The schedule shall indicate the testing of each system, subsystem and component including the control systems of the packaged system suppliers.

F. Reference Section 16760 for fiber optic cable testing requirements.

PART 2 – TEST EQUIPMENT

2.01 TESTING AND DIAGNOSTIC SOFTWARE:

A. All instruments and equipment shall be provided with any available testing and diagnostic software by the Contractor.

B. The testing and diagnostic software shall be delivered with the Operations and Maintenance materials.

2.02 COMMUNICATION TEST EQUIPMENT

A. Communications test equipment will be provided for all types of networks to be connected to the panels.

PART 3 - EXECUTION

3.01 FACTORY ACCEPTANCE TEST:

A. General

1. It shall be the responsibility of the Supplier to coordinate all facilities, necessary testing devices and personnel to perform the tests required to determine conformance to the requirements of the Contract Documents and control panel drawings.

2. The complete control system shall be factory tested prior to installation of the control panels, PLC, communications and SCADA system. The Factory Acceptance Tests (FAT) for the entire system, including any designated Packaged Control Systems, shall be conducted at the test facility as a complete and operable system including the SCADA, OITs and PLCs for all systems supplied and indicated on the Contract Drawings.

B. Factory Inspection

1. Instrumentation and control panels shall be inspected for compliance with specified requirements at the factory prior to comprehensive system factory testing and before shipment to the FAT test facility. The Supplier shall notify the Engineer two weeks in advance of the testing date. The Engineer will visit the factory to make the inspection.
2. Inspection and testing shall include:
   a. All alarm and interlock circuits rung out to determine their operability.
   b. Electrical circuits checked for continuity and where applicable, operability.
   c. Basic panel operation.
   d. Nameplates checked for correct spelling and correct size of letters.
   e. Other tests deemed necessary by the Engineer that are required to place the panel in an operating condition.

C. Factory Acceptance Testing:

1. The Supplier shall set-up, configure and interconnect all PLC panels and computer equipment in an environmentally controlled area with sufficient space and access for PLC and SCADA system testing. The system shall remain set-up until the factory testing is completed.

2. The Integrator shall coordinate all panel configuration and interconnection requirements.

3. The Supplier shall furnish and install all temporary interconnection cables and terminations for loop testing, PLC and SCADA communications and analog signal tests, unless otherwise noted in the specifications.

4. Tests shall be conducted to exercise all process variables and confirm setpoint trip points, process permissives, process interlocks, alarming and control functions. The Integrator shall provide the necessary personnel to operate, simulate, test and confirm all SCADA and PLC associated functions pertaining to graphical displays, setpoint interaction, PLC control strategies, alarm monitoring and manual control of the equipment with Operations staff.

5. The Integrator shall prepare a FAT test procedure in the form of I/O checklists, calibration sheets for analog I/O tests that exercise all normal, emergency and alternative control modes. I/O checklist shall reference each I/O by type, tag and description with a checkbox to verify PLC operation, Communication, SCADA Display, Alarm Function and Command function with a comment field for testing notes.

6. The Integrator shall set up and configure a programming workstation to display all PLC input and output values being tested and verified.

3.02 SYSTEM PRE-COMMISSIONING:

A. General

1. Pre-commissioning testing shall be conducted prior to any system commissioning efforts, to verify general equipment installation, instrument calibration, and equipment configurations are per the specified requirements.

2. The Instrument Supplier(s) shall provide all necessary labor, tools, and equipment to field test, inspect and adjust each instrument to its indicated performance requirement in accordance with manufacturer's specifications and instructions. Any instrument which fails to meet any Contract requirement, or any published manufacturer performance specification for functional and operational parameters, whether or not indicated in the Contract Documents, shall be recalibrated, repaired or replaced, at the discretion of the Engineer at no additional cost.

3. Prior to System Commissioning all cable testing shall be complete as follows:
   a. Continuity Tests

   b. Megger Testing

c. Communications Cable Testing

d. Field Conductors terminated and labeled

B. Equipment Installation Verification

1. The Engineer shall confirm all equipment is installed and terminated in conformance with the Contract Drawings, approved interconnection drawings and manufacturer's recommended procedures.

2. The Engineer shall verify:

a. Operational Voltages

b. Fuse Sizes

c. Equipment Terminations

d. Ventilation

e. Field Conductors terminated and labeled

C. Basic Operation Testing

1. All equipment shall undergo a basic individual equipment operational test to confirm the following:

a. Equipment Rotation

b. Operator switches are functional

c. Indicators are operating correctly

d. Equipment displays do not indicate failure

D. Communications Cabling Test

1. The Integrator, in coordination with the Contractor, shall test all plant communications links utilizing communications test equipment and diagnostic software to verify that a viable communications link is established.

E. Instrument Calibration:

1. All analog and discrete instrumentation and all control system equipment shall be field calibrated and tested after installation to verify that requirements are satisfied.

2. The Instrument Supplier(s) shall provide all necessary labor, tools, and equipment to calibrate and test each instrument in accordance with the manufacturer's instructions. Each instrument shall be calibrated at a minimum of five (5) points, using test equipment to simulate inputs and read outputs.

3. All test equipment and all instruments used to simulate inputs and read outputs shall be suitable for the purpose intended and shall have accuracy better than the required accuracy of the instrument being calibrated. Test equipment shall have accuracies traceable to the NIST as applicable. All analog instruments shall be calibrated and tested in place without removal.

4. Test data, applicable accuracy requirements, all instrument manufacturer published performance specifications and all permissible tolerances at each point of calibration shall be entered on submitted test forms. These test forms shall verify compliance with all.

5. Field calibration, along with the factory calibration, reports shall be delivered to the Engineer for each instrument, certifying that the instrument has been calibrated in the presence of the Engineer’s designated representative and meets contract and system requirements.

F. Point Testing

1. Instrument and packaged system Suppliers shall provide qualified field representatives onsite during point testing of their respective instruments and equipment.

2. Digital Signal Test: The Integrator shall be responsible for point checking and testing all digital instrument, device and equipment status signals. The Integrator shall coordinate all point check functions with the PLC and SCADA system, final element, PLC logic and intermediate equipment to ensure that a single total point check is conducted. The intent of the point checks is to confirm and document each signal's component specification conformance up to and including all field-situated devices.

3. Analog Signal Tests: The Integrator shall be responsible for point checking and testing all analog signals. The Engineer shall coordinate all point check functions with the PLC and SCADA system, final element, PLC logic and intermediate equipment to ensure that a single total point check is conducted. The intent of the point checks is to confirm and document each signal’s component specification conformance up to and including all field-situated devices.

4. Programmable Controllers, Operator Interface Units, and Electronic Function Modules shall be tested and exercised by the Engineer with Operations staff to demonstrate the correct operation; first individually and then collectively as functional analog networks.

G. Functional Loop Testing

1. Each hardwired analog control network shall be tested to verify proper performance within indicated accuracy tolerances. Accuracy tolerances for each analog network are defined as the root-mean-square summation of individual component accuracy tolerances. Individual component accuracy tolerances shall be as indicated by contract requirements, or by published manufacturer accuracy specifications, whenever contract accuracy tolerances are not indicated.

2. Each analog network shall be tested by applying simulated inputs to the first element(s). Simulated sensor inputs corresponding to 10 percent, 30 percent, 50 percent, 80 percent and 90 percent of span shall be applied, and the resulting outputs read to verify compliance to network accuracy tolerance requirements. Continuously variable analog inputs shall be applied to verify the proper operation of discrete devices. Temporary settings shall be made on controllers, alarms, etc. during analog loop tests. All analog loop test data shall be recorded on test forms, which include calculated root-mean-square summation system accuracy tolerance requirements for each output.

3. When installation and loop tests have been successfully completed for all individual instruments and all separate analog control networks, a certified copy of all test forms signed by the Engineer, with test data entered, shall be submitted together with a clear and unequivocal statement that all instrumentation has been successfully calibrated, fully inspected, and fully tested.

4. Functional loops will be tested end to end with the SCADA/PLC system utilizing a diagnostic test screen to verify range, scale and I/O channel from the instrument to the PLC. The Integrator shall coordinate PLC testing of the analog loops.

3.03 SYSTEM COMMISSIONING:

A. General

1. System commissioning shall be a joint effort between the Integrator, Contractor, and Operations staff to facilitate the plant start-up.

2. The Integrator, Contractor, and Supplier shall provide qualified start-up and testing representatives on-site, performing, assisting and participating in the testing full-time, for the duration of System Commissioning.

3. Provide additional staff as needed to operate equipment, provide safety, verify field signals, verify equipment operation, etc.

B. Functional Testing

1. All equipment shall be functionally tested to be ready for full operation as a part of the operational readiness test and prior to process testing.

2. General equipment items shall be functionally tested to be operational by the Engineer and Contractor.

C. Operational Readiness Testing (ORP)

1. The Integrator shall be responsible for demonstrating the operability of all electrical controlled and monitored equipment provided under this and other related specifications. The ORT shall commence after acceptance of all wire, all calibrating and loop tests, and all inspections have been conducted. The ORT shall demonstrate proper operation of all subsystems with process equipment operating over full operating ranges under actual operating conditions, if possible.

2. Operational readiness testing activities shall include the use of water to establish service conditions that simulate, to the greatest extent possible, normal final control element operating conditions in terms of applied process loads, operating ranges and environmental conditions. Final control elements, control panels, and ancillary equipment shall be tested under start-up and steady-state operating conditions to verify that proper and stable control is achieved using motor control center and local field mounted control circuits. All hardwired and software control circuit interlocks and alarms shall be operational.

3. The control of final control elements and ancillary equipment shall be tested using both manual and automatic (where provided) control circuits. The stable steady-state operation of final control elements running under the control of field mounted automatic analog controllers or software-based controllers shall be assured by adjusting the controllers, as required, to eliminate oscillatory final control element operation. The transient stability of final control elements operating under the control of field mounted, and software based automatic analog controllers shall be verified by applying control signal disturbances, monitoring the amplitude and decay rate of control parameter oscillations (if any) and making necessary controller adjustments, as required, to eliminate excessive oscillatory amplitudes and decay rates.

4. All electronic control stations incorporating proportional, integral or differential control circuits shall be optimally tuned, experimentally, by applying control signal disturbances and adjusting the gain, reset or rate setting(s) as required to achieve a proper response. Tuning shall be based on the 1/4 amplitude response method.

5. Equipment functional testing:

6. All individual equipment items shall be functionally tested in hand, local auto and remote auto to verify proper equipment configuration and operating status.

7. Functional tests shall include verification of hardwired interlocks with other equipment.

8. Measured final control element variable position/speed setpoint settings shall be compared to measured final control element position/speed values at 10 percent, 50 percent and 90 percent of span and the results checked against indicated accuracy tolerances. Accuracy tolerances are defined as the root-mean-square summation of individual component accuracy tolerances.

9. Individual component accuracy tolerances shall be as indicated in the Contract Documents or as specified by published manufacturer accuracy specifications whenever not indicated.

10. The Integrator shall submit an instrumentation and control ORT completion report which shall state that all Contract requirements have been met and shall include a listing of all instrumentation and all control system maintenance and repair activities conducted during the pre-commissioning testing. The instrumentation and control system pre-commissioning test report must be accepted before the Final Acceptance Test may begin.

D. Process Control Testing (PCT)

1. Process Control Testing shall proceed after all equipment has been functionally tested and commissioned per the operational readiness testing requirements, including those systems provided by the Packaged System Suppliers to be operational.

2. Process Testing: The Integrator, Contractor, and Supplier shall furnish personnel and any packaged system and instrument manufacturers' representatives as required during the testing period to produce and maintain a fully operational system.

3. Process testing shall be conducted by the Integrator, Contractor, and Supplier in conjunction with Operations staff to operate the system under various load and operational conditions. The operational testing shall include all normal modes of operation, alternate models of operations, demonstrate all back-up control systems, demonstrate all emergency power systems and operate the system under various control scenarios. The Integrator, Contractor, and Supplier shall provide field personnel to exercise all modes of operation and demonstrate the system to Operations staff.

4. The Supplier shall submit instrumentation and control ORT completion report which shall state that all Contract requirements have been met and shall include a listing of all instrumentation and all control system maintenance and repair activities conducted during the pre-commissioning testing. The instrumentation and control system pre-commissioning test report must be accepted before the 15-day Final Acceptance Test may begin.

3.04 FINAL ACCEPTANCE TESTING:

A. Upon completion of Operational Readiness Testing, the entire system shall undergo a Final Acceptance Test. The acceptance test shall be performed by the Operations staff to exercise all systems.

B. The Final Acceptance Test shall not commence until all Operations and Maintenance Manuals, As-Built Drawings and Field Interconnection Drawings have been submitted and approved, the Operations staff has been fully trained, and all spare parts provided.

END OF SECTION

DIVISION 15

MECHANICAL

SECTION 15090

VALVE ACTUATORS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Manual and powered actuators for proper operation of all valves required for equipment, valves or systems.

1.02 SCOPE OF WORK:

A. Provide 480V, 3-phase throttling actuators for each pond's gate valve located in the valve vault per the Contract Drawings.

1.03 RELATED WORK IN OTHER SECTIONS:

A. Division 16 – Electrical

B. Section 13400 – Measurement and Controls Instrumentation

1.04 REFERENCES:

A. AWWA C500 – Metal Seated Gate Valves for Water Supply Service

B. AWWA C540 – Power-Actuating Devices for Valves and Sluice Gate

C. NEMA ICS-2—Industrial Control and Systems Controllers, Contactors, and Overload Relays Not More Than 2000 Volts AC or 750 Volts DC

1.05 SYSTEM RESPONSIBILITY:

A. Motor powered actuators:

1. Contractor shall insure that only one manufacturer is provided for all valves on this project regardless of valve manufacturer or type of valve.

2. Coordinate design criteria and operating requirements of the driven valve or equipment to the powered actuator manufacturer for proper sizing and power requirements.

3. Coordinate delivery of actuators to valve or equipment manufacturers for mounting.

1.06 SUBMITTALS:

A. Comply with requirements and submit under provisions of Division 01.

B. Certificate of System Responsibility Assignment attesting that the Contractor has assigned unit responsibility in accordance with the requirements of Section 01610. No other submittal material will be reviewed until the certificate has been received and found to be in conformance with these Contract Documents.

C. Provide a copy of any pertinent Drawings, this specification section and all related Sections of paragraph 15090-1.2 with all addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate the requested deviations from the specification requirements.

D. Shop Drawings: Submit complete fabrication, assembly foundation, and installation drawing for all pumps, motors and accessories to illustrate construction, assembly of components and required clearances from piping, equipment, walls or other items.

E. Product Data—Provide complete data on valve accessories sufficient to verify compliance with the specifications:

1. Provide manufacturer's catalog information with size, dimensions, number of turns to open, speed of opening, materials, assembled weights and warranty.

2. Provide wiring and control diagrams for valves with electric actuators.

F. Manufacturer's Installation Instructions:

1. Provide connection requirements and start-up instructions for pumps.

G. Field Test Procedure: Contractor test procedure to be submitted prior to conducting the performance test. Include forms for data collection, description of all sample collections, and analyses required.

H. Manufacturer's Field Start-up Report:

1. Indicate personnel present and actual tests and start-up procedures that were performed by manufacturer's representative.

I. Manufacturer's Certificate: Provide certificate stating equipment and subsystems are installed in accordance with the manufacturer's instructions and inspected by a manufacturer's authorized representative, serviced with the proper initial lubricants, applicable safety equipment is properly installed, proper electrical and mechanical connections are properly made, and installation meets the manufacturer's requirements for a valid warranty.

1.07 WARRANTY:

A. Provide manufacturer’s warranty for a period of one year beginning from the date of Substantial Completion in accordance with the requirements of Division 01.

1.08 OPERATION AND MAINTENANCE DATA:

A. Submit under provisions of Division 01.

B. Operation Data: Include manufacturer's instructions, description of system operation, startup data, trouble-shooting check lists, and repair data.

C. Maintenance Data: Include installation and maintenance instructions, recommended spare parts lists and exploded assembly views of actuators and accessories.

1.09 DELIVERY, STORAGE, AND HANDLING:

A. Deliver, store, protect, and handle products to site as specified in Section 01610 and in accordance with manufacturer’s instructions.

B. Prepare valves accessories for shipment according to AWWA C540, Section 7.2.

1.10 MAINTENANCE MATERIALS:

A. Provide spare parts and special tools under provisions of Division 01.

B. Store spare parts and special tools in accordance with Division 01.

C. Provide the minimum spare parts as follows:

1. Provide a 1-year supply of all greases and lubricants for each pump in accordance with Division 01.

2. Provide touch-up primer and finish paint.

PART 2 – PRODUCTS

2.01 MANUAL ACTUATORS:

A. General:

1. Provide a manual actuator except where valves are to have motor or cylinder actuator.

2. Buried valves or valves operated through floor boxes and as indicated on Drawings: Wrench nuts.

3. Adequate to seat, unseat, and maintain valve position under all operating conditions.

4. Provide with position indicator on each actuator or each operating nut.

B. Rotation:

1. Counterclockwise (to the left) to open.

2. The word "OPEN" and an arrow indicating the direction to open cast on each valve body or actuator.

C. Lever actuator:

1. Size: Valves 6 inches or less.

2. Operation: ¼ turn to fully open and close valve.

3. Lever length: 12 inches.

4. Max pull required: 80 lb.

5. Withstand 200 lb pull without damage.

D. Handwheel actuator:

1. Size: Valves greater than 6 inches.

2. Totally enclosed worm gear actuator.

3. Handwheel diam: 6-24 inches.

4. Max pull required: 80 lb.

5. Withstand 200 lb pull without damage.

E. Chain wheel actuator:

1. Size: Valves 3 inches or greater.

2. Location: Valves with centerline greater than 6 feet above finished floor.

3. Totally enclosed worm gear actuator, permanently lubricated and with sealed bearings.

4. Equipped with chain guide to permit rapid chain handling of the chain without "gagging" the wheel and to permit reasonable side pull on the chain.

5. With extensions as required to prevent interference with adjacent piping or equipment.

6. Chain:

a. Hot-dip galvanized carbon steel except where specified otherwise.

b. Looped to extend within 3 feet to 4 feet of the floor or finish grade below valve.
c. Smooth, welded, closed link type.
d. Overlapping, open link type is not acceptable.

7. Max pull required: 80 lb.
8. Withstand 200 lb pull without damage.
9. For valves placed in a horizontal run, provide 90 degree or 270 degree gearing for actuator.

F. Wrench nuts:

1. AWWA C500, Section 19.

2. Withstand 300 feet per lb torque without damage.

3. Readily locked in the open, closed, and not less than five intermediate positions.

G. Extension stems:

1. Provide where indicated on Drawings, or as specified, or as required for proper operation and for buried valves.

2. Non-rising stems:

a. Solid steel shafting with O.D. not less than O.D. of valve stem or galvanized steel pipe with I.D. not less than O.D. of valve stem.
b. Connected to the valve by a flexible socket coupling.
c. All other connections pinned, keyed, or socket.

3. Rising stems:
a. Stainless steel or carbon steel shafting with OD not less than OD of valve stem.
b. Bronze or stainless steel sleeves securely attached to stem.
c. Sleeve length and location to extend through each stem guide throughout the full vertical travel of the stem.

4. Stem guides:
a. Cast iron, bronze bushed, adjustable in 2 directions.
b. If extension stem length exceeds 120 inches or the weight exceeds 20 lb, provide a suitable thrust bearing to carry extension stem weight.
c. Maximum spacing:
i. Non-rising stems: 100 times stem O.D.
ii. 10 feet max.

5. Buried valves:
a. Stem extends to within 6 inch of grade.
b. Provide spacers to center stem in valve box.
c. Provide wrench nut.
6. Operating stands

a. Provide where indicated on Drawings or as specified.
b. Cast iron or fabricated steel.
c. Thrust bearing: Suitable to carry weight of extension stem.
d. Handwheel or lever as indicated on Drawings or as specified:
   i. Approximately 36 inches above floor.
   ii. Handwheel minimum diameter: 8 inches.
e. Sleeve: Provide standard weight galvanized steel pipe for opening in floor beneath each operating stand.

H. Valve boxes:

1. Provide for all buried valves.
2. Cast iron extension sleeve type with boxes and covers.
3. Depth as required for valve.
4. Minimum diameter: 5 inch.
5. Minimum thickness: 3/16 inch.
6. Box, cover, and base coated by dipping in asphalt varnish.
7. An appropriate word designating the valve service cast on cover.

2.02 MOTOR ACTUATORS – THROTTLING AND OPEN/CLOSE SERVICE (VALVES 4 INCHES AND GREATER)

A. Provide motor actuators where indicated on Drawings, for automated system operation or as specified for individual systems.

B. Each motor actuator to consist of motor, gearing, handwheel, limit, and torque switches, lubricants, heating elements, wiring, terminals, and integral reversing controller constructed as a self-contained unit.

C. Housing: NEMA 4 die cast aluminum with baked-on powder coated epoxy.

D. Operating time from fully open to fully closed or the reverse for throttling valves: Adjustable from 15 seconds to two minutes.

E. Motors:

1. Mounted horizontally adjacent to or vertically above gearing.
2. Do not mount with motor vertical below gearing.
3. Totally enclosed, high torque, designed expressly for valve operator service.
4. Capable of operating valve under full differential pressure for two complete open-close cycles without overheating.
5. Designed in accordance with NEMA Standards.
6. Insulation: Class F or better.
7. Bearings: Permanently lubricated.
8. Voltage tolerance: ± 10 percent.
9. Voltage rating: 120 V, 60 Hz, 1 phase or 480 V, 60 Hz, 3 phase as required.
10. Produce 1.5 times required torque.
11. Allow for 60 starts per hour minimum.

F. Gearing:

1. All grease lubricated.
2. Service factor: 2.0.
3. Effectively sealed against entrance of foreign matter.
4. AGMA nameplate not required.
5. Designed to permit field ratio changes.
6. Designed so motor comes up to speed before stem load is encountered in opening and closing direction.
7. Conform to AWWA C540.

G. Handwheel mechanism:

1. Designed so handwheel doesn't operate during motor operation.
2. Designed so motor doesn't rotate when handwheel is rotated.
3. Provide declutching extensions to allow declutching of all electric actuators from floor level.
4. Actuator responsive to electrical power and control at all times, instantly disengaging handwheel.
5. Rotation: Counterclockwise to open.
6. An arrow indicating the open direction and the word "OPEN" cast on the handwheel.
7. Max force required: 80 lb.

H. Torque switches:

1. Provide opening and closing torque and thrust limit switches.
2. Micrometer adjustment on each switch:
   a. Reference setting indicator.
   b. Variability 40 percent.
3. Contact rating: 6 amp inductive at 120 V AC and 2.2 amp at 115 V DC.

I. Geared limit switches:

1. Space for 4 geared limit switch assemblies.
2. Each assembly with 4 separate limit switches.
3. Each assembly geared to driving mechanism and independently adjustable to transfer at any point between fully open and fully closed valve position.
4. Contact rating: 6 amp inductive at 120 V AC and 2.2 amp at 115 V DC.
5. Set limit switches as indicated on Drawings.
6. Provide 2 limit switch assemblies.

J. Heating elements:

1. Provide in motor and geared limit switch compartment.
2. Rated 120 V AC.
3. Continuously energized.

K. Terminal facilities: Provide for connection to motor leads, switches, slide-wire type position transmitter, if required, and heating elements in geared limit switch compartment.

L. Controller:

1. Integrally mounted reversing motor starter in geared limit switch compartment.
2. Motor overload protective device in each phase:
3. In 480 V units, a control power transformer with fused and grounded 120 V secondary, with volt ampere capacity suitable for starter control plus continuous service to heater elements in motor housing and limit switch compartment.
4. A nameplate of permanent type construction on the controller enclosure identifying the equipment controlled as with letters and numerals not less than 3/4 inch high.
5. Mechanically and electrically interlocked.
6. Provided with the necessary direct operated auxiliary contacts for required interlocking and control.
7. Pilot devices:
   a. In a weatherproof enclosure close coupled to actuator housing if actuator is easily accessible; if actuator is not easily accessible, locate pilot devices on nearby wall or mounting station.
   b. Local Open-Stop-Close momentary push buttons.
   c. Local-Off-Remote maintained selector switch.
   d. Local Red "Open" and Green "Closed" indicating lights.
8. NEMA Size 1 minimum.
9. For throttling valves, provide manual-automatic switch and solid state modulator to receive 4-20 mA control signal and actuate valve to signaled position.

M. Ethernet option card:
1. Provide integral Ethernet option card for network control and monitoring.
   a. Fully enclosed within actuator.
   b. Supports Ethernet/IP, Modbus TCP/IP, PROFINET.
   c. Dual RJ45 connections.
   d. 10/100 Mbps.
   e. Temperature range: -40 to 158 degrees F.
   f. Ethernet compliance: PI and ODVA certified.

N. Manufacturers:
1. Rotork: IQ3.
2. AUMA
3. Engineered approved equal.

2.03 MOTOR ACTUATORS – OPEN/CLOSE SERVICE (VALVES LESS THAN 4 INCHES)

A. Provide motor actuators where indicated on Drawings, for automated system operation or as specified for individual systems.

B. Each motor actuator to consist of motor, gearing, handwheel, limit, and torque switches, lubricants, heating elements, wiring, terminals, and integral reversing controller constructed as a self-contained unit.

C. Housing: NEMA 4 die cast aluminum with baked-on powder coated epoxy.

D. Motors:
1. Thermal overload sensor.
2. 50 percent duty cycle.
3. Voltage rating: 120 V, 60 Hz, 1 phase.
4. Produce 1.5 times required torque.

E. Gearing: Hardened steel gear train.

F. Lubrication: Gear train and drive components immersed in multipurpose grease suitable for service of 32 degrees to 150 degrees Fahrenheit.

G. Limit switches:
1. Two end of travel limit switches.
2. Activated by independently adjustable stainless steel cams.
3. Contact rating: 10 amp inductive at 120 V AC.

H. Limit switches:
1. Provide in motor and geared limit switch compartment.
2. Rated 120 V AC.
3. Continuously energized.

I. Controller:
1. Integrally mounted reversing motor starter.
2. Motor overload protective device.

J. Ethernet option card:
1. Provide integral Ethernet option card for network control and monitoring.
    a. Fully enclosed within actuator.
    b. Supports Ethernet/IP, Modbus TCP/IP, PROFINET.
    c. Dual RJ45 connections.
    d. 10/100 Mbps.
    e. Temperature range: -40 to 158 degrees F.
    f. Ethernet compliance: PI and ODVA certified.

K. Manufacturers:
1. Rotork: IQ3.
2. AUMA
3. Engineer approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION – GENERAL:

A. Install actuators in accordance with the manufacturer's instructions.

B. Install actuators such that position indicators are visible by standing on operations floor or from permanent platform.

C. Valve control stations:

1. Provide for all powered actuators.

2. Install where accessible by standing on operations floor or from permanent elevated platform.

3. If valve is not within reach or easily accessible by standing on operations floor or from permanent elevated platform, install remote valve control station at location acceptable to Engineer.

D. Provide minimum distances required from walls and other piping to center of valve to accommodate actuator dimensions and to facilitate maintenance of actuator. Immediately notify Engineer of all conflicts or discrepancies.

3.02 ADJUSTMENTS

A. Check and adjust valves and accessories for smooth operation in accordance with manufacturer's instructions.

B. Powered Actuator:

1. Adjust limit and torque switches as indicated on Drawings.

2. Adjust opening/closure speed as indicated in the schedule of this specification.

3.03 MANUFACTURER SERVICES:

A. Provide under provisions of Division 01.

B. The actuator manufacturer shall provide the services of a factory-qualified field engineer to initially check installation of the powered actuators before energizing the equipment, make electrical control panel modifications as necessary, and to place the unit in service in accordance with this section. The factory field engineer shall also be responsible for instructing operation personnel as to proper process and maintenance procedures.

C. Supervise equipment start-up during the start-up, field testing and pre-demonstration period of Section 01910.

D. Complete Manufacturer's Field Report.

E. Complete Manufacturer's Installation Certificate of Section 01910.

F. Complete Manufacturer’s Instruction Certificate of Section 01910.

G. Coordinate inspection of all valves by manufacturer's representative and instruct plant personnel on their operation and maintenance.

H. Provide manufacturer's field service representative for a minimum of one (1) day to inspect installation and observe startup.

I. Provide additional two (2) hours of Owner's personnel training after startup.

END OF SECTION

DIVISION 16

ELECTRICAL

SECTION 16050

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: General administrative, procedural requirements, and installation methods for electrical installations specified in Division 16.

B. The Drawings are schematic and are not intended to show every detail of construction.
   1. In general, conduits/raceways, transitions and offsets shown on Drawings indicate approximate locations in plan and elevation where the systems are intended to be run.
   2. CONTRACTOR shall fully coordinate electrical Work with other trades to avoid interferences.
   3. In the event of interferences, CONTRACTOR shall request clarification from ENGINEER in writing.

B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Sections, apply to Work of this Section.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with requirements of the City of Dayton Construction and Material Specifications, most recent edition, covering the items included under this Section of Work. Shop Drawing submittals shall include:
   1. Submit product data covering the items included under this Section of Work.

B. Conforming to Construction Drawings: Submit a complete set of Drawings showing the locations of the piping, ductwork, etc., as actually installed. Such Drawings shall be submitted to ENGINEER in electronic format (PDF), one full size print, and one 11x17 print.

C. Operation and Maintenance Manuals: Submit in accordance with requirements of the City of Dayton Construction and Material Specifications, most recent edition, operation and maintenance manuals for items included under this Section. Include following information for equipment items:
   1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
   2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
   3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
   4. Servicing instructions and lubrication charts and schedules.

1.03 RECORD DOCUMENTS

A. Prepare Record Documents in accordance with requirements of the City of Dayton Construction and Material Specifications, most recent edition. In addition, CONTRACTOR shall submit, prior to final payment, Drawings conforming to construction records of systems it has installed. Vendor drawings shall be sized as manufacturers' standard.

B. Provide typewritten data sheets on motor control circuits with following information on each branch feeder: Load name, horsepower or KVA (transformer), fuse size, starter size, service factor of motor, motor nameplate currents, power factor correction capacitor size (if used), and thermal overload part number.

1.04 QUALITY ASSURANCE

A. National Electrical Code: Comply with NFPA 70, National Electrical Code.

B. UL Compliance and Labeling: Use products and components labeled by UL.

1.05 PERMITS, INSPECTIONS, AND LICENSES

A. CONTRACTOR shall procure all necessary permits and licenses, observe and abide by all applicable laws, codes, regulations, ordinances, and rules of the State, territory, or political subdivision thereof, wherein Work is done, or any other duly constituted public authority, and further agrees to hold OWNER harmless from liability or penalty which might be imposed by reason of an asserted violation of such laws, codes, regulations, ordinances, or other rules.
   1. Upon completion of Work, CONTRACTOR shall secure certificates of inspection from the inspector having jurisdiction and shall submit 3 copies of the certificates to OWNER. CONTRACTOR shall pay the fees for the permits, inspections, licenses, and certifications when such fees are required.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification. Equipment shall be packaged to prevent damage during shipment, storage, and handling. Do not install damaged units; replace, and remove damaged units from Site.

PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION

3.01 GENERAL ELECTRICAL INSTALLATION

A. Provide electrical materials and equipment enclosures appropriate for areas in which they are installed. Each area will be designated on Drawings with a type of construction such as NEMA 4, 4X, 7 or 9 if it is other than NEMA 12. An area designated by a name and elevation includes space bounded by floor, ceiling, and enclosing walls.
   1. Exception: Provide manufacturer's standard construction for indoor or outdoor application where equipment is not manufactured to NEMA specifications (e.g., switchgear, transformers, high voltage capacitors, bus duct, and light fixtures; materials and equipment used in finished areas such as offices, laboratories, etc.).

B. Provide nonmetallic electrical materials and equipment enclosures in NEMA 4X areas; watertight NEMA 4 and equipment enclosures for outdoor applications and indoor applications below grade; explosion-proof NEC Class I, Division 1, Group D equipment for NEMA 7 areas; explosion-proof NEC Class II, Division 2, Group F equipment for NEMA 9 areas.

C. Supporting devices and sleeves shall be set in poured-in-place concrete and other structural components as they are constructed.

D. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide maximum headroom possible.

E. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

F. Install systems, materials, and equipment to conform with approved submittal data, including coordination Drawings, to greatest extent possible. Conform to arrangements indicated by Drawings recognizing that portions of Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to ENGINEER.

G. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components where installed exposed in finished spaces.

H. As much as practical, connect equipment for ease of disconnecting with minimum of interference with other installations.

I. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.02 RACEWAY INSTALLATION

A. Outdoors, use the following materials:
   1. Exposed Conduit: PVC externally coated rigid metal conduit and fittings.
   2. Underground Direct Buried Conduit: Intermediate or Rigid metal conduit.
   3. Conduit Used to Connect to Vibrating Equipment including transformers and hydraulic, pneumatic or electric solenoid or motor-driven equipment: Liquidtight flexible metal conduit.

B. Indoors, use the following wiring materials:
   1. Connection to Vibrating Equipment, including transformers and hydraulic, pneumatic or electric solenoid or motor-operated equipment: Liquidtight flexible metal conduit.
   2. Exposed Conduit: Rigid metal conduit or intermediate metal conduit.

C. Minimum size conduit shall be 3/4 inch unless shown otherwise.

D. Instrument Signal Conduit Requirements: Shielded signal wires for 4-20 mA type instruments or thermocouple wires assigned to the same control panel may be run in the same conduit. Shielded instrument signal wires, thermocouple wires, and shielded 2-wire intercom wires

may be run in the same conduit. No other wires will be permitted in an instrument signal/2-wire intercom conduit. Conduit shall be IMC, RMC or PVC-coated RMC.

E. Conduit Thread Paint: Make threaded conduit joints watertight by coating threaded portions with a spray-on or brush-on zinc-bearing paint. Provide paint containing 90 percent minimum by weight of metallic zinc powder in the dried film. Clean field-cut threads of oil using the recommended solvent prior to coating threads.

F. Install expansion/deflection fittings where conduit passes a building expansion joint or where conduits are attached to two structures joined by a concrete expansion joint.

G. Exposed or Concealed Construction: Install conduit exposed inside buildings except for areas with finished walls (e.g., offices, laboratories, lavatories, locker rooms, etc.) unless otherwise indicated.

H. Exposed Raceways: Install parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical. Make bends and offsets so the inside diameter is not effectively reduced. Keep the legs of a bend in the same plane and the straight legs of offsets parallel. Conduits shall slope away from loads to keep moisture from entering the load. Run parallel or banked raceways together. Make bends in parallel or banked runs from the same centerline so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed parallel. This requires that there be a change in the plane of the run, such as from wall to ceiling and that the raceways be of the same size. In other cases, provide field bends for parallel raceways. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.

I. Space raceways, fittings, and boxes 0.25 inch from mounting surface in NEMA 4 and NEMA 7 areas. Spacers shall be one-piece construction of stainless steel, galvanized steel, PVC, ABS, or other noncorrosive material.

J. Flexible Connections: Use short length (maximum 6 feet for lighting fixtures; maximum 3 feet for all other equipment) of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement, and all motors. Use liquidtight flexible conduit in all locations except rated flexible connections for hazardous locations. Install separate ground conductor across flexible connections.

K. Join raceways with fittings designed and approved for the purpose and make joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors.

L. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate metal conduit, use threaded rigid metal conduit fittings. For PVC externally coated rigid metal conduit, use only factory-coated fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduit.

M. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL listed sealing compound. For concealed raceways, install each fitting in a flush metal box with a blank cover

plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
1. Where required by the NEC.

N. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring. Provide knockout closures to cap unused knockout holes where blanks have been removed.

O. Fasten electrical boxes firmly and rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete masonry.

P. Support exposed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.

Q. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box and tighten the chase nipples so no threads are exposed.

R. Complete installation of electrical raceways before starting installation of conductors within raceways and prevent foreign matter from entering raceways by using temporary closure protection. Cap spare conduit. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

S. Install pull wires in empty raceways: Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-pound tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.

3.03 WIRE AND CABLE INSTALLATION

A. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant where necessary.

B. Keep branch circuit conductor splices to minimum. Splice feeders only where indicated. Use a standard kit. No splices are allowed for instrument and telephone cables except at indicated splice points.

C. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced. Use splice and tap connectors which are compatible with conductor material and are UL listed as pressure type connectors.

D. Provide adequate length of conductors within electrical enclosures and train conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than No. 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at terminal.

E. Terminate power conductors at equipment using pressure-type terminals specifically designed for type of terminations to be made. Terminate no more than 2 conductors No. 8 AWG and smaller within the same pressure-type terminal. These 2 conductors shall be no more than 4 wire gauge sizes apart. Terminate no more than 1 conductor larger than No. 8 AWG within any pressure-type terminal.

F. Seal wire and cable ends until ready to splice or terminate.

3.04 EQUIPMENT CHECKOUT AND TESTING

A. In addition to testing recommended by equipment or material supplier and called for in equipment or material specification, perform the following.

B. Check-out Procedures. In general, check-out procedures (as listed below) which are applicable for a particular item of equipment shall be performed:
1. Vacuum interior of cubicles and remove foreign material.
2. Wipe clean with a lint-free cloth insulators, bushings, bus supports, etc.
3. Check and adjust time delay, under-voltage devices, phase relay, over-current relays, etc., as required by coordination study or ENGINEER.
4. Fill motor bearings requiring oil.
5. Check and change, as required, thermal overload heater elements to correspond with motor full-load current and service factors of installed motor.
6. Check direction of rotation of motors and reverse connections if necessary. Check rotation with motor mechanically uncoupled where reverse rotation could damage equipment.
7. Equipment with two or more sources of power connected by tie breakers, transfer switches, or generator receptacles shall be checked for rotation from each possible combination of power sources. Power sources must have the same phase sequence for each source throughout entire facility.
8. Check exposed bolted power connections for tightness.
9. Check operation of breakers, contactors, etc., and control and safety interlocks.
10. Check tightness of bolted structural connections.
11. Check leveling and alignment of enclosures.
12. Check operating parts and linkages for lubrication, freedom from binding, vibration, etc.
13. Check tightness and correctness of control connections at terminal blocks, relays, meters, switches, etc.
14. Clean auxiliary contacts and exposed relay contacts after vacuuming.

END OF SECTION

SECTION 16060

GROUNDING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Electrical grounding and bonding Work as follows:
   1. Solidly grounded.

B. Applications of electrical grounding and bonding Work in this Section:
   1. Underground metal water piping.
   2. Underground metal structures.
   3. Metal building frames.
   4. Electrical power systems.
   5. Grounding electrodes.
   6. Raceways.
   7. Enclosures.
   8. Equipment.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with the City of Dayton Construction and Material Specifications, most recent edition, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Product Data: Submit manufacturer's data on grounding and bonding products and associated accessories.

1.03 QUALITY ASSURANCE

A. Codes and Standards:
   1. UL Compliance: Comply with applicable requirements of UL Standards No. 467, "Electrical Grounding and Bonding Equipment," and No. 869, "Electrical Service Equipment," pertaining to grounding and bonding of systems, circuits, and equipment. In addition, comply with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products which are UL listed and labeled for their intended usage.
   2. IEEE Compliance: Comply with applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141, and 142 pertaining to grounding and bonding of systems, circuits, and equipment.

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING

A. Materials and Components:
   1. Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials including, but not limited to, cables/wires,

connectors, solderless lug terminals, grounding electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for complete installation. Where more than one type component product meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications indicated.

2. Conductors: Electrical copper grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.
3. Grounding Electrodes: Steel with copper welded exterior, 3/4-inch diameter by 10 feet.
4. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

PART 3 - EXECUTION

3.01 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

A. Connect grounding conductors to underground grounding electrodes using exothermic weld process or mechanical compression type connectors.

B. Ground electrical service system neutral at service entrance equipment to grounding electrodes.

C. Ground each separately derived system neutral to effectively grounded metallic water pipe, effectively grounded structural steel member, and separate grounding electrode.

D. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

E. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus, or bushing.

F. Connect grounding electrode conductors to 1-inch diameter or greater, metallic cold water pipe using a suitably sized ground clamp. Provide connections to flanged piping at street side of flange.

G. Connect building reinforcing steel, building steel beam, building steel roof and walls and duct bank and vault reinforcing steel to ground mat using No. 4/0 AWG bare copper grounding cable.

H. Bond bare No. 4/0 AWG grounding cable in duct banks to grounding cable in vaults and to power equipment ground bus at ends of each duct bank.

I. Bond strut and other metal inside of electrical manholes and vaults to bare No. 4/0 AWG grounding cable carried in duct bank.

J. Bond grounding cables to both ends of metal conduit or sleeves through which such cables pass.

K. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque-tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

L. Install braided type bonding jumpers with code-sized ground clamps on water meter piping to electrically bypass water meters.

M. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible while following building lines to minimize transient voltage rises. Protect exposed cables and straps where subject to mechanical damage.

N. Apply corrosion-resistant finish to field connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed and are subjected to corrosive action.

3.02 FIELD QUALITY CONTROL – NOT USED

END OF SECTION

SECTION 16070

SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes: Secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

1.02 SUBMITTALS:

A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Product data for each type of product specified.

1.03 QUALITY ASSURANCE:

A. Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Slotted Metal Angle and U-Channel Systems:
      a. Allied Tube & Conduit.
      b. American Electric.
      c. B -Line Systems, Inc.
      d. Cinch Clamp Co., Inc.
      e. GS Metals Corp.
      f. Haydon Corp.
      g. Kin-Line, Inc.
      h. Unistrut Diversified Products.
   2. Conduit Sealing Bushings:
      a. Bridgeport Fittings, Inc.
      b. Cooper Industries, Inc.
      c. Elliott Electric Mfg. Corp.
      d. GS Metals Corp.
      e. Killark Electric Mfg. Co.
      f. Madison Equipment Co.
      g. L.E. Mason Co.
      h. O-Z/Gedney.
      i. Producto Electric Corp.
      j. Raco, Inc.
      k. Red Seal Electric Corp.
      l. Spring City Electrical Mfg. Co.

m. Thomas & Betts Corp.

2.02 COATINGS:

A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors, in NEMA 4 areas, or embedded in concrete shall be hot-dip galvanized.

2.03 MANUFACTURED SUPPORTING DEVICES:

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

B. Fasteners. Types, materials, and construction features as follows:
1. Expansion Anchors: Carbon steel wedge or sleeve type.
2. Toggle Bolts: Steel springhead type.
3. Hanger Rods: 0.375-inch diameter minimum, steel.

C. Conduit Sealing Bushings: Factory fabricated, watertight conduit sealing bushing assemblies suitable for sealing around conduit or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

D. Cable Supports for Vertical Conduit: Factory fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable iron casting with hot-dip galvanized finish.

E. U-Channel Systems: 12 gauge or 0.105-inch-thick steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center in top surface. Provide fittings and accessories that mate and match with U-channel and are of same manufacturer.

2.04 FABRICATED SUPPORTING DEVICES:

A. Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

C. Pipe Sleeves: Provide a waterstop on pipe sleeves. Provide pipe sleeves of 2 standard sizes larger than conduit/pipe passing through it and of one of the following:
1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gauge metal for sleeve diameter noted:
a. 3-inch and smaller: 20-gauge.
b. 4-inch to 6-inch: 16-gauge.
c. Over 6-inch: 14-gauge.
2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.
3. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe.

PART 3 – EXECUTION – NOT USED

END OF SECTION

SECTION 16075

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes: Identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including, but not limited to, the following:

1. Buried electrical line warnings.
2. Identification labeling for cables and conductors.
3. Operational instruction signs.
4. Warning and caution signs.
5. Equipment labels and signs.

1.02 SUBMITTALS:

A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
1. Product Data for each type of product specified.

PART 2 - PRODUCTS

2.01 ELECTRICAL IDENTIFICATION PRODUCTS:

A. Colored Adhesive Marking Tape for Wires and Cables: Self-adhesive, vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.

B. Pre-tensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: Flexible acrylic bands sized to suit raceway diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.

C. Underground Line Marking Tape: Permanent, bright colored, continuous printed, plastic tape compounded for direct-burial service not less than 6 inches wide by 4 mils thick. Printed legend indicative of general type of underground line below.

D. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with pre-printed numbers and letter.

E. Engraved, Plastic Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16 inch minimum thick for signs up to 20 square inches or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in white letters on black face and punched for mechanical fasteners.

F. Baked Enamel Warning and Caution Signs for Interior Use: Pre-printed aluminum signs, punched for fasteners, with colors, legend, and size appropriate to the location.

G. Exterior Metal-Backed Butyrate Warning and Caution Signs: Weather-resistant, nonfading, pre-printed cellulose acetate butyrate signs with 20-gauge galvanized steel backing, with colors, legend, and size appropriate to location. Provide 1/4-inch grommets in corners for mounting.

H. Fasteners for Plastic Laminated and Metal Signs: Self-tapping stainless steel screws or Number 10/32 stainless steel machine screws with nuts and flat and lock washers.

I. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18 inch minimum width, 50-pound minimum tensile strength, and suitable for a temperature range from minus 50 to 350 degrees F. Provide ties in specified colors when used for color coding.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification Work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by Code.

B. Underground Electrical Line Identification: During trench backfilling for exterior nonconcrete encased underground power, signal, and communications lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench, do not exceed an overall width of 16 inches; install a single line marker.

C. Install line marker for underground wiring, both direct buried and in raceway.

D. Conductor Color Coding: Provide color coding for secondary service, feeder, and branch circuit conductors throughout the Project secondary electrical system following OWNER's method of phase identification or as follows:
   1. 480/277 Volt, 3-Phase Power:
      a. Brown.
      b. Orange.
      c. Yellow.
      d. Grey Neutral.
   2. 208 Volt, 3-Phase Power:
      a. Black.
      b. Red.
      c. Blue.
   3. 240/120 Volt, 1-Phase Power:
      a. Black.
      b. Red.
      c. White Neutral.
   4. Motor Leads, Control Cabinet/MCC:
      a. Black, numbered L1-T1, etc.
   5. Control Wiring:
      a. Red Control circuit wiring that is de-energized when the main disconnect is opened.
      b. Yellow Control circuit wiring that remains energized when the main disconnect is opened.
      c. Blue DC.

d. Green Ground.

E. Use conductors with color factory applied entire length of conductors except as follows:
1. The following field applied color coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
a. Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last 2 laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.
b. In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply 3 ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.

F. Power Circuit Identification: Securely fasten identifying metal tags of aluminum wraparound marker bands to cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms with 1/4-inch steel letter and number stamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55-pound test monofilament line or one-piece self-locking nylon cable ties.

G. Install wire/cable designation tape markers at termination points, splices, or junctions in each circuit. Circuit designations shall be as indicated on Drawings.

END OF SECTION

SECTION 16130

RACEWAYS

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes: Raceways for electrical wiring. Types of raceways in this Section include the following:
   1. Intermediate metal conduit.
   2. Liquidtight flexible conduit.
   3. Rigid metal conduit.
   4. PVC externally coated rigid metal conduit.
   5. Conduit bodies.

1.02 SUBMITTALS:

A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Product data for the following products:
      a. Conduit.
      b. Conduit bodies.

1.03 QUALITY ASSURANCE:

A. Codes and Standards:
   1. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.
   2. UL Compliance and Labeling: Comply with applicable requirements of UL standards pertaining to electrical raceway systems. Provide raceway products and components listed and labeled by UL, ETL, or CSA.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in Work include:
   1. Conduit:
      a. Allied Tube.
      b. Carlon.
      c. General Electric Co.
      d. Johns Manville.
      e. Occidental Coatings.
      f. Orangeburg.
      g. Perma-Cote Industries.
      h. Republic Steel.
      i. Robroy Industries.

j. Steelduct Co.
k. Triangle Conduit.
l. Wheatland Tube.
m. Youngstown Sheet and Tube.

2. Liquidtight Conduit:
   a. Anamet, Inc.
   b. Carlon.
   c. Electric-Flex.
   d. Thomas and Betts.
3. Conduit Bodies:
   a. Adalet-PLM.
   b. American Electric.
   c. Appleton Electric Co.
   d. Carlon.
   e. Crouse-Hinds Division, Cooper Industries, Inc.
   f. Delta Industrial Products.
   g. Killark Electric Mfg. Co.
   h. Kraloy Products Co.
   i. O-Z/Gedney Co.
   j. Perma-Cote Industries.
   k. Robroy Industries.
   l. Spring City Electrical Mfg. Co.
4. Conduit Thread Paint:
   a. CRC Chemicals, USA.
   b. Sherwin Williams.
   c. ZRC Chemical Products Co.

2.02 METAL CONDUIT AND TUBING:

A. Rigid Metal Conduit: ANSI C 80.1, hot-dip galvanized.

B. Intermediate Metal Conduit: UL 1242, hot-dip galvanized.

C. PVC Externally Coated Rigid Metal Conduit and Fittings: ANSI C 80.1 and NEMA RN 1., Type 40, 40 mil nominal coating and thickness. The bond of the PVC to the substrate shall be stronger than the tensile strength of the PVC.

D. Liquidtight Flexible Metal Conduit and Fittings: UL 360. Fittings shall be specifically approved for use with this raceway.

2.03 CONDUIT BODIES:

A. Provide matching gasketed covers secured with corrosion-resistant screws. Use cast covers in NEMA 4 areas and stamped steel covers in NEMA 1 and 12 areas. Use nonmetallic covers in NEMA 4X areas and threaded, ground joint covers in NEMA 7 and NEMA 9 areas.

B. Metallic Conduit and Tubing: Use metallic conduit bodies as follows:
   1. Rigid Metal Conduit: Use cast or malleable iron conduit bodies with zinc electroplating, aluminum enamel or lacquer finish, and threaded hubs.
   2. Intermediate Metal Conduit: Use cast or malleable iron conduit bodies with zinc electroplating, aluminum enamel or lacquer finish, and threaded hubs.

3. PVC Externally Coated Rigid Metal Conduit: Use hot-dipped galvanized or cadmium-plated cast or malleable iron conduit bodies with threaded hubs factory PVC-coated. Field application of PVC coating to conduit bodies is not acceptable. Secure covers using PVC encapsulated or stainless steel screws.

PART 3 – EXECUTION – NOT USED

END OF SECTION

SECTION 16135

CABINETS, BOXES, AND FITTINGS

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes: Cabinets, boxes, and fittings for electrical installations and certain types of electrical fittings not covered in other Sections. Types of products specified in this Section include:
   1. Pull and junction boxes.
   2. Bushings.
   3. Locknuts.
   4. Conduit hubs.

1.02 SUBMITTALS:

A. Shop Drawings: Submit in accordance with the City of Dayton Construction and Material Specifications, most recent edition, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Shop Drawings for floor boxes and boxes, enclosures, and cabinets that are to be shop-fabricated, (nonstock items). For shop-fabricated junction and pull boxes, show accurately scaled views and spatial relationships to adjacent equipment. Show box types, dimensions, and finishes.
   2. Product data for boxes, fittings, cabinets, and enclosures.

1.03 QUALITY ASSURANCE:

A. Codes and Standards:
   1. UL Listing and Labeling: Items provided under this section shall be listed and labeled by UL.
   2. NEMA Compliance: Comply with NEMA Standard 250, "Enclosures for Electrical Equipment (1,000 Volts Maximum)."

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Junction and Pull Boxes, Exposed Conduit System:
      a. Appleton Electric, Type FS/FD.
      b. Crouse-Hinds, Type FS/FD.
   2. Bushings, Knockout Closures, Locknuts, and Connectors:
      a. Adalet-PLM Div., Scott Fetzer Co.
      b. AMP, Inc.
      c. Arrow-Hart Div., Crouse-Hinds Co.
      d. Appleton Electric Co., Emerson Electric Co.

e. Bell Electric; Square D Co.
f. Midland-Ross Corp.
g. Midwest Electric, Cooper Industries, Inc.
h. OZ/Gedney Co., General Signal Co.
i. RACO Div., Harvey Hubbell, Inc.
j. Thomas & Betts Co., Inc.

2.02 CABINETS, BOXES, AND FITTINGS – GENERAL:

A. Junction and Pull Boxes: Suitable for the conduit system installation as follows:
1. Exposed Conduit: For pull and junction boxes 50 cubic inches and smaller, provide cast or malleable iron, zinc electroplated boxes finished with aluminum lacquer or enamel. Provide exterior mounting lugs and cast covers with neoprene gaskets. For pull and junction boxes larger than 50 cubic inches provide watertight sheet metal boxes. Grind exposed edges smooth or roll edges to prevent scuffing of wire during installation. Provide code-gauge sheet steel construction for boxes smaller than 1,000 cubic inches. Provide 0.10-inch steel construction, hot-dip galvanized after fabrication for boxes larger than 1,000 cubic inches. Secure box covers using No. 8 or larger machine screws spaced at intervals not exceeding 6 inches. Provide a continuous neoprene or rubber gasket cemented to the box cover where it contacts the box body.
a. Exceptions: Provide nonmetallic pull and junction boxes in NEMA 4X areas. Provide appropriate explosion-proof construction for boxes located in NEMA 7 and NEMA 9 areas. Provide factory PVC-coated boxes for areas where PVC conduit is used.

B. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications. Provide watertight hubs on conduits terminated at sheet steel enclosures in NEMA 4 areas.

PART 3 – EXECUTION – NOT USED

END OF SECTION

SECTION 16220

MOTORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section applies, in general, to all electric or DC motor-driven equipment provided under Divisions 2 through 16 Sections. This Section shall supplement the detailed Equipment Specifications, but in cases of conflict, the Specifications indicated in this Section shall govern.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with the City of Dayton Construction and Material Specifications, most recent edition, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Submittals for motors shall accompany the specific equipment the motor is to be supplied with.
   2. Submit product literature for each motor.

B. Operation and Maintenance Manuals: Submit in accordance with requirements of the City of Dayton Construction and Material Specifications, most recent edition, operation and maintenance manuals for items included under this Section.

1.03 QUALITY ASSURANCE

A. Electrical Codes, Ordinances, and Industrial Standards: The design, testing, assembly, and methods of installation of the wiring materials, electrical equipment, and accessories proposed under this Contract shall conform to the National Electrical Code and to applicable State and local requirements. UL listing and labeling shall be adhered to under this Contract. Any equipment that does not have a UL, FM, CSA, or other listed testing laboratory label, shall be furnished with a notarized letter signed by the supplier stating that the equipment furnished has been manufactured in accordance with the National Electrical Code and OSHA requirements. Any additional cost resulting from any deviation from codes or local requirements shall be borne by CONTRACTOR.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, motors shall be standard design and construction. Manufacturers offering products which may be incorporated in Work include:
   1. Motors:
      a. Marathon Blue Chip Series.
      b. Siemens, Inc.
      c. General Electric Co.
      d. Reliance Electric Co.
      e. U.S. Electric Motors.

B. For motors that are integrally constructed as a piece of equipment, such as appliances, hand tools, etc., and where manufacturer would be required to redesign equipment to meet these general specifications, it is the intent to allow such standard motors to be used, provided they do not exceed 1-1/2 horsepower and are suitable for use on standard power systems.

2.02 MATERIALS

A. Shop primers shall be Tnemec "77 Chem-Prime," or equal.

B. Rust preventive compound shall be equal to Dearborn Chemical "No-Ox-ID2W," Houghton "Rust Veto 344," or Rust-Oleum "R-9".

2.03 MANUFACTURED UNITS

A. Electrical Motors: Motor design and application shall comply with current ANSI, IEEE, NEMA, and AFBMA standards and with the NEC where applicable. They shall be squirrel cage induction motors rated 60 hertz, continuous duty for use in 40 degrees C ambient temperature. Motors shall comply with NEMA MG1-1993, Rev. 1, Part 31, Definite Purpose Inverter-Fed Motors whether used with variable frequency drives or not.
   1. The motors shall be sized within their rated loads under the specified conditions without utilizing the top 15 percent of the 1.0 or 1.15 service factor. Motor sizing measured at the motor output shaft shall include all loadings on the motor. Motor loadings shall include the maximum or specified load condition of the driven equipment plus all drive losses of components, located between the motor and the driven equipment.
   2. The motor winding temperature rise shall be NEMA Standard for the class of insulation used at the rated service factor load.
   3. The motors shall be capable of handling unfiltered voltage peaks of up to 1600 volts, and rise times of 0.1 micro-seocnds.

B. Motors 50 horsepower and larger shall have embedded passive temperature switches in the windings for use in the motor control circuit that will limit the winding temperature as defined by NEMA Standard MG1-12.53 Type 1. The contact shall be normally closed and rated to operate a 120 volt AC control relay (40 VA).

C. Unless these general specifications are supplanted by the detailed equipment specifications, motors shall be rated and constructed as follows:
   1. Below 1/2 Horsepower: Motors shall be rated 115/230 volts, single phase, but shall be suitable for use on 208 volt power system. They shall have permanently lubricated sealed bearings (antifriction type where high radial or axial thrusts are produced by the driven equipment). Standard motors shall be totally enclosed fan cooled, totally enclosed air-over, or totally enclosed nonventilated capacitor start type as shown on Equipment Schedule(s) or specified in the equipment specifications. Totally enclosed explosion-proof motors shall be provided where required per equipment specifications section.
   2. From 1/2 to 1-1/2 Horsepower: Motors shall be rated 115/230 volts single phase or shall be rated 230/460 volts 3-phase as indicated by Equipment Schedule(s). In either case they shall be suitable for use on 208 volt power systems under their given load conditions. They shall have bearings as in 2.03 F.1. The standard enclosures shall be totally enclosed fan cooled, totally enclosed nonventilated, totally enclosed explosion-proof, or open drip-proof as shown on Equipment Schedule(s) or specified in the equipment specifications.
   3. From 2 to 200 Horsepower: Motors shall be rated 230/460 or 460 volt, 3-phase. They shall be grease lubricated, ball bearing, Class B insulated, minimum or as specified. Horizontal motors

shall be open drip-proof, totally enclosed fan-cooled or totally enclosed explosion-proof (NEC, Class I, Group D) as shown on Equipment Schedule(s) or specified in the equipment specifications. Vertical motors shall meet NEMA standard open drip-proof specifications as a vertical motor when called for or totally enclosed fan cooled or totally enclosed explosion-proof as shown on Equipment Schedule(s).

D. Horizontal and vertical motors may also be weather protected, Type I, and shall have encapsulated or sealed windings.

E. Open drip-proof type motors shall have encapsulated or sealed windings when called for on Drawings or Equipment Schedules.

F. Special duty and severe environment application shall have motors which are designed specifically to meet the special conditions as specified.

G. The following symbols will be employed on Equipment Schedule(s) to indicate the required motor enclosure and construction features:
   1. TE Totally Enclosed, may be nonventilated, fan-cooled or air-over type.
   2. TENV Totally Enclosed Nonventilated.
   3. TEFC Totally Enclosed Fan-cooled.
   4. TEEP Totally Enclosed Explosion-proof, Class I, Div. I, Group D.
   5. ODP Open Drip-proof.
   6. WPI Weather Protected Type I.
   7. E/S Encapsulated or Sealed Windings.
      a. All motors with encapsulation or sealed windings shall have a water-tight conduit box.

H. See NEMA Standard MG1 for definition of above terms.

I. Motor Efficiency: Where Equipment Schedule(s) indicate that motors shall be designed for high efficiency, they shall meet or exceed the Motor Operating Characteristics shown on High Efficiency Motor Schedule No. 16220.2, appended to this Section. Guaranteed minimum efficiency at full load shall be based on IEEE Standard 112, Test Method B. Nominal motor efficiencies are average expected values. Manufacturer's motor Shop Drawings shall indicate full compliance with the High Efficiency Motor Schedule No. 16220.2.

J. Motors shall have winding heaters. Winding heaters shall be 120 volt AC single phase. Motors with winding heaters shall include heater leads in a separate conduit box mounted on the motor frame. The conduit box shall have an access cover.

2.04 FABRICATION

A. Electric motors shall be shop-finished with 2 coats of enamel paint per manufacturer's recommendations.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's written installation and alignment instructions.

B. Lubricate oil-lubricated bearings.

C. Provide electrical wiring and connections as specified in Division 16 Sections.

3.02 FIELD QUALITY CONTROL

A. Inspect all terminations for proper connection.

B. Check motor for proper rotation.

3.03 INSTALLATION CHECK

A. Installation Check: Manufacturer shall provide the services of a factory-trained representative to check the installation of all equipment installed in this Section. The services shall be as noted in Section 01600. Equipment supplier's representative shall revisit Site as often as necessary until all trouble is corrected and equipment installation and operation is satisfactory to ENGINEER.

B. Manufacturer's representative shall provide all necessary tools and testing equipment required including noise level and vibration sensing equipment.

C. Inspection Report: A written report of the installation check shall be submitted to ENGINEER. The report shall be as noted under Section 01600 certifying that the equipment:
   1. Has been properly installed and lubricated;
   2. Is in accurate alignment;
   3. Is free from any undue stress imposed by any connection or anchor bolts;
   4. Has been operated under full load condition and that it operated satisfactorily to ENGINEER; and
   5. That OWNER's representative has been instructed in the proper maintenance and operation of the equipment.
   6. Furnish OWNER a copy of all test data recorded during the installation check including noise level and vibration readings.

HIGH EFFICIENCY MOTOR SCHEDULE NO. 16220.2
MOTOR OPERATING CHARACTERISTICS

		Efficiency (percent)						
		Guar.						
	RPM	Min.		Nominal		Power Factor (percent)		
HP	Syn.	Full	1/2	3/4	Full	1/2	3/4	Full
1	1800	81.5	78.1	81.0	81.5	54.2	67.3	75.8
	1200	75.5	69.5	75.6	78.5	38.4	49.4	58.3
	3600	78.5	78.4	80.2	81.5	75.3	84.4	88.8
1.5	1800	81.5	79.2	82.9	84.0	52.1	65.1	74.0
	1200	81.5	80.5	83.4	84.0	44.0	56.6	85.6
	3600	81.5	78.8	82.9	84.0	66.3	78.4	85.0
2	1800	81.5	78.8	82.6	84.0	48.9	61.7	70.0
	1200	84.0	83.0	83.6	86.5	46.6	59.6	68.0
	3600	84.0	75.4	84.3	86.5	69.7	80.0	85.6
3	1800	86.5	86.9	88.5	88.5	62.3	73.9	79.9
	1200	86.5	84.5	87.5	88.5	45.9	58.3	68.0
	3600	86.5	86.2	88.2	88.5	71.7	81.7	86.4
5	1800	88.5	84.0	88.2	88.5	68.5	79.2	84.6
	1200	86.5	85.8	88.2	88.5	50.8	63.8	71.9
	3600	86.5	82.9	86.7	88.5	75.9	84.3	88.1
7.5	1800	88.5	89.2	90.3	90.2	66.5	77.2	82.4
	1200	86.5	87.5	88.8	88.5	58.6	68.8	73.7
	3600	86.5	87.7	89.0	88.5	77.1	84.5	87.6
10	1800	88.5	89.3	90.4	90.2	67.6	77.4	81.9
	1200	88.5	89.0	90.3	90.2	60.1	70.2	74.9
	3600	88.5	82.3	87.4	90.2	81.1	87.2	90.4
15	1800	90.2	91.0	91.9	91.7	68.5	78.1	82.3
	1200	88.5	89.9	90.6	90.2	67.4	77.1	81.4
	3600	90.2	89.1	91.1	91.7	83.7	88.5	90.5
20	1800	90.2	90.9	91.9	91.7	68.9	78.1	81.8
	1200	90.2	91.0	91.0	91.7	69.8	78.5	81.9
	3600	90.2	91.6	92.0	91.7	81.9	88.6	90.6
25	1800	91.7	92.8	93.2	92.4	72.7	81.4	84.5
	1200	90.2	90.0	91.4	91.7	79.8	84.5	85.5
	3600	90.2	90.6	91.7	91.7	81.1	87.8	90.3
30	1800	91.7	92.8	93.3	93.0	71.5	80.6	84.2
	1200	90.2	91.7	92.0	91.7	78.9	85.4	86.8
	3600	90.2	89.1	91.2	91.7	83.8	88.6	89.9
40	1800	91.7	91.0	92.6	93.0	71.6	80.6	84.2
	1200	91.7	93.0	93.3	93.0	80.9	86.4	88.0
	3600	90.2	88.7	90.8	91.7	82.5	90.8	92.0
50	1800	93.0	92.4	93.7	94.1	76.4	83.7	86.3
	1200	91.7	93.0	93.3	93.0	80.9	87.3	88.9
	3600	91.7	89.9	92.0	93.0	84.9	89.9	91.6
60	1800	93.0	93.2	94.0	94.1	76.3	84.0	86.8
	1200	91.7	92.5	93.1	93.0	75.8	82.9	85.5
	3600	93.0	91.0	93.1	94.1	82.6	88.7	90.9
75	1800	93.0	92.6	93.8	94.1	76.4	83.8	86.6
	1200	93.0	93.5	94.2	94.1	75.1	82.4	84.7
	3600	93.0	91.3	93.3	94.1	86.1	89.7	91.0
100	1800	94.1	93.8	94.8	95.0	83.8	87.6	89.0
	1200	93.0	93.1	93.9	94.1	72.5	80.0	83.2
	3600	93.0	91.2	93.1	94.1	83.0	88.3	89.0
125	1800	93.7	93.5	94.6	95.0	79.2	84.6	86.0
	1200	93.0	93.5	94.2	94.1	75.2	82.3	85.2
	3600	93.0	91.8	93.4	94.1	85.3	89.3	89.1
150	1800	94.1	93.7	94.7	95.0	81.6	86.4	86.6
	1200	94.1	94.1	94.9	95.0	77.2	84.4	85.7
	3600	94.1	92.7	94.3	95.0	83.3	87.5	88.5
200	1800	94.5	94.2	94.9	95.0	80.0	85.6	86.7
	1200	94.3	94.2	94.9	95.0	78.0	84.5	86.0
	3600	94.3	94.8	95.5	95.3	83.0	87.5	88.5
250	1800	94.3	96.0	96.0	95.8	79.5	85.6	83.0

END OF SECTION

SECTION 16410

CIRCUIT AND MOTOR DISCONNECTS

PART 1 - GENERAL

1.01 SUBMITTALS:

A. Shop Drawings: Submit shop drawings in accordance with the City of Dayton Construction and Material Specifications, most recent edition covering the items included under this Section. Shop Drawing submittals shall include:
   1. Product data for each type of product specified.

B. Operation and Maintenance Manuals: Submit in accordance with requirements of the City of Dayton Construction and Material Specifications, most recent edition, operation and maintenance manuals for items included under this Section, including circuits and motor disconnects.

1.02 QUALITY ASSURANCE:

A. Codes and Standards:
   1. Electrical Component Standards: Provide components which are listed and labeled by UL. Comply with UL Standard 98 and NEMA Standard KS 1.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Allen-Bradley.
   2. Appleton.
   3. Crouse-Hinds Co.
   4. Cutler-Hammer.
   5. Furnas Electric Co.
   6. General Electric Co.
   7. Siemens, Inc.
   8. Square D Company.

2.02 CIRCUIT AND MOTOR DISCONNECT SWITCHES:

A. Provide NEMA 4, 4X, 7, 9, or 12 enclosure to match the rating of the area in which switch is installed. For motor and motor starter disconnects through 100 horsepower, provide units with horsepower ratings suitable to loads. For motor and motor starter disconnects above 100 horsepower, clearly label switch, "DO NOT OPEN UNDER LOAD."

B. Fusible Switches: (Heavy-duty) switches, with fuses of classes and current ratings indicated. See Section "Fuses" for specifications. Where current limiting fuses are indicated, provide switches with non-interchangeable feature suitable only for current limiting type fuses.

C. Non-fusible Disconnects: (Heavy-duty) switches of classes and current ratings as indicated.

2.03 ACCESSORIES:

A. Special Enclosure Material: Provide special enclosure material as follows for switches indicated:
1. Stainless Steel for NEMA 4 outdoor switches.

PART 3 – EXECUTION – NOT USED

END OF SECTION

SECTION 16420

MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Types of motor controllers, including:
   1. Combination controllers.
   2. Fractional HP manual controllers.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Shop Drawings: Submit Shop Drawings of motor controllers showing dimensions and sizes.
   2. Product Data: Submit manufacturer's data and installation instructions on motor controllers.
   3. Wiring Diagrams: Submit power and control wiring diagrams for motor controllers.

1.03 QUALITY ASSURANCE

A. Codes and Standards:
   1. UL Compliance: Comply with applicable requirements of UL 486A and B, and UL 508, pertaining to installation of motor controllers. Provide controllers and components which are UL listed and labeled.
   2. NEMA Compliance: Comply with applicable requirements of NEMA Standards ICS 2, "Industrial Control Devices, Controllers and Assemblies," and Pub No. 250, "Enclosures for Electrical Equipment (1,000 Volts Maximum)," pertaining to motor controllers and enclosures.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Allen-Bradley Co.
   2. Crouse-Hinds Co.
   3. Cutler-Hammer Products/Eaton Corp.
   4. Emotron.
   5. Furnas Electric Co.
   6. General Electric Co.
   7. Siemens, Inc.
   8. Square D Company.

2.02 MOTOR CONTROLLERS

A. Except as otherwise indicated, provide motor controllers and ancillary components which comply with manufacturer's standard materials, design, and construction in accordance with published product information and as required for a complete installation.

B. Combination Controllers: Consist of controller and circuit breaker or fusible disconnect switch mounted in common enclosure of types, sizes, ratings, and NEMA sizes indicated. Equip starters with block-type manual reset overload relays. Provide control and pilot devices indicated. Provide 90 degree C SIS or MTW, No. 14 AWG control wiring, tagged at each termination. Provide operating handle for disconnect switch mechanism with indication and control of switch position, with enclosure door either opened or closed, and capable of being locked in OFF position with 3 padlocks. Construct and mount controllers and disconnect switches in single NEMA-type enclosure suitable for the location in which it is installed; coat with manufacturer's standard color finish.
   1. The 3-phase starter may be the following types:
      a. Full Voltage Non-reversing (FVNR): One 3-pole magnetic contactor with a set of 3 overload devices.

C. Control and Pilot Devices: Provide an individually fused control power transformer in each starter unit. Provide 2 fuses in the transformer primary circuit and 1 in transformer secondary circuit. Size transformers such that they can supply 100VA in excess of the unit requirements or provide 150VA rated transformer, whichever is greater. Provide 300 volt rated, oiltight type pilot lights, push buttons with extended guard and black color insert. Equip stop push buttons with half guard and red color insert. Provide 120/6 volt transformer type push-to-test pilot lights with lens color indicated. Provide machine tool type relays, each with 1 spare N.O. contact. Provide 6-digit elapsed time indicators with one-tenth hour increments. When timers are required, they shall be synchronous type.

D. Fractional HP Manual Controllers: Provide 3-phase and single-phase fractional horsepower manual motor controllers, of sizes and ratings indicated. Equip with manually operated quick-make, quick-break toggle mechanisms, and with one-piece melting alloy type thermal units. Controller shall become inoperative when thermal unit is removed. Provide controllers with double-break silver alloy contacts, visible from both sides of controller, and switch capable of being padlocked-OFF. Enclose controller unit in NEMA-type enclosure suitable for the location in which it is installed; coat with manufacturer's standard color finish.

PART 3 – EXECUTION - NOT USED

END OF SECTION

SECTION 16760

FIBER OPTIC CABLE SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Communications network fiber optic cabling.

B. Patch panels.

C. Connectors, hardware, and accessories

1.02 WORK INCLUDED:

A. The intent of these specifications is to describe the requirements of hardware, installation, testing and implementing the fiber optic network.

B. The Contractor shall install all cable, network switches and related equipment, and provide all labor and materials necessary for complete and operating networks in accordance with the Contract Drawings and these specifications. The installation work shall include, but is not necessarily limited to, the following:

C. Install outdoor single-mode fiber optic cable in direct buried conduit and, using mid-span entry, render it complete and operable for all termination ports in well cabinets and other locations as shown on the Contract Drawings. A Google Earth file, identifying coordinates of all well cabinets, poles and other key locations will be provided.

D. Conform to Operations requirements where applicable. In the event of any conflicts, advise the Engineer.

E. Provide a comprehensive fiber optic OTDR testing plan and conduct such tests as necessary to validate correct installation.

1.03 RELATED SECTIONS:

A. Section 16050—Basic Electrical Requirements

1.04 REFERENCES:

A. Shop Drawings, Product Data, and Samples

1. 568A Commercial Building Telecommunications Cabling Stranded

2. 569A Commercial Building Standard for Telecommunications Pathways & Spaces

3. 598A Optical Fiber Color Coding

4. 607 Grounding and Bonding Standard

5. TSB-67 Transmission Performance Specifications for Field Testing of UTP Cabling Systems

6. TSB-72 Centralized Optical Fiber Cabling Guidelines

7. EIA for Fiber Optic Testing Procedures (FOTP)

   a. FOTP-1 Cable Flexing for Fiber Optic Connectors

   b. FOTP-2 Impact Test Measurements for Fiber Optic Devices

   c. FOTP-3 Temperature Cycling of Fiber Optic Connectors (Thermal Shock)

   d. FOTP-5 Humidity Test Procedures for Fiber Optic Connecting Devices

   e. FOTP-6 Cable Retention Test Procedure for Fiber Optic Interconnection Devices

   f. FOTP-11 Vibration Test Procedure for Fiber Optic Connecting Devices

   g. FOTP-14 Fiber Optic Shock Test

   h. FOTP-25 Impact Testing of Fiber Optic Cable and Cable Assemblies

   i. FOTP-30 Frequency Domain Measurement of Multimode Optical Fiber Information Transmission Capacity

   j. FOTP-35 Interconnection Device Insertion Loss Test

   k. FOTP-36 Twist Test for Fiber Optic Cable Assemblies

   l. FOTP-41 Compressive Loading Resistance of Fiber Optic Cable

   m. FOTP-46 Spectral Attenuation Measurements for Long-Length, Graded-Index Optical Fibers

   n. FOTP-50 Light Launch Conditions for Long-Length Graded-Index Optical Fiber Spectral Attenuation Measurements

B. National Fire Protection Association (NFPA):

   1. National Electrical Code (NEC)

C. Underwriters Laboratories, Inc. (UL):

1. 13 Safety Power-Limited Circuit Cables

2. 44 Safety Rubber-Insulated Wires and Cables

3. 486A Safety Wire Connector and Soldering Lugs for use with Copper Conductors

4. 910 Safety Test Method for Fire and Smoke Characteristics of Electrical and Optical-Fiber Cables used in Air Handling Spaces

5. 1072 Safety Medium-Voltage Power Cables

6. 1277 Safety Electrical Power and Control Tray Cables with Optical-Fiber Members

7. 1581 Safety Reference Standard for Electrical Wires, Cables and Flexible Cords

8. 1666 Standard for Safety Test for Flame-Propagation Height of Electrical and Optical-Fiber Cables Installed Vertical in Shafts

D. Institute of Electronic and Electrical Engineers (IEEE):

1. 802.3 CSMA/CD Access Method and Physical Layer

1.05 SUBMITTALS:

A. Comply with requirements of and submit in accordance with the City of Dayton Construction and Material Specifications, most recent edition.

B. Include a copy of this specification section; pertinent Contract Drawings; other relevant specification sections as noted above; and all addendum updates with each specification paragraph and Contract Drawing clearly check-marked to indicate compliance with specification and drawing requirements or marked to indicate requested deviations/substitutions from the specification requirements.

C. Shop Drawings: Provide drawings indicating the locations of all pullboxes with station numbers.

D. Product Data:

1. Catalog data on conduit system, pullboxes, conduit fittings, conduit plugs, pull rope, identification tape, and warning signs.

2. Catalog data on all testing devices proposed for use plus certifications of accuracy, calibration, and traceability to standards of the National Institute for Standards and Testing

3. Wire and cable descriptive product information

E. Cable pulling calculations for all conduit runs. Indicate on the submittal any additional pullboxes that are required, including station number and a written description of the location.

F. A cable pulling and splicing work plan shall be submitted a minimum of 45 days prior to the planned initiation of cable pulling. The work plan must be approved by the Engineer a minimum of 15 days prior to pulling cable. Work plan shall include the following:

1. Pull tension calculations

2. Calculated amount of lubrication required

3. Detailed description of pull operation methods for all conduit runs

4. Tools and equipment to be used for cable installation and testing

5. Physical location of equipment setup and type

6. Exact location of splice points

7. Safety and manual assist cable pulling operations

8. Detailed schedule for pulling and testing cables

G. Quality Assurance Submittals:

1. Test Report showing compliance with this Section.

2. Manufacturer certification that cable is suitable for installation in conduit underground.

1.06 RECORD DRAWINGS:

A. In compliance with the City of Dayton Construction and Materials Specifications, most recent edition, the Contractor shall, upon completion, submit Record Drawings showing the following:

1. Horizontal alignment of fiber optic conduit

2. Vertical alignment of fiber optic conduit

3. Location of all pullboxes using Station Number, and the exact Northing and Easting of each pullbox using the North American Datum (NAD) 83 coordinate system.

1.07 QUALITY ASSURANCE:

A. The Contractor shall be factory certified to install fiber optic cable, with demonstrated experience in the mid-span entry and direct buried installation methods described in subsection 3.1.

B. Cabled optical fibers shall be 100% attenuation tested at the factory. The attenuation of each fiber shall be provided with each cable reel. The attenuation shall be measured at 9/125 nm for single-mode fibers. The manufacturer will store these values for a minimum of 5 years. These values shall be made available upon request.

C. The cable manufacturer shall be ISO 9001 certified.

D. Contractor shall provide verification of current manufacturer certification for the installation of network equipment and cabling to be installed under this contract.

E. Contractor shall provide verification of a current Contractor's license from the Contractor's State Licensing Board.

PART 2 - PRODUCTS

2.01 FIBER OPTIC CABLE:

A. Cable Type: All dielectric outdoor plant stranded loose-tube, gel-filled fiber optic cable, OM3.

B. Number of Fibers: 48 fibers as indicated in Table 1 at the end of this section.

C. Buffer Tubes:

1. Optical fibers shall be grouped inside a loose buffer tube. Tubes shall be color coded and arranged symmetrically around the central member.

2. The fibers shall not adhere to the inside walls of the loose buffer tube. Buffer tubes shall be kink resistant within the specified minimum bend radius.

3. Each buffer tube shall be filled with a non-hygroscopic, non-nutritive to fungus, electrically non-conductive, homogenous gel. The gel shall be free from dirt and foreign matter. The gel shall be readily removable with conventional nontoxic solvents.

4. Buffer tubes shall be stranded around a central member using the reverse oscillation, or “S-Z”, stranding process.

5. Binders shall be applied with sufficient tension to secure the buffer tubes to the member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking and dielectric with low shrinkage.

D. Each fiber shall be numbered and color-coded.

1. Fibers will be assigned per the color codes identified in Table 1 at the end of this section.

2. The colors of the individual fibers shall be stable across the indicated storage and operating temperature range and not be subject to fading or smearing onto each other or into the gel filling material.

3. Colors shall not cause fibers to stick together.

E. Cable Core:

1. Filler may be included in the cable core composition to lend symmetry to the cable cross section where needed.

2. A central anti-buckling member shall be included in the cable. The anti-buckling member shall be composed of a glass reinforced plastic rod.

3. The cable core shall contain a water-blocking material. The water blocking material shall be non-nutritive to fungus, electrically non-conductive and homogenous. It shall also be free from dirt and foreign matter and shall be readily removable with conventional nontoxic solvents.

4. Tensile strength shall be provided by a combination of high tensile strength dielectric yarns. The high tensile strength dielectric yarns shall be helically stranded evenly around the cable core.

F. The all-dielectric cable shall be sheathed with medium density polyethylene (MDPE). The minimum nominal jacket thickness shall be 1.4-mm. Jacketing material shall be applied directly over the tensile strength members and water blocking material. The jacket or sheath shall be free of holes, splits, and blisters. The cable jacket shall contain no metallic elements and shall be of a consistent thickness.

G. The cable shall contain at least one ripcord under the sheath for easy sheath removal.

H. Fan-Out Termination for Loose Tube Cables:

1. Individual fibers within the loose tube cable require handling protection inside the termination cabinets. Fan-out kits shall be installed in the patch panel enclosures to transition the loose tube fibers to ruggedized tight-buffered fiber pigtail cables. Fan-out tubes or furcation kits shall not be used. Optical fusion splices shall connect the loose tube fibers to the tight-buffered pigtail cables. The optical splice loss shall comply with the specifications for optical splices. Splice protection sleeves shall protect all splices. A wall-mountable splice center shall house the splices and serve to fully protect excess lengths of loose tube fibers from exposure.

2. The tight-buffered pigtails shall be terminated with LC connectors.

I. Fan-Out Pigtail Cable Specifications:

1. Single mode fiber shall be used in the pigtails.

J. Fiber optic cable to be Corning, or engineer approved equal.

2.02 FIBER OPTIC TERMINATION PATCH PANELS:

A. Fiber optic cable shall terminate inside well cabinets, per the Contract Drawings.

B. Fiber optic cable shall terminate inside communications cabinets at both the Miami Well Field office and the Miami Water Treatment Plant on a termination patch panel. Fiber sub-cables within the cable shall be terminated with STEM compatible connectors. The patch panel shall have a fiber capacity equal to the total number of fibers (connected and spare) for all cables to be connected. Patch panels shall be designed for either mounting on a standard equipment rack or housed in an enclosure for direct wall mounting. The patch panel shall contain STEM type bayonet couplings. Unused couplings shall have protective dust covers. Panels shall be furnished with locking doors. Factory-terminated, tight-buffered, aramid-reinforced fiber optic jumper assemblies or interconnect cables, standard 3.0-mm OD, shall connect the optical cable terminations to the patch panel couplings.

C. The termination patch panel shall be equipped with a suitable means for routing and securing of cables and shall provide a suitable means of protection for the mounted fiber connectors, to prevent damage to fibers and connectors during all regular operation and maintenance functions. Cables shall be provided with strain relief. Bend diameters on cable fibers and jumpers shall be greater than 4-inches for optical and mechanical integrity of the optical fibers.

D. Fiber optic termination patch panels to be provided and installed by the Contractor.

2.03 OPTICAL CONNECTORS:

A. Connectors shall be field-installable and perfectly matched to the cable used. The connectors shall provide tight fitting termination to the cladding and buffer coating. Epoxy-based or hot melt adhesives shall be used to bond the fiber and buffer to the connector ferrule and body prior to polishing the end face. No dry-termination, mechanical or quick crimp connectors are allowed.

B. After termination with connectors, the fiber ends shall be visually inspected at a magnification of not less than 100 power to check for cracks or pits in the end face of the fiber. If irregularities cannot be removed by further polishing, the entire process shall be redone by cutting off and disposing of the connector body.

C. Connectors shall have a maximum allowable connection loss of 0.3 dB per mated pair, as measured per EIA-455-34. No index-matching gel is to be used; only dry interfaces will be accepted.

1. Single-mode connectors shall be capable of field installation on 9/125 micron fibers with 900 micron buffers (OD).

D. Each connector shall be of the industry standard LC type compatible, designed for single-mode tolerances, shall meet or exceed applicable EIA-455, and shall be capable of 100 repeated matings with a maximum loss increase of 0.1 dB. Connector bodies and couplings shall be made of corrosion-resistant and oxidation-resistant materials, designed to operate in humid environments without degradation of surface finishes.

2.04 SPLICE CLOSURES:

A. Splice closures shall be of the re-enterable type, with an external moisture-proof shell, inner closure, and encapsulant.

B. Closure shall have removable interior splice trays.

C. Closures shall be Corning Cable Systems (Secure) type SCN or equal.

2.05 CONDUIT:

A. Conduit shall be electrical conduit as indicated. Fittings shall be appropriate for underground installation.

B. Conduit Duct Plugs shall be Jackmoon Simplex Duct Plugs or equal, with bushing sleeves.

C. Pull Rope shall be Low friction, polyethylene jacketed polypropylene rope with 1800 psi tensile strength, Vikamatic “Fiber Glide” or equal.

PART 3 - EXECUTION

3.01 FIBER OPTIC CABLE INSTALLATION:

A. General

1. The Contractor shall utilize mid-span entry for installing and terminating cable within well cabinets.

2. Work shall be carried out in accordance with and consistent with the highest standards of quality and craftsmanship in the communication industry with regard to the electrical and mechanical integrity of the connections; the finished appearance of the installation; and the accuracy and completeness of documentation.

3. The Contractor shall make a physical survey of the Site for the purpose of establishing the exact cable routing and cutting lengths prior to the commencement of any work or committing any materials.

4. The cable shall be carefully inspected for jacket defects as it is removed from the reel. If defects are noticed, the pulling operation shall be terminated immediately and the Engineer notified.

5. Fiber optic cables shall be installed in continuous lengths without intermediate splices throughout the project. Cable installation personnel shall be familiar with the manufacturer's recommended procedures including at least the following:

   a. Pulling using direct attachment to internal strength members.

   b. Cable tensile limitations and tension monitoring procedures.

   c. Cable bending radius limitations.

   d. Cable twisting limitations.

B. Mid-Span Entry: Contractor shall utilize mid-span entry of the loose tube ribbon fiber optic cable (i.e., ring cut) to reduce splice points of the larger fiber count cables. A mid-span entry shall be used to access only the fibers required for splicing to the smaller cables. Fibers are dropped off the main cable mid-span to connect with other cables/drop cables; the remaining fibers continue for service beyond the drop-off location. Care is required to ensure that the integrity and safety of the continuous fibers is maintained. Cutting the cable and splicing all of the fibers is not permitted.

C. Underground Installation: Fiber shall be installed underground in direct buried conduit as indicated on the Contract Drawings. For strands that will be terminated in the future, a mid-span entry ring cut shall be performed and the designated strands shall be extracted and coiled in a pull box until they can be terminated.

D. Cable Protection During Installation:

1. Care shall be exercised to reduce the possibility of damage to the outer jacket of the fiber optic cable. The requirements herein shall be followed at a minimum, but the Contractor shall be responsible for additional measures if necessary to protect the cable. Damage shall be repaired by the Contractor as part of the work.

2. The Contractor shall comply with the cable manufacturer's recommended installation procedures at all times.

3. The cable shall be carefully inspected for jacket defects as it is removed from the reel. If defects are noticed, the pulling operation shall be terminated immediately and the Engineer notified.

4. Precautions shall be taken during installation to prevent the cable from being kinked, crushed, or twisted. Crushed or kinked cable shall be replaced with new cable.

5. A cable feeder guide shall be used between the cable reel and the face of the duct and conduit to protect the cable and guide it off the reel and into the duct. A pulling eye shall be attached to the cable end to pull the cable through the duct and conduit system. As the cable is pulled off the reel and into the cable feeder guide, it shall be lubricated.

6. Dynamometers or break away pulling swings shall be used to ensure the pulling line tension does not exceed the installation tension values specified by the cable manufacturer. The mechanical stress placed upon the cable during installation shall not be such that the cable is twisted and stretched. Maximum allowable cable strain during installation shall be less than 0.75 percent.

E. Lubrication: As the cable is pulled into the conduit system, it shall be coated with a water-based lubricant approved by the cable manufacturer. Lubricant shall be applied at a rate to provide a continuous 10-mil coating or as recommended by the manufacturer. Lubricant shall be Polywater F7 manufactured by American Polywater or equal.

F. To accommodate long continuous installation lengths, bi-directional “center pull” techniques for pulling of the fiber optic cable are acceptable.

G. When power equipment is used to install fiber optic cables, the pulling speed shall not exceed 30 meters per minute. The pulling tension, bending radius, and twist limitation for fiber optic cable shall not be exceeded under any circumstances.

H. Large diameter wheels, pulling sheaves, and cable guides shall be used to maintain the appropriate bending radius. Tension monitoring shall be accomplished using commercial dynamometers or load cell instruments.

I. The pulling eye/sheath termination hardware on the fiber optic cables shall not be pulled over any sheave blocks.

J. Pulls shall be documented by a graph which is annotated with the following information:

1. Reel number

2. Station from and station to

3. Date and time

4. Explanations of abnormalities in readings or interruptions

5. Sign-off by Contractor and Engineer.

K. Under no conditions shall the cable be left exposed or unattended.

L. Repairs: Repair of cable jacket will not be permitted. Jacket damage shall require removal and re-installation of new cable at the Contractor's expense.

M. Installation at Pullboxes:

1. Pulling of the cable shall be hand assisted at each handhole or pullbox. The cable shall not be crushed, kinked, or forced around a sharp corner. Sufficient slack shall be left at each end of the cable to allow proper cable termination.

2. Pulling of the cable shall be hand assisted at each handhole or pullbox. The cable shall not be crushed, kinked, or forced around a sharp corner. Sufficient slack shall be left at each end of the cable to allow proper cable termination.

3. The cable shall be looped in all pullboxes as indicated to provide approximately 15-feet of extra cable in the pullbox. At termination points such as at cabinets or computers, a 15-foot loop shall also be provided wherever space permits. The fiber optic cable shall be coiled and secured with cable ties in the pullbox. The Contractor shall not compromise the minimum bending radius of the fiber optic cable when preparing this stored cable slack.

4. Imprinted plastic-coated cloth identification/warning tags shall be securely attached to the cables in at least two locations in each handhole. Tags shall be by Brady or Thomas & Betts.

5. When cables at each pullbox are securely racked, unused conduits and voids around conduit containing cables shall be sealed.

6. Cable Marking: At each pullbox and at each cabinet, the cable shall be visibly marked with yellow warning tape as follows:

   a. “CAUTION - FIBER OPTIC CABLE”

N. Splicing:

1. Splicing of fiber optic cable will not be permitted except in emergency conditions or if indicated otherwise. Cable runs and looping of the cable shall be provided in one continuous length. If the Engineer authorizes splicing, splicing shall be by trained, authorized persons only. Any allowed splicing of fiber optic cable shall be by fusion splice only; no mechanical splices are permitted.

2. Fusion splicing equipment shall be in good working order, properly calibrated, and meeting all industry standards and safety regulations. Cable preparation, closure installation and splicing shall be accomplished in accordance with accepted and approved industry standards.

3. Splices shall be made in pullboxes and using re-enterable splice closures.

4. The average splice loss shall be 0.1 dB or less per splice. The average splice loss is defined as the summation of the loss as measured in both directions using an optical time domain reflectometer (OTDR) through the fusion splice, divided by two. No individual splice loss measured in a single direction shall exceed 0.15 dB.

5. Upon completion of a splicing operation, waste material shall be deposited in suitable containers, removed from the Site, and disposed of in an environmentally acceptable manner.

O. Spares

1. Contractor to include two spare strands per well, looped and ready for future termination.

3.02 CONDUIT INSTALLATION:

A. General:

1. Conduit sections shall be joined in accordance with the manufacturers' recommendations. Joints shall be watertight.

2. Conduit shall be cleaned and tested prior to installation of cables.

3. Contractor shall install pull rope in the conduit.

4. Conduits entering pullboxes shall be sealed with duct plugs.

5. The conduit shall gradually and smoothly slope up to the elevation of the pullbox entrance. Use of manufactured bends shall be limited to an absolute minimum. Factory bends, if required, shall be no more than 222 degrees.

6. A trace wire shall be installed along the entire fiber optic cable route for use in active cable location. The trace wire shall be a #8 AWG bare-copper solid strand. No insulation or other coating material shall be on the trace wire. The trace wire shall have a termination at each pullbox for connection to testing equipment.

7. Identification Tape: A 6-inch wide magnetically detectable warning tape with orange protective polyethylene jacket resistant to alkalies, acids, and other destructive elements shall be installed along the entire length of the conduit route. The polyethylene tape shall be continuously imprinted “CAUTION-FIBER OPTIC CABLE”. The warning tape shall be Teletrace by Vikamatic, or equal.

B. Conduit Installation along Pipelines:

1. Conduits shall be installed on one side of the trench, at least 2-inches and not more than 12-inches in from the trench wall, at a depth of 3- to 4-feet below grade along the entire pipeline route. The conduit shall not cross over the pipeline.

2. Conduits shall clear concrete structures and vaults associated with the pipeline by a minimum of one (1) foot.

3. Conduit shall be installed in the annular space between the carrier pipe and the casing or tunnel liner for all 2-pass tunnel or jack and bore sections of the pipeline alignment.

4. Contractor shall install marker signs on marker posts for the pipeline as indicated.

3.03 PULLBOXES:

A. Field Location of Pullboxes

1. The Contract Drawings indicate the desired location of pullboxes, conduit runs, and other items. Exact locations shall be determined by the Contractor based on physical size and arrangement of equipment, finished elevations, calculated cable pulling tensions, field obstructions, and the criteria below. Locations on the Contract Drawings should be followed as closely as possible; however, pullboxes shall be located according to the following criteria:

2. At no point shall the cable pulling tension exceed 600 pounds. If cable pulling tension is calculated to exceed 600 pounds, additional pullboxes shall be provided at no extra cost to the Owner.

3. The maximum distance between any two pullboxes shall not exceed 1,200 feet.

4. Within the 1,200-feet distance, the Contractor shall install pullboxes at locations wherever the cumulative change of direction of the conduit exceeds 180 degrees.

5. The minimum bending radius for conduit shall be 3-feet.

6. A pullbox shall be installed on one side of a tunneled crossing. However, for any crossing, which requires more than 180 degrees of conduit bends to account for elevation differences or route adjustments, a pullbox shall be provided on both sides of the crossing.

7. Pullboxes shall be installed a minimum of 12-inches away from all structures.

B. Construction:

1. The Contractor shall install the pullbox covers so that the top of the cover is flush with the restored pavement. Pullboxes installed in soil areas shall be installed so that the top of the cover is at least one-inch but not more than 4-inches above the final grade level of the restored surface to prevent accumulation of dirt, silt, and debris on the top of the hand hole cover. Pullboxes installed in areas not subject to flooding or standing water shall have a minimum of five 5-inch drainage holes in the bottom of the box.

2. Contractor shall perform conduit integrity tests for each section between pullboxes after backfilling and compaction using the test and procedures described in this Section. These tests shall be performed prior to installation of the pull rope.

3. Pullbox conduit entries shall be sealed with duct plugs to prevent the intrusion of water and debris into the pullboxes.

4. Pullboxes shall be installed on a compacted level foundation consisting of 4-inches of granular material complying with the City of Dayton Construction and Material Specification, most recent edition.

5. Compaction around pullboxes and associated details shall be performed in accordance with the City of Dayton Construction and Material Specifications, most recent edition.

6. Upon final acceptance of the conduit system all pullboxes shall be free of debris and water and be ready for installation.

3.04 MODIFICATIONS:

A. All dimensions and exact locations of underground substructures shall be field verified. Minor changes in locations of pullboxes, which result in no additional costs for material or labor, shall be made at no additional cost to the Owner. However, the Contractor shall prepare proposals consisting of detailed material lists, cost estimates, and schedules for rerouting the conduit around existing unforeseen underground utilities and structures, which result in additional cost, to be considered in accordance with the provisions of the General Conditions.

B. The Contractor shall consider the following when preparing proposals:

1. Manufactured bends shall be minimized

2. Required bends shall be less than 222 degrees

3. Clearances between conduits and other structures shall be:

Structures	Minimum Separations
Power or other foreign conduit	12 inches
Pipe for electrical, gas, oil, water, sewage	6 inches when crossing 12 inches when parallel

3.05 FIBER OPTIC CABLE TESTING:

A. General: The Contractor shall perform pre-installation and post-installation FOC tests. The Engineer shall be notified a minimum of 10 days in advance so that these tests are witnessed. All test equipment shall be traceable to LIST standards.

B. Test Equipment: The Contractor shall use the following to perform pre-installation and post-installation FOC tests:

1. FiberXpert OTDR 5000 Optical Time Domain Reflectometer (OTDR)

2. Electronic reports shall be generated with Softing eXport software

C. Pre-Installation Tests:

1. The purpose of these tests is to perform acceptance tests on the cable prior to installation to verify that the cable conforms to the manufacturer's specifications, and is free of defects, breaks and damages by transportation and manufacturing processes.

2. Prior to removal of each cable from the delivery reel, all optical fibers within the cables shall be tested by the Contractor using an OTDR. The OTDR tests shall

consist of end-to-end length and fiber attenuation (dB/km) measurements to ensure proper performance of the fiber optic cable. The tests shall be performed from both ends of each fiber to ensure complete fiber continuity within the cable structure.

3. Pre-installation, “on-reel” test results shall be compared with the manufacturer's test report delivered with the cable. Gross dissimilarities shall be noted and remedied between the Contractor and manufacturer. In all cases, all fibers must meet the optical attenuation specifications prior to cable installation.

4. The Contractor shall perform tests on all reels of cable. The Engineer shall be notified a minimum of 15 days prior to any test.

5. The Contractor shall document each test and submit the report for review.

6. Cable shall not be installed until the Engineer has reviewed the test report.

7. Maximum allowable attenuation is 0.5 dB/km at 1310 and 1550 nm. The Contractor shall replace any cable in which any fiber does not meet this requirement.

D. Post-Installation Tests: After fiber optic cable has been installed the following tests shall be performed:

1. A recording OTDR shall be used to test for end-to-end continuity and attenuation of each optical fiber. The OTDR shall be equipped with a 1310 nm and 1550 nm light source for the single mode fiber (SMF). The OTDR shall have an X-Y plotter to provide a hard copy record of each trace of each fiber. The OTDR shall be equipped with sufficient internal masking to allow the entire cable section to be tested. This may be achieved by using an optical fiber pigtail of 30 feet or more to display the required cable section.

2. The maximum permissible end-to-end loss shall be 0.5 dB/km. The Contractor shall replace any cable in which any fiber does not meet this requirement.

3. The OTDR shall be calibrated for the correct index of refraction to provide proper length measurement for the known length of reference fiber.

4. A transmission test shall be performed with the use of a 1310 and 1550 nm stabilized light sources and 1310 nm/1550 nm power meters for SMF. This test shall be conducted in both directions on each fiber of each cable.

5. Hard and electronic copy of test documentation shall be submitted to the Engineer. The documentation shall include the trace plot, index, dB/km loss, cable length, date and time of test, wavelength, pulse width, the test site, cable ID, fiber number and type, and operator's initials. The Contractor shall compare the pre-installation test results to the post-installation results. If a deviation of greater than one dB occurs, the Engineer shall be notified in writing by the Contractor, and the cable shall be removed and replaced at no additional cost.

6. Upon completion of the previous tests all FOC coils shall be secured with ends capped to prevent intrusion of dirt and water.

E. Required OTDR Trace Information:

1. All traces shall display the entire length of cable under test, highlighting any localized loss discontinuities (installation-induced losses and/or connector losses). The trace shall display fiber length (in kilofeet), fiber loss (dB), and average fiber attenuation (in dB/km) as measured between two markers placed as near to the opposite ends of the fiber under test as is possible while still allowing an accurate reading. Care shall be taken to ensure that the markers are placed in the linear region of the trace: away from the front-end response and far-end Fresnel reflection spike. Time averaging shall be used to improve the display signal to noise ratio. The pulse width of the OTDR shall be set to a sufficient width to provide adequate injected power to measure the entire length of the fiber under test.

2. If connectors exist in the cable under test, then two traces shall be recorded. One trace shall record the fiber loss (dB) and average attenuation (dB/km) of the entire cable segment under test, including connectors. The second trace shall display a magnified view of the connector regions, revealing the connector losses (dB). All connector losses shall be measured using the 5-point splice loss measurement technique.

3. The OTDR trace shall also include the following information:

a. The date and time of the test

b. The cable ID number

c. The cable segment ID number

d. The fiber color or sub-cable number

e. Launch point connector number

f. The optical wavelength used for the test

g. The refractive index setting of the OTDR

h. The pulse width setting of the OTDR

i. The averaging interval of the test

3.06 CONDUIT SYSTEM CLEANING AND TESTING:

A. Following the backfill placement and compaction, all conduits shall be cleared of loose material by brush and compressed air.

B. Conduit shall be tested for leakage by air testing at 5 psi, maintaining the pressure for one hour without showing any leakage.

C. Following the leakage test, a test mandrel d inch smaller than the inside diameter shall be passed through all conduits to detect alignment and deformation problems. Mandrel shall be passed in both directions.

D. Cleaning and testing of the conduit shall be performed by the Contractor and witnessed by the Engineer. The cleaning and testing operation shall be conducted for each conduit section between adjacent pullboxes, a section at a time, for the entire route. The results of tests shall be documented by the Contractor and signed by the Engineer and the Contractor.

E. The Contractor shall provide a five-day advance notice of the schedule and location of test to the Engineer.

F. The Contractor shall remove and replace conduit which fails either test and shall repeat the test.

3.07 SYSTEM ACCEPTANCE:

A. After all network equipment, cables, and all other necessary devices are installed and tested and accepted by the Engineer, the Contractor shall conduct tests to verify that all the networks perform as a system as intended according to this specification. The Contractor shall demonstrate that the network is able to transmit/receive data and signals at the various user locations in the Well Field at the speed and quality as stipulated in this specification. The Contractor shall repair, adjust, and replace, at his cost any deficiency in material, equipment, and installation before the system will be accepted by the Engineer.

3.08 WARRANTY:

A. The Contractor shall furnish an unconditional warranty on fiber optic cable for a minimum period of two years following system acceptance.

Table 1.

Miami Well Field			
96-Strand Fiber for North Route			
Drawing Reference: I-106			
Hub Location	Remote Location	Buffer Tube	Strand
Recharge Pump Station	Well 34 I/O	Blue	Blue - Orange
Recharge Pump Station	Well 34 Spares	Blue	Green - Brown
Recharge Pump Station	E12 I/O	Blue	Slate - White
Recharge Pump Station	E12 Spares	Blue	Red - Black
Recharge Pump Station	P9 I/O	Blue	Yellow - Violet
Recharge Pump Station	P9 Spares	Blue	Rose - Aqua
Recharge Pump Station	E6 I/O	Orange	Blue - Orange
Recharge Pump Station	E6 Spares	Orange	Green - Brown
Recharge Pump Station	E4 I/O	Orange	Slate - White
Recharge Pump Station	E4 Spares	Orange	Red - Black
Recharge Pump Station	E5 I/O	Orange	Yellow - Violet
Recharge Pump Station	E5 Spares	Orange	Rose - Aqua
Recharge Pump Station	E7 I/O	Green	Blue - Orange
Recharge Pump Station	E7 Spares	Green	Green - Brown
Recharge Pump Station	Well 35 I/O	Green	Slate - White
Recharge Pump Station	Well 35 Spares	Green	Red - Black
Recharge Pump Station	P7 I/O	Green	Yellow - Violet
Recharge Pump Station	P7 Spares	Green	Rose - Aqua
Recharge Pump Station	Future Well I/O	Brown	Blue - Orange
Recharge Pump Station	Future Well Spares	Brown	Green - Brown
Recharge Pump Station	P6 I/O	Brown	Slate - White
Recharge Pump Station	P6 Spares	Brown	Red - Black
Recharge Pump Station	H10-H11 I/O	Brown	Yellow - Violet
Recharge Pump Station	H10-H11 Spares	Brown	Rose - Aqua
Recharge Pump Station	H9 I/O	Slate	Blue - Orange
Recharge Pump Station	H9 Spares	Slate	Green - Brown
Recharge Pump Station	P8 I/O	Slate	Slate - White
Recharge Pump Station	P8 Spares	Slate	Red - Black
Recharge Pump Station	P4 I/O	Slate	Yellow - Violet
Recharge Pump Station	P4 Spares	Slate	Rose - Aqua
Recharge Pump Station	Future Well I/O	White	Blue - Orange
Recharge Pump Station	Future Well Spares	White	Green - Brown
Recharge Pump Station	P3 I/O	White	Slate - White
Recharge Pump Station	P3 Spares	White	Red - Black
Recharge Pump Station	Future Well I/O	White	Yellow - Violet

Recharge Pump Station	Future Well Spares	White	Rose - Aqua
Recharge Pump Station	P2 I/O	Red	Blue - Orange
Recharge Pump Station	P2 Spares	Red	Green - Brown
Recharge Pump Station	P1 I/O	Red	Slate - White
Recharge Pump Station	P1 Spares	Red	Red - Black
Recharge Pump Station	Spares	Red	Yellow - Violet
Recharge Pump Station	Spares	Red	Rose - Aqua
Recharge Pump Station	Spares	Black	Blue - Orange
Recharge Pump Station	Spares	Black	Green - Brown
Recharge Pump Station	Spares	Black	Slate - White
Recharge Pump Station	Spares	Black	Red - Black
Recharge Pump Station	Spares	Black	Yellow - Violet
Recharge Pump Station	Spares	Black	Rose - Aqua

Table 2.

Miami Well Field			
96-Strand Fiber for South Route			
Drawing Reference: I-104			
Hub Location	Remote Location	Buffer Tube	Strand
Recharge Pump Station	Well 23 I/O	Blue	Blue - Orange
Recharge Pump Station	Well 23 Spares	Blue	Green - Brown
Recharge Pump Station	Well 27 I/O	Blue	Slate - White
Recharge Pump Station	Well 27 Spares	Blue	Red - Black
Recharge Pump Station	Well 28 I/O	Blue	Yellow - Violet
Recharge Pump Station	Well 28 Spares	Blue	Rose - Aqua
Recharge Pump Station	K2 I/O	Orange	Blue - Orange
Recharge Pump Station	K2 Spares	Orange	Green - Brown
Recharge Pump Station	K1 I/O	Orange	Slate - White
Recharge Pump Station	K1 Spares	Orange	Red - Black
Recharge Pump Station	Spares	Orange	Yellow - Violet
Recharge Pump Station	Spares	Orange	Rose - Aqua
Recharge Pump Station	Well 29 I/O	Green	Blue - Orange
Recharge Pump Station	Well 29 Spares	Green	Green - Brown
Recharge Pump Station	K3 I/O	Green	Slate - White
Recharge Pump Station	K3 Spares	Green	Red - Black
Recharge Pump Station	P10 I/O	Green	Yellow - Violet
Recharge Pump Station	P10 Spares	Green	Rose - Aqua
Recharge Pump Station	K4 I/O	Brown	Blue - Orange
Recharge Pump Station	K4 Spares	Brown	Green - Brown
Recharge Pump Station	K5 I/O	Brown	Slate - White

Recharge Pump Station	K5 Spares	Brown	Red - Black
Recharge Pump Station	K6 I/O	Brown	Yellow - Violet
Recharge Pump Station	K6 Spares	Brown	Rose - Aqua
Recharge Pump Station	Spares	Slate	Blue - Orange
Recharge Pump Station	Spares	Slate	Green - Brown
Recharge Pump Station	Spares	Slate	Slate - White
Recharge Pump Station	Spares	Slate	Red - Black
Recharge Pump Station	Spares	Slate	Yellow - Violet
Recharge Pump Station	Spares	Slate	Rose - Aqua
Recharge Pump Station	Spares	White	Blue - Orange
Recharge Pump Station	Spares	White	Green - Brown
Recharge Pump Station	Spares	White	Slate - White
Recharge Pump Station	Spares	White	Red - Black
Recharge Pump Station	Spares	White	Yellow - Violet
Recharge Pump Station	Spares	White	Rose - Aqua
Recharge Pump Station	Spares	Red	Blue - Orange
Recharge Pump Station	Spares	Red	Green - Brown
Recharge Pump Station	Spares	Red	Slate - White
Recharge Pump Station	Spares	Red	Red - Black
Recharge Pump Station	Spares	Red	Yellow - Violet
Recharge Pump Station	Spares	Red	Rose - Aqua
Recharge Pump Station	Spares	Black	Blue - Orange
Recharge Pump Station	Spares	Black	Green - Brown
Recharge Pump Station	Spares	Black	Slate - White
Recharge Pump Station	Spares	Black	Red - Black
Recharge Pump Station	Spares	Black	Yellow - Violet
Recharge Pump Station	Spares	Black	Rose - Aqua

Table 3.

Miami Well Field			
96-Strand Fiber for East Route			
Drawing Reference: I-107			
Hub Location	Remote Location	Buffer Tube	Strand
Recharge Pump Station	Well 25 I/O	Blue	Blue - Orange
Recharge Pump Station	Well 25 Spares	Blue	Green - Brown
Recharge Pump Station	Well 26 I/O	Blue	Slate - White
Recharge Pump Station	Well 26 Spares	Blue	Red - Black
Recharge Pump Station	E1 I/O	Blue	Yellow - Violet
Recharge Pump Station	E1 Spares	Blue	Rose - Aqua
Recharge Pump Station	P11 I/O	Orange	Blue - Orange

Recharge Pump Station	P11 Spares	Orange	Green - Brown
Recharge Pump Station	Future Well I/O	Orange	Slate - White
Recharge Pump Station	Future Well Spares	Orange	Red - Black
Recharge Pump Station	E2-E3 I/O	Orange	Yellow - Violet
Recharge Pump Station	E2-E3 Spares	Orange	Rose - Aqua
Recharge Pump Station	P12 I/O	Green	Blue - Orange
Recharge Pump Station	P12 Spares	Green	Green - Brown
Recharge Pump Station	Future Well I/O	Green	Slate - White
Recharge Pump Station	Future Well Spares	Green	Red - Black
Recharge Pump Station	Future Well I/O	Green	Yellow - Violet
Recharge Pump Station	Future Well Spares	Green	Rose - Aqua
Recharge Pump Station	Well EI I/O	Brown	Blue - Orange
Recharge Pump Station	Well EI Spares	Brown	Green - Brown
Recharge Pump Station	KI Well I/O	Brown	Slate - White
Recharge Pump Station	KI Well Spares	Brown	Red - Black
Recharge Pump Station	Well 36 I/O	Brown	Yellow - Violet
Recharge Pump Station	Well 36 Spares	Brown	Rose - Aqua
Recharge Pump Station	E10 I/O	Slate	Blue - Orange
Recharge Pump Station	E10 Spares	Slate	Green - Brown
Recharge Pump Station	E8-E11 I/O	Slate	Slate - White
Recharge Pump Station	E8-E11 Spares	Slate	Red - Black
Recharge Pump Station	Spares	Slate	Yellow - Violet
Recharge Pump Station	Spares	Slate	Rose - Aqua
Recharge Pump Station	E9 I/O	White	Blue - Orange
Recharge Pump Station	E9 Spares	White	Green - Brown
Recharge Pump Station	P5 I/O	White	Slate - White
Recharge Pump Station	P5 Spares	White	Red - Black
Recharge Pump Station	Spares	White	Yellow - Violet
Recharge Pump Station	Spares	White	Rose - Aqua
Recharge Pump Station	H16 I/O	Red	Blue - Orange
Recharge Pump Station	H16 Spares	Red	Green - Brown
Recharge Pump Station	Future Well I/O	Red	Slate - White
Recharge Pump Station	Future Well Spares	Red	Red - Black
Recharge Pump Station	Spares	Red	Yellow - Violet
Recharge Pump Station	Spares	Red	Rose - Aqua
Recharge Pump Station	Spares	Black	Blue - Orange
Recharge Pump Station	Spares	Black	Green - Brown
Recharge Pump Station	Spares	Black	Slate - White
Recharge Pump Station	Spares	Black	Red - Black
Recharge Pump Station	Spares	Black	Yellow - Violet

Recharge Pump Station	Spares	Black	Rose - Aqua

Table 4.

Miami Well Field			
96-Strand Fiber for West Route			
Drawing Reference: I-105			
Hub Location	Remote Location	Buffer Tube	Strand
Recharge Pump Station	Well 24 I/O	Blue	Blue - Orange
Recharge Pump Station	Well 24 Spares	Blue	Green - Brown
Recharge Pump Station	H12 I/O	Blue	Slate - White
Recharge Pump Station	H12 Spares	Blue	Red - Black
Recharge Pump Station	Well 33 I/O	Blue	Yellow - Violet
Recharge Pump Station	Well 33 Spares	Blue	Rose - Aqua
Recharge Pump Station	H7-H8 I/O	Orange	Blue - Orange
Recharge Pump Station	H7-H8 Spares	Orange	Green - Brown
Recharge Pump Station	H6 I/O	Orange	Slate - White
Recharge Pump Station	H6 Spares	Orange	Red - Black
Recharge Pump Station	Well 32 I/O	Orange	Yellow - Violet
Recharge Pump Station	Well 32 Spares	Orange	Rose - Aqua
Recharge Pump Station	Well 30 I/O	Green	Blue - Orange
Recharge Pump Station	Well 30 Spares	Green	Green - Brown
Recharge Pump Station	Well 31 I/O	Green	Slate - White
Recharge Pump Station	Well 31 Spares	Green	Red - Black
Recharge Pump Station	H13 I/O	Green	Yellow - Violet
Recharge Pump Station	H13 Spares	Green	Rose - Aqua
Recharge Pump Station	H5 I/O	Brown	Blue - Orange
Recharge Pump Station	H5 Spares	Brown	Green - Brown
Recharge Pump Station	H3 I/O	Brown	Slate - White
Recharge Pump Station	H3 Spares	Brown	Red - Black
Recharge Pump Station	H1-H2 I/O	Brown	Yellow - Violet
Recharge Pump Station	H1-H2 Spares	Brown	Rose - Aqua
Recharge Pump Station	H4 I/O	Slate	Blue - Orange
Recharge Pump Station	H4 Spares	Slate	Green - Brown
Recharge Pump Station	Future Well I/O	Slate	Slate - White
Recharge Pump Station	Future Well Spares	Slate	Red - Black
Recharge Pump Station	Spares	Slate	Yellow - Violet
Recharge Pump Station	Spares	Slate	Rose - Aqua
Recharge Pump Station	Spares	White	Blue - Orange
Recharge Pump Station	Spares	White	Green - Brown
Recharge Pump Station	Spares	White	Slate - White

Recharge Pump Station	Spares	White	Red - Black
Recharge Pump Station	Spares	White	Yellow - Violet
Recharge Pump Station	Spares	White	Rose - Aqua
Recharge Pump Station	Spares	Red	Blue - Orange
Recharge Pump Station	Spares	Red	Green - Brown
Recharge Pump Station	Spares	Red	Slate - White
Recharge Pump Station	Spares	Red	Red - Black
Recharge Pump Station	Spares	Red	Yellow - Violet
Recharge Pump Station	Spares	Red	Rose - Aqua
Recharge Pump Station	Spares	Black	Blue - Orange
Recharge Pump Station	Spares	Black	Green - Brown
Recharge Pump Station	Spares	Black	Slate - White
Recharge Pump Station	Spares	Black	Red - Black
Recharge Pump Station	Spares	Black	Yellow - Violet
Recharge Pump Station	Spares	Black	Rose - Aqua

END OF SECTION

SECTION 16905

CONTROL NARRATIVES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. The Work of this Section includes programming and control logic for new control systems. Except where this section is applied to Vendor Control Panels, the Supplier is not to provide PLC or OIT programming services. PLC and OIT programming for all PLCs, as well as any modifications to existing PLCs, shall be provided by the Owner's SCADA Systems Integrator.

1.02 RELATED SECTIONS:

A. Section 13400 – Measurement and Controls Instrumentation

B. Section 13450 – Programmable Logic Controllers

C. Section 13490 – System Testing and Quality Control

1.03 SUBMITTALS:

A. Submit a written listing of all control systems that will require PLC programming logic.

B. Provide written request for clarification describing any additional control narrative information required from Engineer or Owner.

1.04 OPERATIONS AND MAINTENANCE DATA:

A. Submit revised controls narratives.

PART 2 – PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 PROGRAM DEVELOPMENT

A. The PLC and HMI programming standards are to be developed in accordance with the Owners preferences. The PLC and HMI programs will adhere to these standards. This includes, but is not limited to:

1. Tagnaming convention.

2. Color schemes.

3. Graphical object representation

4. Alarms

3.02 CONTROL NARRATIVE FORMAT

A. Control Narratives are presented in the attached Control Narrative document in the following format:

1. P&ID: Identifies the associated Process and Instrumentation Drawing.

2. Equipment Identification: Describes the equipment to be controlled (e.g., Wet Residual Transfer Pumps) and the associated equipment tag numbers (e.g., WR-WXP-01).

3. General: Provides a general overview of the function of the equipment within the process.

4. Signals: Lists all signals related to control of the equipment. The list includes the following:
   a. Tagname: Tagname entered into the SCADA database. SCADA tagnames are based on, but do not match, the designated equipment tag numbers. They follow the tag naming conventions used throughout the City of Datyon's SCADA system. Tags will follow the PlantPAx data type as applicable. As an example:

      The tagname HYP_P01.Sts_Running includes the following information:
      a. HYP = Area or section of process area
      b. P01 = Equipment
      c. Sts_Running = Data type from PlantPAx instructions

      The tagname FAC_RES_LI.Val includes the following information:
      a. FAC = Area or section of process area
      b. RES = Equipment
      c. LI = Indication/command description
      d. Val = Data type from PlantPAx Instructions

b. Type: Identifies how the tagname is linked to the SCADA system:
   a. AI: Hardwired analog input to the PLC
   b. DI: Hardwired digital input to the PLC
   c. AO: Hardwired analog output from the PLC
   d. DO: Hardwired digital output from the PLC
   e. SFT/xx: Signal is directly linked via the SCADA network. All signals to/from vendor PLC control systems are identified as SFT ('software') signals. /xx designates signal type. Example – SFT/AI represents an Analog Input signal type to the PLC from the SCADA network.

5. Automatic Control: Defines the control functions when the equipment or associated process is placed in SCADA Automatic.

6. Manual Control: Defines the control functions when the equipment or associated process is placed in SCADA Manual.

7. Interlocks and Alarms:

   a. Defines interlock conditions which affect equipment operation. Interlock conditions will prevent equipment from operating, whether that equipment is operating or not. For example, High Pump Discharge Pressure will typically cause the control system to shut down the associated pump.

   b. This section also identifies additional alarm conditions which will not affect equipment operation but will trigger a SCADA alarm.

3.03 CONTROL NARRATIVES:

A. Pump Station (P&ID: I-603)

1. General
   a. The Miami Well Field Recharge pump station is used to pump water from the Miami River to the well field recharge ponds. There are a total of 6 constant speed pumps – 5 existing and 1 new.

2. Signals

Tagname	Type	Description	Display	Historian
MIA-RPS-P01-YN	SFT/DI	Pump 1 Running/Stopped Status	Y	N
MIA-RPS-P01-YC	SFT/DO	Pump 1 Run Command	N	N
MIA-RPS-P01-ZS	DI	Pump 1 Valve Status	Y	N
MIA-RPS-P01-PI	AI	Pump 1 Pressure	Y	Y
MIA-RPS-P02-YN	SFT/DI	Pump 2 Running/Stopped Status	Y	N

Tagname	Type	Description	Display	Historian
MIA-RPS-P02-YC	SFT/DO	Pump 2 Run Command	N	N
MIA-RPS-P02-ZS	DI	Pump 2 Valve Status	Y	N
MIA-RPS-P02-PI	AI	Pump 2 Pressure	Y	Y
MIA-RPS-P03-YN	SFT/DI	Pump 3 Running/Stopped Status	Y	N
MIA-RPS-P03-YC	SFT/DO	Pump 3 Run Command	N	N
MIA-RPS-P03-ZS	DI	Pump 3 Valve Status	Y	N
MIA-RPS-P03-PI	AI	Pump 3 Pressure	Y	Y
MIA-RPS-P04-YN	SFT/DI	Pump 4 Running/Stopped Status	Y	N
MIA-RPS-P04-YC	SFT/DO	Pump 4 Run Command	N	N
MIA-RPS-P04-ZS	DI	Pump 4 Valve Status	Y	N
MIA-RPS-P04-PI	AI	Pump 4 Pressure	Y	Y
MIA-RPS-P05-YN	SFT/DI	Pump 5 Running/Stopped Status	Y	N
MIA-RPS-P05-YC	SFT/DO	Pump 5 Run Command	N	N
MIA-RPS-P05-ZS	DI	Pump 5 Valve Status	Y	N
MIA-RPS-P05-PI	AI	Pump 5 Pressure	Y	Y
MIA-RPS-P06-YN	SFT/DI	Pump 6 Running/Stopped Status	Y	N
MIA-RPS-P06-YC	SFT/DO	Pump 6 Run Command	N	N
MIA-RPS-P06-ZS	DI	Pump 6 Valve Status	Y	N
MIA-RPS-P06-PI	AI	Pump 6 Pressure	Y	Y
MIA-RPS-WW-YA	DI	Wet Well Alarm	Y	Y
MIA-RPS-BDG-YA	DI	Building Entry Alarm	Y	Y
MIA-RPS-TURB-AI	AI	Raw Water Pump Turbidity	Y	Y
MIA-RPS-FI	AI	Recharge Lagoon Flow Rate	Y	Y
MIA-RPS-H2O-PI	AI	Water Pressure	Y	Y

Tagname	Type	Description	Display	Historian
MIA-RPS-P06-FI	AI	Pump 6 Flow	Y	Y

3. Automatic Control:
   a. In SCADA Auto Mode, the 6 recharge pumps will turn on and off to meet the total recharge flowrate needed by the active ponds. The recharge rate for each pond is visible from SCADA along with the predicted flowrate based on which pumps are running. Since the pumps are constant speed, they cannot hit a specific flow setpoint but will maintain the flow within an operator-adjustable deadband. The pumps operate in a Lead/Lag1/Lag2/Lag3/Lag4/Lag5 configuration. The pump ranking is automatically based on runtime hours to balance wear on the pumps. This ranking can be overwritten by an authorized user from the HMI.
4. Manual Control:
   a. In SCADA Manual Mode, an authorized user can turn pumps on and off from the HMI, based on the amount of recharge flow needed.
5. Interlocks and Alarms:
   a. Interlocks:
      i. An individual pump will stop if:
         1. The pump valve is closed.
         2. The pump discharge pressure is high.
      ii. All pumps will stop if:
         1. High Raw Water Turbidity is sustained over an operator-adjustable time setpoint.
         2. All the pond flow control valves are closed.
         3. All the ponds are at their respective high level setpoints.
   b. Alarms:
      i. Wet Well Alarm.
      ii. Building Entry Alarm.
      iii. Pump 1 failed to start.
      iv. Pump 1 failed to stop.
      v. Pump 2 failed to start.
      vi. Pump 2 failed to stop.
      vii. Pump 3 failed to start.
      viii. Pump 3 failed to stop.
      ix. Pump 4 failed to start.
      x. Pump 4 failed to stop.
      xi. Pump 5 failed to start.
      xii. Pump 5 failed to stop.
      xiii. Pump 6 failed to start.
      xiv. Pump 6 failed to stop.

B. Ponds (P&ID: I-604 and I-605)

1. General
   a. There are a total of 44 recharge ponds in the Miami Recharge Well Field – 12 existing E ponds, 14 existing H ponds, 6 existing K ponds, and 12 new P ponds. In general, each pond has a modulating valve, a level radar

transmitter, and a high-level switch. The following ponds share a modulating valve, level radar transmitter, and high-level switch:

i. E2 and E3.
ii. E8 and E11.
iii. H1 and H2.
iv. H7 and H8.
v. H10 and H11.

2. Signals

Tagname	Type	Description	Display	Historian
MIA-WFD-E1-HSR	SFT/DI	E1 Flow Control Valve in Remote	Y	N
MIA-WFD-E1-ZI	SFT/AI	E1 Flow Control Valve Position Feedback	Y	N
MIA-WFD-E1-ZC	SFT/AO	E1 Flow Control Valve Position Command	N	N
MIA-WFD-E1-LSH	DI	E1 Pond High Level Alarm	Y	Y
MIA-WFD-E1-LI	AI	E1 Pond Level	Y	Y
MIA-WFD-E2-E3-HSR	SFT/DI	E2-E3 Flow Control Valve in Remote	Y	N
MIA-WFD-E2-E3-ZI	SFT/AI	E2-E3 Flow Control Valve Position Feedback	Y	N
MIA-WFD-E2-E3-ZC	SFT/AO	E2-E3 Flow Control Valve Position Command	N	N
MIA-WFD-E2-E3-LSH	DI	E2-E3 Pond High Level Alarm	Y	Y
MIA-WFD-E2-E3-LI	AI	E2-E3 Pond Level	Y	Y
MIA-WFD-E4-HSR	SFT/DI	E4 Flow Control Valve in Remote	Y	N
MIA-WFD-E4-ZI	SFT/AI	E4 Flow Control Valve Position Feedback	Y	N
MIA-WFD-E4-ZC	SFT/AO	E4 Flow Control Valve Position Command	N	N
MIA-WFD-E4-LSH	DI	E4 Pond High Level Alarm	Y	Y
MIA-WFD-E4-LI	AI	E4 Pond Level	Y	Y
MIA-WFD-E5-HSR	SFT/DI	E5 Flow Control Valve in Remote	Y	N
MIA-WFD-E5-ZI	SFT/AI	E5 Flow Control Valve Position Feedback	Y	N
MIA-WFD-E5-ZC	SFT/AO	E5 Flow Control Valve Position Command	N	N
MIA-WFD-	DI	E5 Pond High Level Alarm	Y	Y

Tagname	Type	Description	Display	Historian
E5-LSH				
MIA-WFD-E5-LI	AI	E5 Pond Level	Y	Y
MIA-WFD-E6-HSR	SFT/DI	E6 Flow Control Valve in Remote	Y	N
MIA-WFD-E6-ZI	SFT/AI	E6 Flow Control Valve Position Feedback	Y	N
MIA-WFD-E6-ZC	SFT/AO	E6 Flow Control Valve Position Command	N	N
MIA-WFD-E6-LSH	DI	E6 Pond High Level Alarm	Y	Y
MIA-WFD-E6-LI	AI	E6 Pond Level	Y	Y
MIA-WFD-E7-HSR	SFT/DI	E7 Flow Control Valve in Remote	Y	N
MIA-WFD-E7-ZI	SFT/AI	E7 Flow Control Valve Position Feedback	Y	N
MIA-WFD-E7-ZC	SFT/AO	E7 Flow Control Valve Position Command	N	N
MIA-WFD-E7-LSH	DI	E7 Pond High Level Alarm	Y	Y
MIA-WFD-E7-LI	AI	E7 Pond Level	Y	Y
MIA-WFD-E8-E11-HSR	SFT/DI	E8-E11 Flow Control Valve in Remote	Y	N
MIA-WFD-E8-E11-ZI	SFT/AI	E8-E11 Flow Control Valve Position Feedback	Y	N
MIA-WFD-E8-E11-ZC	SFT/AO	E8-E11 Flow Control Valve Position Command	N	N
MIA-WFD-E8-E11-LSH	DI	E8-E11 Pond High Level Alarm	Y	Y
MIA-WFD-E8-E11-LI	AI	E8-E11 Pond Level	Y	Y
MIA-WFD-E9-HSR	SFT/DI	E9 Flow Control Valve in Remote	Y	N
MIA-WFD-E9-ZI	SFT/AI	E9 Flow Control Valve Position Feedback	Y	N
MIA-WFD-E9-ZC	SFT/AO	E9 Flow Control Valve Position Command	N	N
MIA-WFD-E9-LSH	DI	E9 Pond High Level Alarm	Y	Y
MIA-WFD-E9-LI	AI	E9 Pond Level	Y	Y
MIA-WFD-E10-HSR	SFT/DI	E10 Flow Control Valve in Remote	Y	N
MIA-WFD-E10-ZI	SFT/AI	E10 Flow Control Valve Position Feedback	Y	N

Tagname	Type	Description	Display	Historian
MIA-WFD-E10-ZC	SFT/AO	E10 Flow Control Valve Position Command	N	N
MIA-WFD-E10-LSH	DI	E10 Pond High Level Alarm	Y	Y
MIA-WFD-E10-LI	AI	E10 Pond Level	Y	Y
MIA-WFD-E12-HSR	SFT/DI	E12 Flow Control Valve in Remote	Y	N
MIA-WFD-E12-ZI	SFT/AI	E12 Flow Control Valve Position Feedback	Y	N
MIA-WFD-E12-ZC	SFT/AO	E12 Flow Control Valve Position Command	N	N
MIA-WFD-E12-LSH	DI	E12 Pond High Level Alarm	Y	Y
MIA-WFD-E12-LI	AI	E12 Pond Level	Y	Y
MIA-WFD-H1-H2-HSR	SFT/DI	H1-H2 Flow Control Valve in Remote	Y	N
MIA-WFD-H1-H2-ZI	SFT/AI	H1-H2 Flow Control Valve Position Feedback	Y	N
MIA-WFD-H1-H2-ZC	SFT/AO	H1-H2 Flow Control Valve Position Command	N	N
MIA-WFD-H1-H2-LSH	DI	H1-H2 Pond High Level Alarm	Y	Y
MIA-WFD-H1-H2-LI	AI	H1-H2 Pond Level	Y	Y
MIA-WFD-H3-HSR	SFT/DI	H3 Flow Control Valve in Remote	Y	N
MIA-WFD-H3-ZI	SFT/AI	H3 Flow Control Valve Position Feedback	Y	N
MIA-WFD-H3-ZC	SFT/AO	H3 Flow Control Valve Position Command	N	N
MIA-WFD-H3-LSH	DI	H3 Pond High Level Alarm	Y	Y
MIA-WFD-H3-LI	AI	H3 Pond Level	Y	Y
MIA-WFD-H4-HSR	SFT/DI	H4 Flow Control Valve in Remote	Y	N
MIA-WFD-H4-ZI	SFT/AI	H4 Flow Control Valve Position Feedback	Y	N
MIA-WFD-H4-ZC	SFT/AO	H4 Flow Control Valve Position Command	N	N
MIA-WFD-H4-LSH	DI	H4 Pond High Level Alarm	Y	Y
MIA-WFD-H4-LI	AI	H4 Pond Level	Y	Y
MIA-WFD-	SFT/DI	H5 Flow Control Valve in Remote	Y	N

Tagname	Type	Description	Display	Historian
H5-HSR				
MIA-WFD-H5-ZI	SFT/AI	H5 Flow Control Valve Position Feedback	Y	N
MIA-WFD-H5-ZC	SFT/AO	H5 Flow Control Valve Position Command	N	N
MIA-WFD-H5-LSH	DI	H5 Pond High Level Alarm	Y	Y
MIA-WFD-H5-LI	AI	H5 Pond Level	Y	Y
MIA-WFD-H6-HSR	SFT/DI	H6 Flow Control Valve in Remote	Y	N
MIA-WFD-H6-ZI	SFT/AI	H6 Flow Control Valve Position Feedback	Y	N
MIA-WFD-H6-ZC	SFT/AO	H6 Flow Control Valve Position Command	N	N
MIA-WFD-H6-LSH	DI	H6 Pond High Level Alarm	Y	Y
MIA-WFD-H6-LI	AI	H6 Pond Level	Y	Y
MIA-WFD-H7-H8-HSR	SFT/DI	H7-H8 Flow Control Valve in Remote	Y	N
MIA-WFD-H7-H8-ZI	SFT/AI	H7-H8 Flow Control Valve Position Feedback	Y	N
MIA-WFD-H7-H8-ZC	SFT/AO	H7-H8 Flow Control Valve Position Command	N	N
MIA-WFD-H7-H8-LSH	DI	H7-H8 Pond High Level Alarm	Y	Y
MIA-WFD-H7-H8-LI	AI	H7-H8 Pond Level	Y	Y
MIA-WFD-H9-HSR	SFT/DI	H9 Flow Control Valve in Remote	Y	N
MIA-WFD-H9-ZI	SFT/AI	H9 Flow Control Valve Position Feedback	Y	N
MIA-WFD-H9-ZC	SFT/AO	H9 Flow Control Valve Position Command	N	N
MIA-WFD-H9-LSH	DI	H9 Pond High Level Alarm	Y	Y
MIA-WFD-H9-LI	AI	H9 Pond Level	Y	Y
MIA-WFD-H10-H11-HSR	SFT/DI	H10-H11 Flow Control Valve in Remote	Y	N
MIA-WFD-H10-H11-ZI	SFT/AI	H10-H11 Flow Control Valve Position Feedback	Y	N
MIA-WFD-H10-H11-ZC	SFT/AO	H10-H11 Flow Control Valve Position Command	N	N
MIA-WFD-H10-H11-LSH	DI	H10-H11 Pond High Level Alarm	Y	Y

Tagname	Type	Description	Display	Historian
MIA-WFD-H10-H11-LI	AI	H10-H11 Pond Level	Y	Y
MIA-WFD-H12-HSR	SFT/DI	H12 Flow Control Valve in Remote	Y	N
MIA-WFD-H12-ZI	SFT/AI	H12 Flow Control Valve Position Feedback	Y	N
MIA-WFD-H12-ZC	SFT/AO	H12 Flow Control Valve Position Command	N	N
MIA-WFD-H12-LSH	DI	H12 Pond High Level Alarm	Y	Y
MIA-WFD-H12-LI	AI	H12 Pond Level	Y	Y
MIA-WFD-H13-HSR	SFT/DI	H13 Flow Control Valve in Remote	Y	N
MIA-WFD-H13-ZI	SFT/AI	H13 Flow Control Valve Position Feedback	Y	N
MIA-WFD-H13-ZC	SFT/AO	H13 Flow Control Valve Position Command	N	N
MIA-WFD-H13-LSH	DI	H13 Pond High Level Alarm	Y	Y
MIA-WFD-H13-LI	AI	H13 Pond Level	Y	Y
MIA-WFD-H16-HSR	SFT/DI	H16 Flow Control Valve in Remote	Y	N
MIA-WFD-H16-ZI	SFT/AI	H16 Flow Control Valve Position Feedback	Y	N
MIA-WFD-H16-ZC	SFT/AO	H16 Flow Control Valve Position Command	N	N
MIA-WFD-H16-LSH	DI	H16 Pond High Level Alarm	Y	Y
MIA-WFD-H16-LI	AI	H16 Pond Level	Y	Y
MIA-WFD-K1-HSR	SFT/DI	K1 Flow Control Valve in Remote	Y	N
MIA-WFD-K1-ZI	SFT/AI	K1 Flow Control Valve Position Feedback	Y	N
MIA-WFD-K1-ZC	SFT/AO	K1 Flow Control Valve Position Command	N	N
MIA-WFD-K1-LSH	DI	K1 Pond High Level Alarm	Y	Y
MIA-WFD-K1-LI	AI	K1 Pond Level	Y	Y
MIA-WFD-K2-HSR	SFT/DI	K2 Flow Control Valve in Remote	Y	N
MIA-WFD-K2-ZI	SFT/AI	K2 Flow Control Valve Position Feedback	Y	N
MIA-WFD-	SFT/AO	K2 Flow Control Valve Position Command	N	N

Tagname	Type	Description	Display	Historian
K2-ZC				
MIA-WFD-K2-LSH	DI	K2 Pond High Level Alarm	Y	Y
MIA-WFD-K2-LI	AI	K2 Pond Level	Y	Y
MIA-WFD-K3-HSR	SFT/DI	K3 Flow Control Valve in Remote	Y	N
MIA-WFD-K3-ZI	SFT/AI	K3 Flow Control Valve Position Feedback	Y	N
MIA-WFD-K3-ZC	SFT/AO	K3 Flow Control Valve Position Command	N	N
MIA-WFD-K3-LSH	DI	K3 Pond High Level Alarm	Y	Y
MIA-WFD-K3-LI	AI	K3 Pond Level	Y	Y
MIA-WFD-K4-HSR	SFT/DI	K4 Flow Control Valve in Remote	Y	N
MIA-WFD-K4-ZI	SFT/AI	K4 Flow Control Valve Position Feedback	Y	N
MIA-WFD-K4-ZC	SFT/AO	K4 Flow Control Valve Position Command	N	N
MIA-WFD-K4-LSH	DI	K4 Pond High Level Alarm	Y	Y
MIA-WFD-K4-LI	AI	K4 Pond Level	Y	Y
MIA-WFD-K5-HSR	SFT/DI	K5 Flow Control Valve in Remote	Y	N
MIA-WFD-K5-ZI	SFT/AI	K5 Flow Control Valve Position Feedback	Y	N
MIA-WFD-K5-ZC	SFT/AO	K5 Flow Control Valve Position Command	N	N
MIA-WFD-K5-LSH	DI	K5 Pond High Level Alarm	Y	Y
MIA-WFD-K5-LI	AI	K5 Pond Level	Y	Y
MIA-WFD-K6-HSR	SFT/DI	K6 Flow Control Valve in Remote	Y	N
MIA-WFD-K6-ZI	SFT/AI	K6 Flow Control Valve Position Feedback	Y	N
MIA-WFD-K6-ZC	SFT/AO	K6 Flow Control Valve Position Command	N	N
MIA-WFD-K6-LSH	DI	K6 Pond High Level Alarm	Y	Y
MIA-WFD-K6-LI	AI	K6 Pond Level	Y	Y
MIA-WFD-P1-HSR	SFT/DI	P1 Flow Control Valve in Remote	Y	N

Tagname	Type	Description	Display	Historian
MIA-WFD-P1-ZI	SFT/AI	P1 Flow Control Valve Position Feedback	Y	N
MIA-WFD-P1-ZC	SFT/AO	P1 Flow Control Valve Position Command	N	N
MIA-WFD-P1-LSH	DI	P1 Pond High Level Alarm	Y	Y
MIA-WFD-P1-LI	AI	P1 Pond Level	Y	Y
MIA-WFD-P2-HSR	SFT/DI	P2 Flow Control Valve in Remote	Y	N
MIA-WFD-P2-ZI	SFT/AI	P2 Flow Control Valve Position Feedback	Y	N
MIA-WFD-P2-ZC	SFT/AO	P2 Flow Control Valve Position Command	N	N
MIA-WFD-P2-LSH	DI	P2 Pond High Level Alarm	Y	Y
MIA-WFD-P2-LI	AI	P2 Pond Level	Y	Y
MIA-WFD-P3-HSR	SFT/DI	P3 Flow Control Valve in Remote	Y	N
MIA-WFD-P3-ZI	SFT/AI	P3 Flow Control Valve Position Feedback	Y	N
MIA-WFD-P3-ZC	SFT/AO	P3 Flow Control Valve Position Command	N	N
MIA-WFD-P3-LSH	DI	P3 Pond High Level Alarm	Y	Y
MIA-WFD-P3-LI	AI	P3 Pond Level	Y	Y
MIA-WFD-P4-HSR	SFT/DI	P4 Flow Control Valve in Remote	Y	N
MIA-WFD-P4-ZI	SFT/AI	P4 Flow Control Valve Position Feedback	Y	N
MIA-WFD-P4-ZC	SFT/AO	P4 Flow Control Valve Position Command	N	N
MIA-WFD-P4-LSH	DI	P4 Pond High Level Alarm	Y	Y
MIA-WFD-P4-LI	AI	P4 Pond Level	Y	Y
MIA-WFD-P5-HSR	SFT/DI	P5 Flow Control Valve in Remote	Y	N
MIA-WFD-P5-ZI	SFT/AI	P5 Flow Control Valve Position Feedback	Y	N
MIA-WFD-P5-ZC	SFT/AO	P5 Flow Control Valve Position Command	N	N
MIA-WFD-P5-LSH	DI	P5 Pond High Level Alarm	Y	Y
MIA-WFD-	AI	P5 Pond Level	Y	Y

Tagname	Type	Description	Display	Historian
P5-LI				
MIA-WFD-P6-HSR	SFT/DI	P6 Flow Control Valve in Remote	Y	N
MIA-WFD-P6-ZI	SFT/AI	P6 Flow Control Valve Position Feedback	Y	N
MIA-WFD-P6-ZC	SFT/AO	P6 Flow Control Valve Position Command	N	N
MIA-WFD-P6-LSH	DI	P6 Pond High Level Alarm	Y	Y
MIA-WFD-P6-LI	AI	P6 Pond Level	Y	Y
MIA-WFD-P7-HSR	SFT/DI	P7 Flow Control Valve in Remote	Y	N
MIA-WFD-P7-ZI	SFT/AI	P7 Flow Control Valve Position Feedback	Y	N
MIA-WFD-P7-ZC	SFT/AO	P7 Flow Control Valve Position Command	N	N
MIA-WFD-P7-LSH	DI	P7 Pond High Level Alarm	Y	Y
MIA-WFD-P7-LI	AI	P7 Pond Level	Y	Y
MIA-WFD-P8-HSR	SFT/DI	P8 Flow Control Valve in Remote	Y	N
MIA-WFD-P8-ZI	SFT/AI	P8 Flow Control Valve Position Feedback	Y	N
MIA-WFD-P8-ZC	SFT/AO	P8 Flow Control Valve Position Command	N	N
MIA-WFD-P8-LSH	DI	P8 Pond High Level Alarm	Y	Y
MIA-WFD-P8-LI	AI	P8 Pond Level	Y	Y
MIA-WFD-P9-HSR	SFT/DI	P9 Flow Control Valve in Remote	Y	N
MIA-WFD-P9-ZI	SFT/AI	P9 Flow Control Valve Position Feedback	Y	N
MIA-WFD-P9-ZC	SFT/AO	P9 Flow Control Valve Position Command	N	N
MIA-WFD-P9-LSH	DI	P9 Pond High Level Alarm	Y	Y
MIA-WFD-P9-LI	AI	P9 Pond Level	Y	Y
MIA-WFD-P10-HSR	SFT/DI	P10 Flow Control Valve in Remote	Y	N
MIA-WFD-P10-ZI	SFT/AI	P10 Flow Control Valve Position Feedback	Y	N
MIA-WFD-P10-ZC	SFT/AO	P10 Flow Control Valve Position Command	N	N

Tagname	Type	Description	Display	Historian
MIA-WFD-P10-LSH	DI	P10 Pond High Level Alarm	Y	Y
MIA-WFD-P10-LI	AI	P10 Pond Level	Y	Y
MIA-WFD-P11-HSR	SFT/DI	P11 Flow Control Valve in Remote	Y	N
MIA-WFD-P11-ZI	SFT/AI	P11 Flow Control Valve Position Feedback	Y	N
MIA-WFD-P11-ZC	SFT/AO	P11 Flow Control Valve Position Command	N	N
MIA-WFD-P11-LSH	DI	P11 Pond High Level Alarm	Y	Y
MIA-WFD-P11-LI	AI	P11 Pond Level	Y	Y
MIA-WFD-P12-HSR	SFT/DI	P12 Flow Control Valve in Remote	Y	N
MIA-WFD-P12-ZI	SFT/AI	P12 Flow Control Valve Position Feedback	Y	N
MIA-WFD-P12-ZC	SFT/AO	P12 Flow Control Valve Position Command	N	N
MIA-WFD-P12-LSH	DI	P12 Pond High Level Alarm	Y	Y
MIA-WFD-P12-LI	AI	P12 Pond Level	Y	Y

3. Automatic Control:
   a. In SCADA Auto mode, pond flow control valves modulate based on the following conditions.
      i. For ponds with individual flow control valves, the valve modulates to maintain the pond level setpoint. If the pond level transmitter is faulted, the flow control valve will close upon the high-level switch tripping.
      ii. For ponds with shared flow control valves, the valve modulates to maintain the shared pond level setpoint based on the average level of both ponds. If the shared pond level transmitter is faulted, the flow control valve will close upon the shared high-level switch tripping. This strategy assumes the shared ponds are at the same elevation and have the same depth. For shared ponds that do not fit this category, the setpoint will be adjusted so that neither pond overflows.
      iii. The pond level setpoints and shared pond level setpoints can be adjusted within specified bounds by an authorized user from the HMI.
4. Manual Control:
   a. In SCADA Manual mode, an authorized user can set the valve position from the HMI.
5. Interlocks and Alarms:

a. Interlocks:
   i. Each pond flow control valve will close if:
      1. The pond level transmitter reaches the high level setpoint.
      2. The pond backup level switch is tripped.
b. Alarms:
   i. N/A

END OF SECTION

ATTACHMENT 1

GEOTECHNICAL EXPLORATION
DAYTON MIAMI WELL FIELD EXPANSION
DAYTON, OHIO

Prepared for:

TETRA TECH
CINCINNATI, OHIO

Prepared by:

UES
CINCINNATI, OHIO

Date:

APRIL 25, 2024

Geotechnology Project No.:

J045355.01

SAFETY
TEAMWORK
RESPONSIVENESS
INTEGRITY
VALUE
EXCELLENCE

April 25, 2024

Mr. James M. Brescol, PE
Tetra Tech
250 W. Court Street
Suite 200W
Cincinnati, Ohio 45202

Re: Geotechnical Exploration
Dayton Miami Well Field Expansion
Dayton, Ohio
Project No. J045355.01

Dear Mr. Brescol:

Presented in this report are the results of our geotechnical exploration completed for the Dayton Miami Well Field Expansion located in Dayton, Ohio. Our services were performed in general accordance with our Proposal No. P045355.01, which was dated February 20, 2024, and authorized by the Subconsultant Services Agreement, dated February 22, 2024.

We appreciate the opportunity to provide the geotechnical services for this project. If you have any questions regarding this report, or if we may be of any additional service to you, please do not hesitate to contact us.

Respectfully submitted,
UES

Daniel A. Furgason, PE
Senior Project Manager

Suraj Khadka, PE
Project Manager

DAF/SK:daf/tmk

Copies submitted: Tetra Tech (email)

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GEOTECHNICAL EXPLORATION
DAYTON MIAMI WELL FIELD EXPANSION
DAYTON, OHIO

April 25, 2024 | Project No. J045355.01

1.0 INTRODUCTION

Geotechnology, LLC, DBA UES (UES) prepared this geotechnical exploration report for Tetra Tech for the Dayton Miami Well Field Expansion Project located in Dayton, Ohio.

The purposes of the geotechnical exploration were: to evaluate the general subsurface profile at the site and the engineering properties of the soils; and to develop recommendations for the geotechnical aspects of the design and construction of the project, as defined in our proposal. Our scope of services included site reconnaissance, geotechnical borings, field infiltration testing, laboratory testing, engineering analyses, and preparation of this report.

2.0 PROJECT INFORMATION

The following project information was derived from:

- The “Dayton Miami Well Field Expansion-Bore Locations”, undated, prepared by Tetra Tech;
- The Proposed Pond Detail and Section plan, undated, prepared by Tetra Tech; and,
- Correspondence with Tetra Tech.

The project will involve construction of twelve (12) new ponds. Each pond will have a 20-foot-wide by 25-foot-deep trench to be backfilled with aggregate. Changes in site grading adjacent to the ponds is assumed to be minimal with cuts and fills less than 3 feet. The site terrain is relatively flat with elevations at El. 770+/- 15 feet. An equipment vault will be constructed at each pond location with plan dimensions of approximately 6 feet by 10 feet and height of 9 feet above the foundation.

3.0 SUBSURFACE EXPLORATION

The subsurface exploration consisted of twenty (20) borings (numbered B-1 through B-20). Borings B-1, B-4, B-6, B-11, and B-19 were drilled to an approximate depth of 91.5 feet below existing ground surface. The remaining fifteen (15) borings were drilled to approximate depth of 41.5 feet below existing ground surface.

The boring locations were selected by Tetra Tech, and were staked in the field by UES using a handheld Trimble Geo7X GPS unit. The locations of Borings B-11 through B-14 were offset a few feet to provide clearance from trees and vegetation for our drilling equipment. Coordinates and elevations at the boring locations are summarized in Table 1. In addition, Borings B-5, B-13, B-

14, B-15, B-17 and B-19 were all moved a few feet from the staked locations shown in Table 1. below, to avoid utilities identified by the private utility locator. The location of the borings are shown on our Exploration Plan, which is included in Appendix A.

Table 1. Summary of Boring Locations, as Drilled.

Boring	Northing	Easting	Elevation (feet) [1]
B-1	663064.5578	1501712.8977	757.9
B-2	663551.9858	1502063.6171	758.4
B-3	663786.5996	1501046.5028	766.5
B-4	664870.0031	1500901.2278	768.9
B-5	664235.9258	1502633.9630	759.2
B-6	664539.8771	1502692.0122	762.0
B-7	664593.7967	1502121.7283	766.0
B-8	664785.6929	1502178.0831	766.9
B-9	665249.7859	1501863.7897	767.9
B-10	665147.1715	1501728.2527	768.7
B-11	664572.8851	1499935.6295	764.2
B-12	664657.3101	1499677.0914	763.3
B-13	665114.2676	1500016.9089	766.8
B-14	665155.7598	1500212.5575	763.6
B-15	665494.3156	1500078.6589	765.1
B-16	665678.4569	1500125.4771	765.6
B-17	665469.2742	1500836.5730	765.4
B-18	665636.5340	1500664.4563	766.0
B-19	666128.7789	1500893.3147	766.0
B-20	665962.1561	1501256.9586	767.4

1. Elevation based on Trimble Geo7X GPS Unit.

The borings were drilled between March 4 and March 15, 2024. A UES field engineer was on site to log the test borings and performed the infiltration testing. Drilling was performed with a CME-55LC track-mounted drill rig with advancing hollow-stem augers. Drill rod energy ratio (ER) for the drill rig is 93% but has been limited to 90% to calculate N60 values.

Sampling of the overburden soils was accomplished ahead of the augers at the depths indicated on the boring logs, with a 2-inch-outside-diameter (O.D.) split-barrel sampler in accordance with procedures outlined by ASTM D1586. Standard Penetration Tests (SPTs) were performed with

the split-barrel sampler to obtain the standard penetration resistance or N-value[1] of the sampled material.

Observations for groundwater were made in the borings during drilling, and before backfilling the boring holes.

As each boring was advanced, the UES field engineer kept a field log of the subsurface profile noting the soil types and stratifications, groundwater, SPT results, and other pertinent data.

Representative portions of the split-barrel samples were placed in glass jars with lids to preserve the in-situ moisture contents of the samples. The glass jars were marked and labeled in the field for identification when returned to our laboratory.

4.0 LABORATORY REVIEW AND TESTING

Upon completion of the fieldwork, the samples recovered from the borings were transported to our Soil Mechanics Laboratory, where they were visually reviewed and classified by the Project Geotechnical Engineer.

Laboratory testing was performed on selected soil and rock samples to estimate engineering and index properties. Laboratory testing of the selected soil samples included various combinations of the following tests: moisture content, Atterberg limits, gradation (particle-size) analyses. The results of these tests are summarized in Section 5.0 of this report and copies of the Laboratory Test results are included in Appendix D.

The boring logs, which are included in Appendix B, were prepared by the Project Geotechnical Engineer on the basis of the field logs, the visual classification of the soil in the laboratory, and the laboratory test results. Soil Classification Sheets are also included in Appendix B, which describe the terms and symbols used on the boring logs. The dashed lines on the boring logs indicate an approximate change in strata as estimated between samples, whereas a solid line indicates that the change in strata occurred within a sample where a more precise measurement could be made. Furthermore, the transition between strata can be abrupt or gradual.

5.0 INFILTRATION TESTING

Infiltration testing was performed from March 19 through March 22, 2024, at four (4) locations selected in consultation with client. New boreholes were drilled for field infiltration testing purpose in proximity to the boring locations (B-5, B-6, B-11, and B-19). The test depth for infiltration testing

[1] The standard penetration resistance, or N-value, is defined as the number of blows required to drive the split-barrel sampler 12 inches with a 140-pound hammer falling 30 inches. Since the split-barrel sampler is driven 18 inches or until refusal, the blows for the first 6 inches are for seating the sampler, and the number of blows for the final 12 inches is the N-value, which is reported as blows per foot (or bpf). Additionally, “refusal” of the split-barrel sampler occurs when the sampler is driven less than 6 inches with 50 blows of the hammer.

at each borehole were chosen upon review of the field logs and discussion with Tetra Tech. The boring locations are shown on the Exploration Plan in Appendix A.

A falling head infiltration test was performed at the test location. Each borehole was drilled to the planned test depth to run infiltration testing. Separate offset holes were drilled as required to run infiltration testing at different depths. Boring B-5 was drilled to a depth of 25 feet to run infiltration testing. Four (4) separate offset holes were drilled around Boring B-6, and then around B-11 to different test depths ranging from 20 to 40 feet for infiltration testing purposes. Boring B-19 was drilled to a depth of 35 feet to run infiltration testing. A total of ten (10) infiltration testing was performed during our field exploration.

The following test procedure was used for the falling head infiltration tests:

- A borehole was augered to the planned depth below grade with a 6.25-inch-diameter hollow-stem auger.
- A 4-inch-diameter PVC pipe was inserted in the borehole to prevent the sidewalls from collapsing, and the pipe length was recorded.
- Bentonite chips were placed around the outside of the PVC pipe.
- The auger was removed from the hole.
- The PVC pipe was filled with water, and the level of water was measured relative to the top of the respective pipe with time.

The measurements from the infiltration tests are recorded on the forms and included in Appendix C.

The data from the infiltration test was used in conjunction with correlations presented in Hvorslev (1951). Based on the setup of the tests, which allows the water to infiltrate through the bottom of the boreholes, Case C from Hvorslev (1951) was used to estimate the permeability.

The permeability of the soils tested during our field infiltration test were computed and are summarized in Table 2.

Table 2. Summary of Infiltration Testing.

Boring	Depth Below Existing Ground (feet)	Soil Type at Test Depth	Infiltration Rate		Approximate Permeability	
			v (in./hr.)	*V* (cm/hr.)	*k* (in./hr.)	*k* (cm/sec.)
B-5	25	Silty Clay (CL)	0.1	0.2	$2.0x10^{-4}$	$1.7x10^{-7}$
B-6	20	Sand with Gravel (SP)	6.0	15.2	$3.1x10^{-2}$	$2.2x10^{-5}$
B-6	25	Sand with Gravel (SP)	13.2	33.5	$6.2x10^{-2}$	$4.4x10^{-5}$
B-6	30	Silt with Sand, Clay (ML)	4.8	12.2	$3.0x10^{-2}$	$2.1x10^{-5}$
B-6	40	Sand with Gravel (SW-SM)	12.0	30.5	$4.4x10^{-2}$	$3.1x10^{-5}$
B-11	20	Sand with Gravel, Floaters (SW-SM)	960	2438	$2.5x10^{1}$	$1.8x10^{-2}$
B-11	25	Sand with Gravel, Floaters (SW-SM)	1200	3048	$2.5x10^{1}$	$1.8x10^{-2}$
B-11	30	Sand with Gravel (SP-SM)	14.4	36.6	$5.0x10^{-2}$	$3.5x10^{-5}$
B-11	40	Sand (SW-SM)	23.4	59.4	$1.0x10^{-1}$	$6.9x10^{-5}$
B-19	35	Sand with Gravel (SW-SM)	12.6	32.0	$3.7x10^{-2}$	$2.6x10^{-5}$

Figure 1 shows typical soil permeability values (from Table 5-10 in FHWA-NHI 06-088) for reader's reference. The computed permeabilities from our field tests for different soil types are generally consistent with the typical soil permeability values. The soils in the test interval of 20 and 25 feet at Boring B-11 encountered sand and gravel with limestone floaters, and resulted in higher permeability than sand and gravel at other locations.

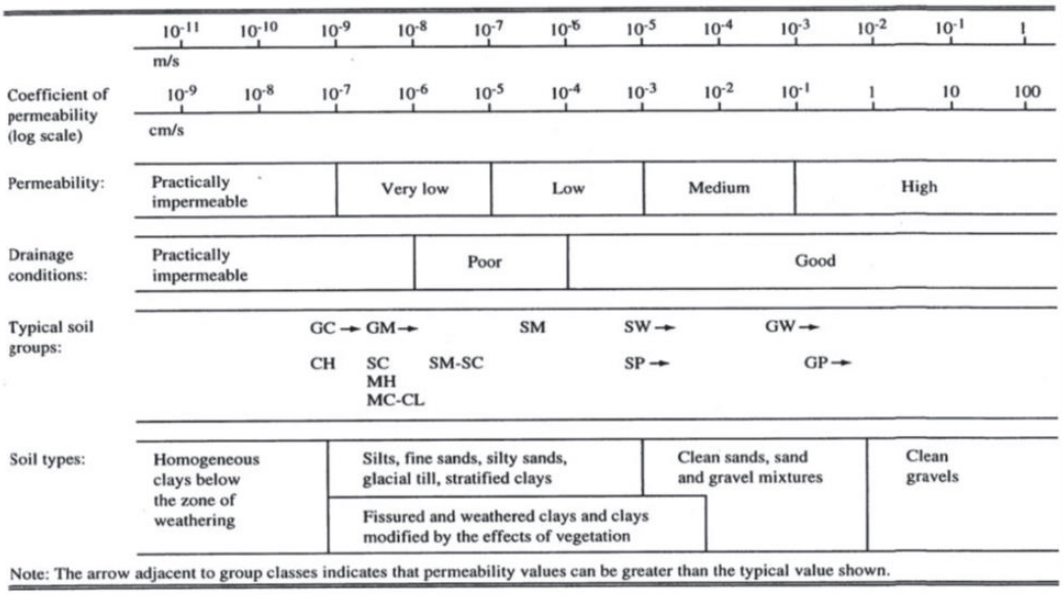


Figure 1. Typical Soil permeability values (from Table 5-10 in FHWA NHI-06-088).

Regarding the infiltration rate (v) of the soils, it can be approximated from the permeability (k) using Darcy's Law as follows:

$$v = ki = k(\Delta h/L)$$

where i is the hydraulic gradient; Δh is the average head loss; and L is the length over which the head loss occurs. According to Massman (2003), the hydraulic gradient for an infiltration basin is approximately 1, which would indicate that the infiltration rate equals the permeability.

It should be noted that sediment and siltation from fines[2] can quickly clog relatively permeable soils (including the amended soils) such that they will not function as designed. Consequently, temporary, and permanent erosion control measures should be implemented to prevent the degradation of the infiltration rate with time. Furthermore, regular maintenance should be planned to maintain the design infiltration rate of the basins throughout their design life, which may require undercutting sediments that have deposited on the retention pond bottom.

[2] Fines are soil particle sizes passing the No. 200 sieve (i.e., clay- and silt-size particles).

6.0 SUBSURFACE CONDITIONS

6.1 Stratification

Generally, the topsoil was underlain by sand and gravel soils which extended to the depths of the borings. The soil became more silty with depth at some locations and clayey silt was present within certain depth intervals in a few borings. More specific descriptions of the subsurface strata are provided below, and the boring logs containing detailed material descriptions are included in Appendix B.

6.1.1 Topsoil

Topsoil was encountered at the ground surface in all of the borings, generally to a depth of 12 inches.

6.1.2 Soil Stratigraphy

Generally, the subsurface soils included alluvium consisting primarily of sand and gravel over glacial outwash sand and gravel with random layers of clayey silt and silt. More specifically, below the topsoil and a thin layer of sandy or clayey silt, or clayey sand (extending to a depth of 2.5 feet or less), all test boring encountered sand and gravel. The sand and gravel was generally loose to medium dense at shallow depths, becoming dense to very dense with increasing depth. Exceptions to this stratigraphy include the following:

- Very stiff silty clay/clayey silt from 22.5 to 27.5 feet at Boring B-3;
- Hard clayey silt from 67.5 to 91.5 feet at Boring B-4;
- Very stiff clayey silt from 17.0 to 28.0 feet at Boring B-5;
- Hard silt at 23.0 to 28.0 feet at Boring B-6;
- Hard clayey silt from 62.5 to 72.5 feet and hard silt from 72.5 to 91.5 feet at Boring B-11; and,
- Hard clayey silt from 57.5 to 62.5 feet at Boring B-19.

A summary of the laboratory test results is included in Appendix data for the granular soils is included in Appendix D.

6.2 Groundwater Conditions

Error! Reference source not found.

As mentioned in Section 3.0, groundwater observations were made in the borings during drilling, and before backfilling the boreholes. Water levels during drilling ranged from 12.5 to 30 feet below the ground surface. Most of the borings encountered water seepage at depths of 20 to 25 feet. Most of the soils encountered were granular and the holes generally caved when the augers were removed. Water levels are shown on the Boring Logs in Appendix B.

Groundwater levels are expected to vary with time, location, season of the year, and amounts of precipitation.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on our engineering reconnaissance of the site, the borings, the visual examination of the recovered samples, the laboratory test results, our understanding of the proposed project, and our experience as Geotechnical Engineers in the Greater Dayton Area, the following conclusions and recommendations are presented.

7.1 Excavation Support

Excavation support should be the responsibility of the Contractor. Excavation support should be designed and implemented such that excavations are adequately ventilated and braced, shored, and/or sloped in order to protect and ensure the safety of workers within and near the excavations and to protect adjacent ground, slopes, structures, and infrastructure. Federal, state, and local safety regulations should be satisfied. The analyses, discussions, conclusions, and recommendations throughout this report are not to be interpreted as pre-engineering compliance with any safety regulation.

The soils at the site are predominantly sand and gravel with lesser components of silt and clay. Based on the dominant presence of granular soils within the test borings, the OSHA soil classification for soil excavations at this site is expected to be Type C. OSHA recommends maximum allowable backslope for temporary cut slopes of 20 feet of less in height to be 1.5H:1V for Soil Type C. Protection for excavations more than 20 feet in depth must be designed by a registered professional engineer. All excavation should comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P “Excavations” and its appendices, as well as other applicable codes.

7.2 Site Preparation and Earthwork

As stated in Section 2.0 earthwork for this project will involve cuts and fills of 3 feet or less.

The initial preparation of the site for grading should include the removal of vegetation, heavy root systems, and topsoil from the proposed cut, fill, pavement, and any structure areas. The topsoil may be stockpiled for future use on the completed cut and fill slopes or in landscaped areas, if permitted by specification, whereas the vegetation, including the heavy root systems, should be disposed of off-site in accordance with applicable regulations.

Following clearing the construction areas of the existing vegetation and topsoil, we recommend that very soft to medium stiff soils present at the ground surface be removed and replaced with stiff to very stiff clayey or suitable granular soils.

Fill materials for embankments or general earthwork should consist of approved on-site, non-organic, clayey soils, or approved borrow material that are relatively free of topsoil, vegetation,

trash, construction or demolition debris, frozen materials, particles over 6 inches in maximum dimension, or other deleterious materials.

The fill should be placed in shallow level lifts (or layers), 6 to 8 inches in loose thickness. Each lift should be moisture-conditioned to within the acceptable moisture content range provided in Table 3, and compacted with a sheepsfoot roller or self-propelled compactor to at least the minimum percent compaction indicated in the same table. Moisture-conditioning may include: aeration and drying of wetter soils; wetting of drier soils; and/or thoroughly mixing wetter and drier soils into a uniform mixture.

Table 3. Percent compaction and moisture-conditioning recommendations for fill and backfill.

Area	Minimum Percent Compaction[a]	Acceptable Moisture Content Range[b]
Structural[c]	98% of SPMDD	-2% to +3% of OMC
Non-structural	95% of SPMDD	±3% of OMC
Pavement subgrade: ≤ 12 inches	98% of SPMDD	±2% of OMC

Notes:
[a] SPMDD = standard Proctor maximum dry density determined from ASTM D698.
[b] OMC = optimum moisture content determined from ASTM D698.
[c] Structural fill and backfill for foundations are defined as fill and backfill located within the zones of influence of structures. The zone of influence of a structure is defined as the area below the footprint of the structure and 2H:1V outward and downward projections from the bearing elevation of the structure.

7.3 Foundations

Foundation loads for the equipment vaults were not available for preparation of this report. Loads are anticipated to be light to moderate. Loose sand was present to an approximate depth of 4.5 feet at Borings B-5, B-6, B-11 and B-16. Medium dense sand was present below the topsoil at all other boring locations. As the soils are likely to vary across the site, it is recommended that spread foundations be proportioned for a maximum net allowable bearing pressure of 2,000 pounds per square foot full dead and full live load. We recommend that the minimum lateral dimensions for continuous wall footings and isolated column footings be at least 18 and 24 inches, respectively.

Based on the assumed maximum net allowable footing bearing pressure, we anticipate total and differential settlements less than 1 inch and ½ inch, respectively.

Exterior footings and footings in unheated interior areas should bear at least 32 inches below the lowest adjacent exterior/unheated grade for protection from frost penetration. Additionally, the foundation bearing elevations should not be located higher than a relationship of 2H:1V above proposed adjacent foundations or the inverts of nearby existing or proposed utilities that parallel

or nearly parallel the foundations, without a site-specific evaluation of the conditions by the Project Geotechnical Engineer.

Where shallow foundations will be subjected to lateral loads, resistance to overturning and sliding may be evaluated using the parameters provided in Table 4. Furthermore, lateral resistance to sliding may be provided by a combination of friction and passive resistance; however, passive resistance should be ignored above the frost penetration depth of 32 inches. It also should be noted that the passive resistance parameters assume a level ground surface. The frictional force should be based on dead normal loads only. A FOS of 1.5 should be applied to the sliding resistance.

Table 4. Design parameters for laterally loaded shallow foundations.

Soil unit weight, γ (pcf)	125
Internal angle of friction, ϕ (°)	26
Cohesion, c (psf)	0
Ultimate coefficient of static friction, μ_{ult}	0.35 for concrete cast on stiff in-situ clayey soils
	0.49 for concrete cast on 12-inch-thick compacted granular base
	0.40 for formed precast concrete on compacted granular leveling base

We recommend that foundation excavations be cut to neat lines and grades so that concrete may be placed directly against the banks of the excavations without forming. Loose, soft, wet, frozen, or otherwise disturbed materials should be removed from the bearing surfaces of the foundations prior to the placement of reinforcing steel and concrete. Foundation excavations should be observed by the geotechnical engineer or his representative to determine if unsuitable soils are present and should be removed. If a crusted or saturated surface develops at the bearing surface for a foundation, we recommend that it be skimmed to expose a fresh surface before reinforcing steel and concrete are placed. Foundation concrete should be placed the same day as the excavation is made to prevent saturation or desiccation of the bearing surfaces.

If concrete mud mats are utilized, the concrete should have a minimum compressive strength of 1,500 psi and a minimum thickness of 3 inches. The excavated bearing surface should be lowered at least the thickness of the mud mat, and the top of the mud mat should be at or below the design bearing elevation of the foundation. Prior to the placement of the concrete mud mat, the bearing surfaces should be cleaned of loose, soft, wet, frozen, or otherwise disturbed material.

Water should not be allowed to pond on top of either bearing soils or bedrock within footing excavations, or on or around completed footings, in order to reduce potential softening or swelling of the bearing materials.

We recommend that foundation steps have a maximum height of 2 feet and a corresponding minimum length of 4 feet. Reinforcing steel and concrete should remain continuous through the foundation steps.

We recommend that foundation excavations be reviewed by the Project Geotechnical Engineer, or a representative thereof, prior to placing concrete in order to confirm that the bearing materials and surfaces are consistent with the design recommendations of this report.

8.0 RECOMMENDED ADDITIONAL SERVICES

The conclusions and recommendations given in this report are based on: UES's understanding of the proposed design and construction, as outlined in this report; site observations; interpretation of the exploration data; and our experience. Since the intent of the design recommendations is best understood by UES, we recommend that UES be included in the final design and construction process, and be retained to review the project plans and specifications to confirm that the recommendations given in this report have been correctly implemented. We recommend that UES be retained to participate in prebid and preconstruction conferences to reduce the risk of misinterpretation of the conclusions and recommendations in this report relative to the proposed construction of the subject project.

Since actual subsurface conditions between boring locations may vary from those encountered in the borings, our design recommendations are subject to adjustment in the field based on the subsurface conditions encountered during construction. Therefore, we recommend that UES be retained to provide construction observation services as a continuation of the design process to confirm the recommendations in this report and to revise them accordingly to accommodate differing subsurface conditions. Construction observation is intended to enhance compliance with project plans and specifications. It is not insurance, nor does it constitute a warranty or guarantee of any type. Regardless of construction observation, contractors, suppliers, and others are solely responsible for the quality of their work and for adhering to plans and specifications.

9.0 LIMITATIONS

This report has been prepared on behalf of, and for the exclusive use of, Tetra Tech for specific application to the named project as described herein. If this report is provided to other parties, it should be provided in its entirety with all supplementary information. In addition, Tetra Tech should make it clear that the information is provided for factual data only, and not as a warranty of subsurface conditions presented in this report.

UES has attempted to conduct the services reported herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions. The recommendations and conclusions contained in this report are professional opinions. The report is not a bidding document and should not be used for that purpose.

Our scope for this phase of the project did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of our client. Our scope did not include an assessment of the effects of flooding and erosion of creeks or rivers adjacent to or on the project site.

The analyses, conclusions, and recommendations contained in this report are based on the data obtained from the subsurface exploration. The field exploration methods used indicate subsurface conditions only at the specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Consequently, subsurface conditions may vary gradually, abruptly, and/or nonlinearly between sample locations and/or intervals.

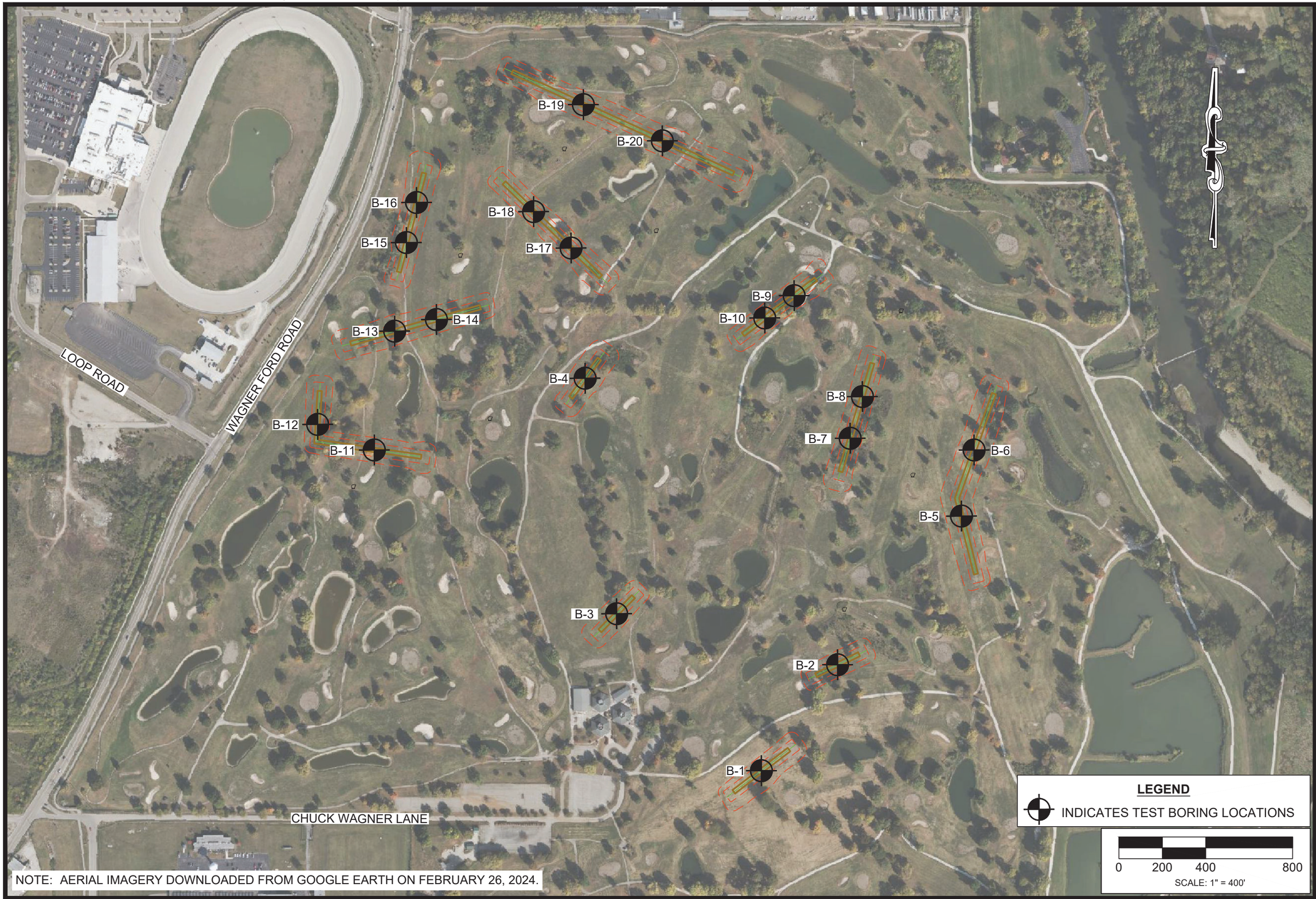
The conclusions or recommendations presented in this report should not be used without UES's review and assessment if the nature, design, or location of the facilities is changed, if there is a substantial lapse in time between the submittal of this report and the start of work at the site, or if there is a substantial interruption or delay during work at the site. If changes are contemplated or delays occur, UES must be allowed to review them to assess their impact on the findings, conclusions, and/or design recommendations given in this report. UES will not be responsible for any claims, damages, or liability associated with any other party's interpretations of the subsurface data or with reuse of the subsurface data or engineering analyses in this report.

The recommendations included in this report have been based in part on assumptions about variations in site stratigraphy that may be evaluated further during earthwork and foundation construction. UES should be retained to perform construction observation and continue its geotechnical engineering service using observational methods. UES cannot assume liability for the adequacy of its recommendations when they are used in the field without UES being retained to observe construction.

A copy of "Important Information about This Geotechnical-Engineering Report" that is published by the Geotechnical Business Council (GBC) of the Geoprofessional Business Association (GBA) is included in Appendix E for your review. The publication discusses some other limitations, as well as ways to manage risk associated with subsurface conditions.

APPENDIX A – PLANS

Exploration Plan, Sheet No. 1



NOTE: AERIAL IMAGERY DOWNLOADED FROM GOOGLE EARTH ON FEBRUARY 26, 2024.

UES

Project: DAYTON MIAMI WELL FIELD EXPANSION

Location: DAYTON, OHIO

Title: EXPLORATION PLAN

Client: TETRA TECH

Date: 3/15/2024

Project No.: J045355.01

Sheet No.: 1

APPENDIX B – BORING INFORMATION

Boring Logs

Soil Classification Sheet

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-1
PROJECT #: J045355.01
PAGE #: 1 of 3
LAT,LON: 39.80870 ,-84.16165

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
757.9	Ground Surface	0.0	0					
756.9	TOPSOIL (12 INCHES).	1.0		SS-1	1-2-2 *N=4*	6	83	
	Brown, moist, loose, Silty Sand, little clay, gravel and root hairs.			SS-2	3-5-4 *N=9*	13	100	
753.4		4.5	5	SS-3	7-12-12 *N=24*	36	78	
	Brown, moist, medium dense, Sand with Silt and Gravel (SP-SM), trace limestone floaters. Gravel=42.8%, Sand=41.9%, Silt & Clay=9.3% on SS-4			SS-4	8-9-15 *N=24*	36	94	
748.4		9.5	10	SS-5	4-9-13 *N=22*	33	67	
	Brown and Gray, moist, medium dense, Gravel with Sand.			SS-6	10-11-14 *N=25*	37	83	
740.4		17.5	15	SS-7	13-13-19 *N=32*	47	72	
	Gray and Brown, wet, dense to very dense, Sand with Gravel.		20 ▽	SS-8	7-13-29 *N=42*	62	100	
			25	SS-9	10-16-29 *N=45*	67	78	
			30	SS-10	8-18-49 *N=67*	99	89	

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 757.9 ft.
Date Started/Completed: 3/15/2024-3/15/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 20' during drilling
▼ At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-1
PROJECT #: J045355.01
PAGE #: 2 of 3
LAT,LON: 39.80870 ,-84.16165

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
715.4	Gray and Brown, wet, very dense, Gravel with Sand.	42.5	35	SS-11	10-32-36 *N=68*	101	89	
			40	SS-12	13-29-33 *N=62*	92	89	
			45	SS-13	20-43-40 *N=83*	123	100	
			50	SS-14	20-29-21 *N=50*	74	100	
			55	SS-15	14-24-30 *N=54*	80	100	
			60	SS-16	12-26-32 *N=58*	86	100	
			65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 757.9 ft.
Date Started/Completed: 3/15/2024-3/15/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
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CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 20' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-1
PROJECT #: J045355.01
PAGE #: 3 of 3
LAT,LON: 39.80870 ,-84.16165

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
			65	SS-17	3-15-50/5"		100	
			70	SS-18	20-30-35 ***N=65***	96	100	
			75	SS-19	10-25-35 ***N=60***	89	100	
			80	SS-20	40-44-25 ***N=69***	102	100	
			85	SS-21	23-39-40 ***N=79***	117	100	
670.4		87.5						
	Gray, wet, very dense, Sand with Gravel.		90	SS-22	28-41-50/5"		100	
666.5		91.4						
	Bottom of test boring at 91.4 feet.		95					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 757.9 ft.
Date Started/Completed: 3/15/2024-3/15/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 20' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-2
PROJECT #: J045355.01
PAGE #: 1 of 2
LAT,LON: 39.81007 ,-84.16044

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
758.4	Ground Surface	0.0					
757.4	TOPSOIL (12 INCHES).	1.0	SS-1	1-2-2 *N=4*	6	67	
753.9	Gray to brown, moist, medium dense, Sand with gravel, trace root hairs .	4.5	SS-2	6-9-8 *N=17*	25	6	
751.4	Brown and gray, moist, medium dense, Sand with Gravel.	7.0	SS-3	9-9-19 *N=28*	42	89	
748.9	Brown and gray, moist, dense, Gravel with Sand.	9.5	SS-4	10-16-16 *N=32*	47	72	
746.4	Brown, moist, dense, Sand, trace gravel.	12.0	SS-5	8-13-21 *N=34*	50	100	
	Brown, wet, medium dense, Gravel with Sand.		SS-6	7-12-15 *N=27*	40	61	
			SS-7	5-8-11 *N=19*	28	100	
			SS-8	4-6-10 *N=16*	24	100	
			SS-9	5-7-7 *N=14*	21	100	
735.9		22.5					
733.9	Brown to gray, wet, very dense, Fine Sand with Gravel, little silt.	24.5	SS-10	15-25-26 *N=51*	76	100	
731.4	Gray, wet, very dense, Sandy Silt, little gravel.	27.0	SS-11	45-50/5"		100	
728.9	Gray, wet, very dense, Gravel with Sandy Silt.	29.5	SS-12	30-38-17 *N=55*	82	100	
	Gray to brown, wet, dense, Sand with Gravel.		SS-13	5-7-22 *N=29*	43	100	

Depth Scale (feet): 0, 5, 10, 15, 20, 25, 30

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 758.4 ft.
Date Started/Completed: 3/4/2024-3/4/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 12.5' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-2
PROJECT #: J045355.01
PAGE #: 2 of 2
LAT,LON: 39.81007 ,-84.16044

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
723.4		35.0	35	SS-14	17-35-46 *N=81*	120	100	
	Gray, wet, very dense, Sand with Gravel.		40	SS-15	25-28-36 *N=64*	95	67	
716.9		41.5						
	Bottom of test boring at 41.5 feet.		45 50 55 60 65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 758.4 ft.
Date Started/Completed: 3/4/2024-3/4/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 12.5' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-3
PROJECT #: J045355.01
PAGE #: 1 of 2
LAT,LON: 39.81065 ,-84.16407

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
766.5	Ground Surface	0.0	0					
765.5	TOPSOIL (12 INCHES).	1.0		SS-1	1-2-3 *N=5*	7	83	
	Brown, moist, medium dense to dense, Gravel with Sand, trace limestone fragments.			SS-2	4-6-6 *N=12*	18	61	
			5	SS-3	10-14-14 *N=28*	42	72	
759.5		7.0		SS-4	5-10-24 *N=34*	50	50	
	Brown and gray, moist, dense, Gravel with Sand, trace limestone fragments.		10	SS-5	7-10-10 *N=20*	30	0	
				SS-6	10-13-20 *N=33*	49	44	
			15	SS-7	11-12-12 *N=24*	36	33	
			20	SS-8	13-13-13 *N=26*	39	72	
744.0		22.5						
	Brown, moist, hard, Silty Clay (CL-ML), some sand, little gravel. LL=22%, PL=15%, PI=7% on SS-9.		25	SS-9	12-14-17 *N=31*	46	100	
739.0		27.5						
	Brown, wet, dense, Gravel with Sand.		30	SS-10	23-21-19 *N=40*	59	39	
734.0		32.5						

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 766.5 ft.
Date Started/Completed: 3/15/2024-3/15/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 30' during drilling
▼ At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-3
PROJECT #: J045355.01
PAGE #: 2 of 2
LAT,LON: 39.81065 ,-84.16407

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
725.0	Brown, wet, very dense, Sand with Gravel, trace limestone fragments.	41.5	35	SS-11	10-20-50/5"		100	
			40	SS-12	25-17-34 *N=51*	76	100	
	Bottom of test boring at 41.5 feet.		45					
			50					
			55					
			60					
			65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 766.5 ft.
Date Started/Completed: 3/15/2024-3/15/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 30' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 8

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-4
PROJECT #: J045355.01
PAGE #: 1 of 3
LAT,LON: 39.81363 ,-84.16466

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
768.9	Ground Surface	0.0	0					
767.9	TOPSOIL (12 INCHES).	1.0		SS-1	2-2-3 *N=5*	7	67	
766.9	Brown, moist, loose, Sandy Silt, trace root hairs.	2.0						
764.4	Brown, moist, medium dense, Sand with Gravel.	4.5		SS-2	5-5-6 *N=11*	16	61	
761.9	Brown, moist, dense, Gravel with Sand, trace limestone fragments.	7.0	5	SS-3	18-18-17 *N=35*	52	39	
754.4	Brown, moist, medium dense, Sand with Gravel (SP-SM), trace silt. Gravel=31%, Sand=62.5%, Silt & Clay=6.5% on SS-4.	14.5		SS-4	6-10-12 *N=22*	33	100	
			10	SS-5	6-10-14 *N=24*	36	67	
				SS-6	7-7-7 *N=14*	21	72	
			15	SS-7	13-20-21 *N=41*	61	72	
746.4	Gray to brown, moist, medium dense to dense, Gravel with Sand, trace limestone fragments.	22.5	20	SS-8	7-10-12 *N=22*	33	61	
741.4	Brown, wet, dense, Gravel with Sand.	27.5	25 ▽	SS-9	11-13-16 *N=29*	43	61	
	Gray to Brown, wet, dense, Sand with Gravel.		30	SS-10	11-13-14 *N=27*	40	100	

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 768.9 ft.
Date Started/Completed: 3/7/2024-3/7/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 25' during drilling
▼ At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 8

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-4
PROJECT #: J045355.01
PAGE #: 2 of 3
LAT,LON: 39.81363 ,-84.16466

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
726.4	Gray to brown, wet, very dense, Gravel with Sand.	42.5	35	SS-11	7-16-20 ***N=36***	53	100	
			40	SS-12	6-20-26 ***N=46***	68	100	
			45	SS-13	12-26-31 ***N=57***	85	100	
			50	SS-14	10-24-30 ***N=54***	80	100	
			55	SS-15	6-26-30 ***N=56***	83	100	
			60	SS-16	10-8-25 ***N=33***	49	61	
			65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 768.9 ft.
Date Started/Completed: 3/7/2024-3/7/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 25' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-4
PROJECT #: J045355.01
PAGE #: 3 of 3
LAT,LON: 39.81363 ,-84.16466

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
701.4			65	SS-17	11-15-17 *N=32*	47	78	4.5
	Gray to brown, wet, hard, Clayey Silt with Sand, little gravel.	67.5	70	SS-18	11-29-41 *N=70*	104	100	4.5
			75	SS-19	15-25-35 *N=60*	89	100	4.5
			80	SS-20	15-21-32 *N=53*	79	100	4.5
			85	SS-21	14-15-30 *N=45*	67	100	4.5
677.4		91.5	90	SS-22	11-26-30 *N=56*	83	100	4.5
	Bottom of test boring at 91.5 feet.		95					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 768.9 ft.
Date Started/Completed: 3/7/2024-3/7/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 25' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-5
PROJECT #: J045355.01
PAGE #: 1 of 2
LAT,LON: 39.81197 ,-84.15845

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
759.2	Ground Surface	0.0	0					
758.2	TOPSOIL (12 INCHES).	1.0		SS-1	1-1-2 *N=3*	4	72	
	Brown, moist, loose, Sand with Gravel.			SS-2	2-4-4 *N=8*	12	72	
754.7		4.5	5	SS-3	8-9-10 *N=19*	28	72	
	Brown, moist, medium dense, Sand with Gravel.			SS-4	6-6-8 *N=14*	21	78	
			10	SS-5	4-6-8 *N=14*	21	89	
744.7		14.5		SS-6	6-7-8 *N=15*	22	72	
	Brown, wet, medium dense, Sand with Gravel.		15 ▽	SS-7	6-10-12 *N=22*	33	72	
742.2		17.0						
	Gray, wet, very stiff, Silty Clay, trace sand and gravel. Gravel=10.2%, Sand=28.8%, Silt=30.4%, Clay=30.6% on SS-9		20	SS-8	7-14-21 *N=35*	52	67	3.5
			25	SS-9	2-11-17 *N=28*	42	100	3.0
731.2		28.0						
	Gray, wet, medium dense to dense, Sand and Gravel.		30	SS-10	4-8-12 *N=20*	30	100	

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 759.2 ft.
Date Started/Completed: 3/14/2024-3/14/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 15' during drilling
▼ At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-5
PROJECT #: J045355.01
PAGE #: 2 of 2
LAT,LON: 39.81197 ,-84.15845

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
			35	SS-11	4-12-18 *N=30*	44	100	
			40	SS-12	10-15-17 *N=32*	47	100	
717.7		41.5						
	Bottom of test boring at 41.5 feet.		45					
			50					
			55					
			60					
			65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 759.2 ft.
Date Started/Completed: 3/14/2024-3/14/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 15' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-6
PROJECT #: J045355.01
PAGE #: 1 of 3
LAT,LON: 39.81281 ,-84.15827

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
762.0	Ground Surface	0.0	0					
761.0	TOPSOIL (12 INCHES).	1.0		SS-1	1-1-2 *N=3*	4	67	
757.5	Brown, moist, loose, Silty Sand, trace gravel.	4.5		SS-2	3-3-4 *N=7*	10	72	
755.0	Brown, moist, medium dense , Silty Gravel (GM), trace limestone fragments. Gravel=55.7%, Sand=28.0%, Silt & Clay=16.3% on SS-3	7.0	5	SS-3	6-9-11 *N=20*	30	44	
744.5	Gray to brown, moist, medium dense , Gravel with Sand, trace limestone fragments.	17.5		SS-4	8-8-10 *N=18*	27	78	
			10	SS-5	10-11-13 *N=24*	36	67	
				SS-6	10-11-13 *N=24*	36	44	
			15	SS-7	10-10-7 *N=17*	25	33	
734.5	Brown, wet, medium dense, Sand with Gravel (SP). Gravel=25.8%, Sand=69.4%, Silt & Clay=4.8% on SS-8	27.5	▽20	SS-8	9-9-9 *N=18*	27	100	
			25	SS-9	4-7-7 *N=14*	21	50	
729.5	Gray, wet, very stiff, Clayey Silt , some sand, trace gravel. W=12.7%, Gravel=1.2%, Sand=29.6%, Silt=43.1%, Sand =26.1% on SS-10	32.5	30	SS-10	5-11-18 *N=29*	43	56	3.5

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 762.0 ft.
Date Started/Completed: 3/14/2024-3/14/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 20' during drilling
▼ At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-6
PROJECT #: J045355.01
PAGE #: 2 of 3
LAT,LON: 39.81281 ,-84.15827

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
	Gray, wet, medium dense , Sand, trace gravel.							
724.5		37.5						
	Brown, wet, dense, Sand with Gravel and Silt (SW-SM). Gravel=40.2%, Sand=50.3%, Silt & Clay=9.5% on SS-12							
719.5		42.5						
	Gray to Brown, wet, very dense, Sand with Gravel.							
714.5		47.5						
	Brown, wet, dense to very dense, Gravel with Sand.							
709.5		52.5						
	Gray, wet, very dense, Sand with Gravel.							
704.5		57.5						
	Brown, wet, very dense, Gravel with Sand, trace limestone fragments.							
699.5		62.5						
	Gray, wet, dense to very dense, Sand with Gravel.							
			35	SS-11	7-12-18 *N=30*	44	83	
			40	SS-12	10-12-18 *N=30*	44	89	
			45	SS-13	6-21-32 *N=53*	79	72	
			50	SS-14	20-35-50/5"		100	
			55	SS-15	40-25-28 *N=53*	79	100	
			60	SS-16	14-26-20 *N=46*	68	100	
			65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 762.0 ft.
Date Started/Completed: 3/14/2024-3/14/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 20' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-6
PROJECT #: J045355.01
PAGE #: 3 of 3
LAT,LON: 39.81281 ,-84.15827

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
			65	SS-17	6-18-30 *N=48*	71	61	
			70	SS-18	40-17-25 *N=42*	62	100	
689.5		72.5						
	Brown, wet, dense to very dense , Gravel with Sand.		75	SS-19	11-30-35 *N=65*	96	100	
			80	SS-20	4-10-18 *N=28*	42	50	
			85	SS-21	19-17-31 *N=48*	71	100	
670.5		91.5	90	SS-22	19-16-24 *N=40*	59	89	
	Bottom of test boring at 91.5 feet.		95					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 762.0 ft.
Date Started/Completed: 3/14/2024-3/14/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 20' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 7

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-7
PROJECT #: J045355.01
PAGE #: 1 of 2
LAT,LON: 39.81293 ,-84.16031

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
766.0	Ground Surface	0.0	0					
765.0	TOPSOIL (12 INCHES).	1.0		SS-1	1-4-6 ***N=10***	15	67	
	Brown, moist, medium dense to dense, Sand with Gravel, trace limestone fragments.			SS-2	9-16-16 ***N=32***	47	89	
			5	SS-3	9-12-11 ***N=23***	34	72	
				SS-4	3-4-5 ***N=9***	13	11	
			10	SS-5	5-6-11 ***N=17***	25	78	
				SS-6	17-25-25 ***N=50***	74	67	
			15	SS-7	10-13-22 ***N=35***	52	72	
			20	SS-8	15-25-22 ***N=47***	70	78	
741.0		25.0	25	SS-9	31-50/5"		100	4.5
	Gray, moist, hard, Silt.							
736.0		30.0	30					
	Brown, wet, dense to very dense, Sand with Gravel.			SS-10	9-16-22 ***N=38***	56	100	

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 766.0 ft.
Date Started/Completed: 3/13/2024-3/13/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 30' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-7
PROJECT #: J045355.01
PAGE #: 2 of 2
LAT,LON: 39.81293 ,-84.16031

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
			35	SS-11	16-35-49 *N=84*	125	100	
			40	SS-12	21-38-48 *N=86*	128	100	
724.5		41.5						
	Bottom of test boring at 41.5 feet.		45					
			50					
			55					
			60					
			65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 766.0 ft.
Date Started/Completed: 3/13/2024-3/13/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 30' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 7

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-8
PROJECT #: J045355.01
PAGE #: 1 of 2
LAT,LON: 39.81346 ,-84.16011

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
766.9	Ground Surface	0.0					
765.9	TOPSOIL (12 INCHES).	1.0	SS-1	2-3-4 *N=7*	10	44	
762.4	Brown, moist, medium dense to dense, Sand with Gravel.	4.5	SS-2	9-6-5 *N=11*	16	61	
759.9	Brown, moist, dense, Gravel with Sand, trace limestone fragments.	7.0	SS-3	14-19-18 *N=37*	55	72	
749.9	Gray and brown, moist, medium dense, Gravel with Sand.	17.0	SS-4	7-9-8 *N=17*	25	61	
			SS-5	6-12-21 *N=33*	49	56	
			SS-6	6-10-18 *N=28*	42	61	
			SS-7	7-12-17 *N=29*	43	61	
747.4	Gray and brown, moist, very dense, Sand with Gravel, trace limestone fragments.	19.5	SS-8	26-42-26 *N=68*	101	72	
739.9	Gray and brown, moist, dense, Gravel with Sand.	27.0	SS-9	14-20-26 *N=46*	68	89	
			SS-10	10-21-26 *N=47*	70	100	
			SS-11	14-17-28 *N=45*	67	100	
737.4	Gray and brown, wet, dense, Gravel with Sand.	29.5	SS-12	4-16-16 *N=32*	47	89	
734.4	Gray and brown, moist, dense, Sand with Gravel.	32.5	SS-13	16-25-18 *N=43*	64	100	

Depth Scale (feet): 0, 5, 10, 15, 20, 25, 30

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 766.9 ft.
Date Started/Completed: 3/4/2024-3/4/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 27' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-8
PROJECT #: J045355.01
PAGE #: 2 of 2
LAT,LON: 39.81346 ,-84.16011

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
	Gray and brown, moist, dense to very dense, Gravel with Sand.		35	SS-14	17-22-29 *N=51*	76	100	
725.4		41.5	40	SS-15	18-19-21 *N=40*	59	100	
	Bottom of test boring at 41.5 feet.		45, 50, 55, 60, 65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 766.9 ft.
Date Started/Completed: 3/4/2024-3/4/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 27' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 5

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-9
PROJECT #: J045355.01
PAGE #: 1 of 2
LAT,LON: 39.81472 ,-84.16126

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
767.9	Ground Surface	0.0	0					
766.9	TOPSOIL (12 INCHES).	1.0		SS-1	1-2-4 *N=6*	8	67	
	Brown, moist, medium dense, Clayey Sandy Silt, trace root hairs.			SS-2	3-4-6 *N=10*	13	100	
763.4		4.5	5	SS-3	6-5-7 *N=12*	16	6	
	Brown, moist, medium dense to dense, Gravel with Sand, trace limestone fragments.			SS-4	7-7-7 *N=14*	18	39	
			10	SS-5	5-8-12 *N=20*	26	56	
				SS-6	12-16-24 *N=40*	53	72	
			15	SS-7	6-12-14 *N=26*	34	61	
			20	SS-8	21-15-17 *N=32*	42	100	
745.4		22.5						
	Brown, wet, dense to very dense, Gravel with Silty Sand.		25 ▽	SS-9	9-15-21 *N=36*	47	100	
			30	SS-10	15-25-33 *N=58*	76	100	

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 767.9 ft.
Date Started/Completed: 3/13/2024-3/13/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55 LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 25' during drilling
▼ At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-9
PROJECT #: J045355.01
PAGE #: 2 of 2
LAT,LON: 39.81472 ,-84.16126

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
730.4	Brown, wet, very dense, Sand with Gravel.	37.5	35	SS-11	9-17-26 *N=43*	57	100	
726.4		41.5	40	SS-12	20-34-28 *N=62*	82	100	
	Bottom of test boring at 41.5 feet.		45, 50, 55, 60, 65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 767.9 ft.
Date Started/Completed: 3/13/2024-3/13/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55 LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 25' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 5

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-10
PROJECT #: J045355.01
PAGE #: 1 of 2
LAT,LON: 39.81440 ,-84.16174

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
768.7	Ground Surface	0.0	0					
767.7	TOPSOIL (12 INCHES).	1.0		SS-1	1-2-4 *N=6*	8	100	
764.2	Brown, moist, medium dense, Sand with Gravel.	4.5		SS-2	6-8-10 *N=18*	24	72	
761.7	Gray, moist, dense, Sand with Gravel.	7.0	5	SS-3	9-17-19 *N=36*	47	50	
759.2	Brown, moist, medium dense, Sand, trace gravel.	9.5		SS-4	5-5-12 *N=17*	22	67	
756.7	Gray to brown, moist, dense, Gravel with Sand, trace limestone fragments.	12.0	10	SS-5	12-19-18 *N=37*	49	44	
751.2	Brown, moist, medium dense, Gravel with Sand.	17.5		SS-6	6-12-13 *N=25*	33	33	
746.2	Brown, wet, medium dense, Gravel with Sand, trace limestone fragments.	22.5	15	SS-7	11-13-12 *N=25*	33	67	
736.2	Brown, wet, very dense, Sand with Gravel.	32.5	20 ▽	SS-8	14-15-10 *N=25*	33	61	
			25	SS-9	20-35-40 *N=75*	99	56	
			30	SS-10	17-20-30 *N=50*	66	100	

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 768.7 ft.
Date Started/Completed: 3/6/2024-3/6/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55 LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 20' during drilling
▼ At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-10
PROJECT #: J045355.01
PAGE #: 2 of 2
LAT,LON: 39.81440 ,-84.16174

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
	Brown, wet, very dense, Sand.		35	SS-11	20-33-39 *N=72*	95	100	
731.2		37.5						
	Brown, wet, very dense, Sand with Gravel.		40	SS-12	7-19-24 *N=43*	57	100	
727.2		41.5						
	Bottom of test boring at 41.5 feet.		45					
			50					
			55					
			60					
			65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 768.7 ft.
Date Started/Completed: 3/6/2024-3/6/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55 LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 20' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 6

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-11
PROJECT #: J045355.01
PAGE #: 1 of 3
LAT,LON: 39.81274 ,-84.16807

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
764.2	Ground Surface	0.0	0					
763.2	TOPSOIL (12 INCHES).	1.0		SS-1	1-2-3 *N=5*	7	100	
	Brown, moist, loose, Silty Sand with Gravel.			SS-2	3-2-3 *N=5*	7	67	
759.7		4.5	5	SS-3	10-19-17 *N=36*	53	61	
	Brown, moist, dense, Gravel with Sand and Silt (GW-SM), trace limestone fragments. Gravel=53.0%, Sand=39.2%,Silt & Clay=7.8% on SS-3.			SS-4	11-13-25 *N=38*	56	67	
			10	SS-5	9-16-24 *N=40*	59	78	
749.7		14.5		SS-6	15-19-18 *N=37*	55	72	
	Brown, moist, very dense, Sand with Gravel, trace limestone fragments.		15	SS-7	13-30-50/2"		64	
746.7		17.5						
	Brown, wet, dense, Sand with Gravel (GS-SM), trace limestone fragments. Gravel=31.1%, Sand=58.8%, Silt & Clay=10.1% on SS-8.		20 ▽	SS-8	10-19-17 *N=36*	53	89	
			25	SS-9	6-16-20 *N=36*	53	100	
736.7		27.5						
	Brown, wet, medium dense to dense , Sand with Gravel (SP-SM). Gravel=34.5%, Sand=65.6%, Silt & Clay=9.9% on SS-10.		30	SS-10	12-11-14 *N=25*	37	72	

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 764.2 ft.
Date Started/Completed: 3/7/2024-3/7/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 20' during drilling
▼ At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-11
PROJECT #: J045355.01
PAGE #: 2 of 3
LAT,LON: 39.81274 ,-84.16807

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
726.7	Brown, wet, dense , Sand with Silt (SW-SM). Gravel=1.1%, Sand=86.9%, Silt & Clay=12% on SS-12.	37.5	35	SS-11	9-18-21 ***N=39***	58	67	
721.7	Brown, wet, dense to very dense , Sand with Gravel, trace limestone fragments.	42.5	40	SS-12	5-12-23 ***N=35***	52	61	
			45	SS-13	10-20-38 ***N=58***	86	100	
711.7	Gray, wet, very dense, Gravel with Sand.	52.5	50	SS-14	15-20-28 ***N=48***	71	100	
			55	SS-15	4-13-26 ***N=39***	58	67	
701.7	Gray, wet, hard, Clayey Silt (CL-ML), some sand and gravel. LL=20%, PL=13%, PI=7% on SS-18.	62.5	60	SS-16	22-32-32 ***N=64***	95	100	
			65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 764.2 ft.
Date Started/Completed: 3/7/2024-3/7/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 20' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-11
PROJECT #: J045355.01
PAGE #: 3 of 3
LAT,LON: 39.81274 ,-84.16807

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
			65	SS-17	13-26-42 *N=68*	101	100	4.5
			70	SS-18	25-36-45 *N=81*	120	100	4.5
691.7		72.5						
	Gray, moist, very dense, Silt.		75	SS-19	16-27-38 *N=65*	96	100	4.5
			80	SS-20	16-28-42 *N=70*	104	100	4.5
			85	SS-21	14-21-46 *N=67*	99	100	4.5
			90	SS-22	16-46-34 *N=80*	119	100	4.5
672.7		91.5						
	Bottom of test boring at 91.5 feet.		95					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 764.2 ft.
Date Started/Completed: 3/7/2024-3/7/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 20' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 6

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-12
PROJECT #: J045355.01
PAGE #: 1 of 2
LAT,LON: 39.81296 ,-84.16901

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
763.3	Ground Surface	0.0	0					
762.3	TOPSOIL (12 INCHES).	1.0		SS-1	1-1-2 *N=3*	4	67	
761.3	Brown, moist, soft, Clayey Silt, trace limestone fragments.	2.0						
758.8	Brown, moist, medium dense, Sand with Gravel.	4.5		SS-2	4-5-8 *N=13*	17	72	
756.3	Brown, moist, medium dense, Sand, trace limestone fragments.	7.0	5	SS-3	16-15-13 *N=28*	37	6	
753.8	Brown to gray, moist, medium dense, Gravel with Sand.	9.5		SS-4	8-7-7 *N=14*	18	67	
748.8	Gray to brown, moist, very dense, Gravel with Sand, trace limestone fragments.	14.5	10	SS-5	14-31-29 *N=60*	79	89	
				SS-6	8-16-21 *N=37*	49	67	
	Gray to brown, moist, dense, Gravel with Sand.		15	SS-7	7-12-10 *N=22*	29	78	
			20	SS-8	9-13-20 *N=33*	43	100	
			25 ▽	SS-9	9-14-20 *N=34*	45	61	
735.8	Gray to brown, moist, dense, Sand with Gravel.	27.5	30	SS-10	21-15-21 *N=36*	47	89	

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 763.3 ft.
Date Started/Completed: 3/6/2024-3/6/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55 LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 25' during drilling
▼ At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-12
PROJECT #: J045355.01
PAGE #: 2 of 2
LAT,LON: 39.81296 ,-84.16901

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
			35	SS-11	12-17-15 *N=32*	42	89	
			40	SS-12	30-19-21 *N=40*	53	100	
721.8		41.5						
	Bottom of test boring at 41.5 feet.		45					
			50					
			55					
			60					
			65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 763.3 ft.
Date Started/Completed: 3/6/2024-3/6/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55 LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 25' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 4

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-13
PROJECT #: J045355.01
PAGE #: 1 of 2
LAT,LON: 39.81426 ,-84.16781

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
766.8	Ground Surface	0.0					
765.8	TOPSOIL (12 INCHES).	1.0	SS-1	1-2-2 N=4	6	67	
764.8	Brown, moist, soft, Clayey Silt, trace root hairs.	2.0					
	Gray to brown, moist, loose, Sand, trace gravel and root hairs.		SS-2	3-4-5 N=9	13	83	
759.8		7.0	SS-3	4-5-5 N=10	15	83	
	Gray to brown, moist, medium dense, Gravel with Sand, trace limestone fragments.		SS-4	11-14-11 N=25	37	61	
757.3		9.5					
	Gray to brown, moist, loose, Sand, trace gravel and limestone fragments.		SS-5	3-4-3 N=7	10	33	
754.8		12.0					
	Gray to brown, moist, medium dense, Sand with Gravel.		SS-6	4-8-8 N=16	24	44	
752.3		14.5					
	Brown, moist, very dense, Gravel with Sand, trace limestone fragments.		SS-7	7-24-31 N=55	82	72	
749.3		17.5					
	Gray to brown, moist, dense, Sand with Gravel.		SS-8	12-20-23 N=43	64	89	
744.3		22.5					
	Brown, wet, medium dense, Silty Sand with Gravel.		SS-9	8-9-10 N=19	28	56	
739.3		27.5					
	Brown, moist, medium dense to dense, Gravel with Sand.		SS-10	9-13-16 N=29	43	100	

Depth Scale (feet): 0, 5, 10, 15, 20, 25, 30

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 766.8 ft.
Date Started/Completed: 3/12/2024-3/12/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 25' during drilling
▼ At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-13
PROJECT #: J045355.01
PAGE #: 2 of 2
LAT,LON: 39.81426 ,-84.16781

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
			35	SS-11	15-22-26 *N=48*	71	100	
			40	SS-12	18-20-22 *N=42*	62	100	
725.3		41.5						
	Bottom of test boring at 41.5 feet.		45					
			50					
			55					
			60					
			65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 766.8 ft.
Date Started/Completed: 3/12/2024-3/12/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 25' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 4

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-14
PROJECT #: J045355.01
PAGE #: 1 of 2
LAT,LON: 39.81436 ,-84.16713

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
763.6	Ground Surface	0.0	0					
762.6	TOPSOIL (12 INCHES).	1.0		SS-1	1-1-3 *N=4*	6	100	
	Brown, moist, medium dense, Sand, trace root hairs.			SS-2	3-3-7 *N=10*	15	33	
759.1		4.5	5					
	Brown, moist, medium dense, Gravel with Sand, trace limestone fragments.			SS-3	6-9-8 *N=17*	25	56	
				SS-4	4-4-10 *N=14*	21	61	
754.1		9.5	10					
	Gray to brown, moist, dense, Gravel with Sand, trace limestone fragments.			SS-5	7-15-18 *N=33*	49	78	
				SS-6	10-16-14 *N=30*	44	56	
			15	SS-7	11-17-15 *N=32*	47	72	
746.1		17.5						
	Brown, wet, medium dense, Gravel with Sand, trace limestone fragments.		20 ▽	SS-8	13-13-13 *N=26*	39	72	
			25	SS-9	7-9-16 *N=25*	37	100	
736.1		27.5						
	Brown to gray, wet, medium dense, Sand, trace gravel.		30	SS-10	13-11-17 *N=28*	42	100	

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 763.6 ft.
Date Started/Completed: 3/11/2024-3/11/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 20' during drilling
▼ At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-14
PROJECT #: J045355.01
PAGE #: 2 of 2
LAT,LON: 39.81436 ,-84.16713

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
726.1	Brown to gray, wet, very dense, Sand with Gravel.	37.5	35	SS-11	13-22-20 *N=42*	62	72	
722.1		41.4	40	SS-12	15-30-50/5"		100	
	Bottom of test boring at 41.4 feet.		45					
			50					
			55					
			60					
			65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 763.6 ft.
Date Started/Completed: 3/11/2024-3/11/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 20' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 2

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-15
PROJECT #: J045355.01
PAGE #: 1 of 2
LAT,LON: 39.81529 ,-84.16765

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
765.1	Ground Surface	0.0	0					
764.1	TOPSOIL (12 INCHES).	1.0		SS-1	1-3-4 *N=7*	10	67	
763.1	Brown, moist, loose, Silty Sand, trace root hairs.	2.0						
	Brown, moist, loose, Sand, trace gravel.			SS-2	3-4-5 *N=9*	13	61	
			5	SS-3	4-4-5 *N=9*	13	61	
758.1		7.0						
	Gray to brown, moist, medium dense, Sand, trace gravel.			SS-4	4-4-16 *N=20*	30	61	
755.6		9.5						
	Gray to brown, moist, medium dense to dense, Gravel with Sand.		10	SS-5	10-11-13 *N=24*	36	72	
				SS-6	8-12-13 *N=25*	37	72	
			15	SS-7	12-10-10 *N=20*	30	56	
			20	SS-8	12-14-24 *N=38*	56	72	
742.6		22.5						
	Brown, wet, dense, Sand with Gravel.		▽25	SS-9	6-14-20 *N=34*	50	100	
737.6		27.5						
	Brown, wet, medium dense, Sand, some gravel.		30	SS-10	23-11-17 *N=28*	42	100	

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 765.1 ft.
Date Started/Completed: 3/11/2024-3/11/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 25' during drilling
▼ At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-15
PROJECT #: J045355.01
PAGE #: 2 of 2
LAT,LON: 39.81529 ,-84.16765

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
			35	SS-11	23-9-17 *N=26*	39	100	
			40	SS-12	12-11-16 *N=27*	40	100	
723.6	Bottom of test boring at 41.5 feet.	41.5	45					
			50					
			55					
			60					
			65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 765.1 ft.
Date Started/Completed: 3/11/2024-3/11/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 25' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 2

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-16
PROJECT #: J045355.01
PAGE #: 1 of 2
LAT,LON: 39.81580 ,-84.16748

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
765.6	Ground Surface	0.0	0					
764.6	TOPSOIL (12 INCHES).	1.0		SS-1	1-2-3 *N=5*	7	72	
763.6	Brown, moist, Sandy Clayey Silt, trace root hairs.	2.0						
	Gray to brown, moist, loose, Sand.			SS-2	2-2-3 *N=5*	7	100	
761.1		4.5						
	Gray to brown, moist, medium dense, Sand with Gravel, trace limestone fragments.		5	SS-3	7-8-6 *N=14*	21	100	
758.6		7.0						
	Gray to brown, moist, medium dense, Sand with Gravel.			SS-4	3-9-7 *N=16*	24	100	
			10	SS-5	3-6-7 *N=13*	19	100	
				SS-6	8-12-13 *N=25*	37	100	
			15	SS-7	4-7-8 *N=15*	22	72	
746.1		19.5		SS-8	8-9-15 *N=24*	36	100	
	Brown, wet, medium dense, Gravel with Sand, trace limestone fragments.		20	SS-9	12-13-11 *N=24*	36	72	
743.6		22.0						
	Gray to brown, wet, dense, Gravel with Sand, trace limestone fragments.			SS-10	8-16-20 *N=36*	53	67	
			25	SS-11	11-19-12 *N=31*	46	89	
				SS-12	9-13-19 *N=32*	47	100	
736.1		29.5						
	Brown, wet, dense to very dense, Sand with Gravel.		30	SS-13	9-12-19 *N=31*	46	67	

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 765.6 ft.
Date Started/Completed: 3/5/2024-3/5/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 22.5' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-16
PROJECT #: J045355.01
PAGE #: 2 of 2
LAT,LON: 39.81580 ,-84.16748

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
			35	SS-14	18-19-31 *N=50*	74	100	
			40	SS-15	19-15-22 *N=37*	55	72	
724.1	Bottom of test boring at 41.5 feet.	41.5	45					
			50					
			55					
			60					
			65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 765.6 ft.
Date Started/Completed: 3/5/2024-3/5/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 22.5' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 3

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-17
PROJECT #: J045355.01
PAGE #: 1 of 2
LAT,LON: 39.81527 ,-84.16493

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
765.4	Ground Surface	0.0					
764.4	TOPSOIL (12 INCHES).	1.0	SS-1	1-3-2 *N=5*	7	67	
763.4	Brown, moist, loose, Sandy Silt, trace root hairs.	2.0					
	Brown, moist, medium dense, Gravel with Sand, trace limestone fragments.		SS-2	6-6-5 *N=11*	16	61	
			SS-3	11-10-9 *N=19*	28	0	
758.4		7.0					
	Gray to Brown, moist, medium dense to dense, Gravel with Sand, trace limestone fragments.		SS-4	5-10-15 *N=25*	37	100	
			SS-5	12-15-17 *N=32*	47	56	
753.4		12.0					
	Gray to Brown, moist, dense to very dense, Gravel with Sand, trace limestone fragments.		SS-6	12-27-27 *N=54*	80	100	
			SS-7	12-17-16 *N=33*	49	100	
			SS-8	12-17-16 *N=33*	49	33	
742.9		22.5					
	Brown, wet, medium dense, Gravel with Sand.		SS-9	8-12-14 *N=26*	39	67	
737.9		27.5					
	Brown, wet, dense to very dense, Sand with Gravel.		SS-10	11-10-26 *N=36*	53	83	
732.9		32.5					

Depth Scale (feet): 0, 5, 10, 15, 20, 25, 30

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 765.4 ft.
Date Started/Completed: 3/17/2024-3/17/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 25' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-17
PROJECT #: J045355.01
PAGE #: 2 of 2
LAT,LON: 39.81527 ,-84.16493

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
723.9	Brown, wet, very dense, Gravel with Sand.	41.5	35	SS-11	10-30-25 ***N=55***	82	100	
			40	SS-12	6-18-26 ***N=44***	65	100	
	Bottom of test boring at 41.5 feet.		45					
			50					
			55					
			60					
			65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 765.4 ft.
Date Started/Completed: 3/17/2024-3/17/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 25' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 3

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-18
PROJECT #: J045355.01
PAGE #: 1 of 2
LAT,LON: 39.81571 ,-84.16555

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
766.0	Ground Surface	0.0	0					
765.0	TOPSOIL (12 INCHES).	1.0		SS-1	1-2-2 *N=4*	6	89	
764.0	Brown, moist, loose, Sandy Clayey Silt, trace root hairs.	2.0						
	Gray to Brown, moist, medium dense, Silty Sand with Gravel, trace limestone fragments.			SS-2	4-8-9 *N=17*	25	39	
			5	SS-3	6-9-11 *N=20*	30	72	
				SS-4	9-11-11 *N=22*	33	56	
756.5		9.5						
	Brown, moist, medium dense to dense, Gravel with Sand, trace limestone fragments.		10	SS-5	17-16-14 *N=30*	44	44	
				SS-6	9-16-21 *N=37*	55	78	
			15	SS-7	14-16-11 *N=27*	40	83	
			20	SS-8	12-15-15 *N=30*	44	78	
743.5		22.5						
	Brown, wet, medium dense to dense, Gravel with Sand, trace limestone fragments.		▽25	SS-9	11-12-15 *N=27*	40	67	
738.5		27.5						
	Gray to brown, wet, dense, Gravel with Sand.		30	SS-10	16-13-20 *N=33*	49	100	

Elevation Ref.: Google Earth Pro
Surface Elevation: 766.0 ft.
Date Started/Completed: 3/6/2024-3/6/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 25' during drilling
▼ At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-18
PROJECT #: J045355.01
PAGE #: 2 of 2
LAT,LON: 39.81571 ,-84.16555

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
724.5	Bottom of test boring at 41.5 feet.	41.5	35 40 45 50 55 60 65	SS-11 SS-12	26-15-29 ***N=44*** 20-30-20 ***N=50***	65 74	100 100	

Elevation Ref.: Google Earth Pro
Surface Elevation: 766.0 ft.
Date Started/Completed: 3/6/2024-3/6/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 25' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 1

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-19
PROJECT #: J045355.01
PAGE #: 1 of 3
LAT,LON: 39.81707 ,-84.16477

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
766.0	Ground Surface	0.0	0					
765.0	TOPSOIL (12 INCHES).	1.0		SS-1	1-2-3 *N=5*	7	78	
764.0	Gray, moist, loose, Sandy Silt, trace root hairs.	2.0						
	Gray to brown, moist, medium dense to dense, Gravel with Sand, trace limestone fragments. Gravel=49.8%, Sand=40.6, Silt & Clay=9.6% on SS-4.			SS-2	6-8-10 *N=18*	24	50	
			5	SS-3	12-13-11 *N=24*	32	44	
				SS-4	10-20-15 *N=35*	46	28	
			10	SS-5	7-9-12 *N=21*	28	67	
				SS-6	12-20-27 *N=47*	62	72	
			15	SS-7	9-12-19 *N=31*	41	61	
748.5		17.5						
	Gray to brown, moist, very dense, Gravel with Sand.			SS-8	12-48-31 *N=79*	104	39	
743.5		22.5	20					
	Gray to brown, wet, dense, Gravel with Sand.		▽25	SS-9	7-18-24 *N=42*	55	100	
738.5		27.5						
	Gray, wet, very dense Sand with Gravel (SW-SM). Gravel=24.2%, Sand=65.8%, Silt & Clay=10% on SS-11.		30	SS-10	20-25-26 *N=51*	67	100	

Elevation Ref.: Google Earth Pro
Surface Elevation: 766.0 ft.
Date Started/Completed: 3/12/2024-3/12/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55 LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 25' during drilling
▼ At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-19
PROJECT #: J045355.01
PAGE #: 2 of 3
LAT,LON: 39.81707 ,-84.16477

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
723.5		42.5	35	SS-11	12-25-23 *N=48*	63	100	
	Gray , wet, very dense, Fine to Medium Sand (SP-SM). Gravel=3.6%, Sand=90.6%, Silt & Clay=5.8% on SS-13.		40	SS-12	19-15-17 *N=32*	42	100	
718.5		47.5	45	SS-13	13-42-34 *N=76*	100	100	
	Gray, wet, very dense, Silty Sand with Gravel.		50	SS-14	22-34-27 *N=61*	80	100	
713.5		52.5						
	Gray , wet, medium dense, Sand.		55	SS-15	22-12-14 *N=26*	34	3	
708.5		57.5						
	Gray, wet, hard, Clay (CL). W=10.6%, LL=20%, PL=14%, PI=8% on SS-16.		60	SS-16	12-18-32 *N=50*	66	100	4.5
703.5		62.5						
	Gray, wet, dense to very dense, Gravel with Sand.		65					

Elevation Ref.: Google Earth Pro
Surface Elevation: 766.0 ft.
Date Started/Completed: 3/12/2024-3/12/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55 LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 25' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-19
PROJECT #: J045355.01
PAGE #: 3 of 3
LAT,LON: 39.81707 ,-84.16477

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
			65	SS-17	12-30-18 *N=48*	63	100	
			70	SS-18	35-20-20 *N=40*	53	100	
			75	SS-19	25-48-50/5"		100	
688.5	Gray, wet, very dense, Silty Gravel with Sand.	77.5						
			80	SS-20	21-35-50/4"		100	
683.5	Gray, wet, very dense, Sand with Gravel.	82.5						
			85	SS-21	16-18-29 *N=47*	62	100	
			90	SS-22	18-33-36 *N=69*	91	100	
674.5	Bottom of test boring at 91.5 feet.	91.5	95					

Elevation Ref.: Google Earth Pro
Surface Elevation: 766.0 ft.
Date Started/Completed: 3/12/2024-3/12/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55 LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 25' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

Pond 1

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-20
PROJECT #: J045355.01
PAGE #: 1 of 2
LAT,LON: 39.81664 ,-84.16347

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
767.4	Ground Surface	0.0	0					
766.4	TOPSOIL (12 INCHES).	1.0		SS-1	1-3-3 *N=6*	9	67	
765.4	Brown, moist, loose, Sandy Clayey Silt, trace root hairs.	2.0						
	Gray to brown, moist, medium dense to dense, Gravel with Sand, trace limestone fragments.			SS-2	7-6-8 *N=14*	21	56	
			5	SS-3	9-14-15 *N=29*	43	78	
				SS-4	9-11-15 *N=26*	39	67	
755.4		12.0	10	SS-5	8-9-12 *N=21*	31	56	
	Gray to brown, moist, medium dense, Gravel with Sand.			SS-6	8-9-12 *N=21*	31	67	
752.9		14.5						
	Gray to brown, moist, very dense, Gravel with Sand, trace limestone fragments.		15	SS-7	11-39-29 *N=68*	101	100	
750.4		17.0						
	Gray to brown, moist, medium dense, Gravel with Sand, trace limestone fragments.			SS-8	10-10-10 *N=20*	30	61	
			20	SS-9	14-10-9 *N=19*	28	72	
				SS-10	10-12-10 *N=22*	33	56	
742.9		24.5						
	Brown, wet, medium dense, Sand with Gravel.		25	SS-11	13-11-5 *N=16*	24	89	
740.4		27.0						
	Brown, wet, medium dense, Silty Gravel with Sand.			SS-12	9-7-7 *N=14*	21	78	
			30	SS-13	4-10-14 *N=24*	36	56	
734.9		32.5						

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 767.4 ft.
Date Started/Completed: 3/4/2024-3/4/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 25' during drilling
▼ At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-20
PROJECT #: J045355.01
PAGE #: 2 of 2
LAT,LON: 39.81664 ,-84.16347

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
729.9	Brown to gray, wet, medium dense, Gravel with Sand.	37.5	35	SS-14	4-9-10 *N=19*	28	67	
725.9	Gray, wet, medium dense, Sand with Gravel.	41.5	40	SS-15	10-19-7 *N=26*	39	100	
	Bottom of test boring at 41.5 feet.		45, 50, 55, 60, 65					

Elevation Ref.: Trimble Zeno GPS Survey
Surface Elevation: 767.4 ft.
Date Started/Completed: 3/4/2024-3/4/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: CME 55LC
Foreman: T. Gilbert
Engineer: Dan Furgason

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 25' during drilling
At Completion: Not Encountered
After:
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 90%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

SOIL CLASSIFICATION SHEET

NON COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

Density

Very Loose	- 4 blows/ft. or less
Loose	- 5 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft.
Very Dense	- 51 blows/ft. or more

Relative Properties

Descriptive Term	Percent
Trace	1 – 10
Little	11 – 20
Some	21 – 35
And	36 – 50

Particle Size Identification

Boulders	- 8 inch diameter or more	
Cobbles	- 3 to 8 inch diameter	
Gravel	- Coarse	- 3/4 to 3 inches
	- Fine	- 3/16 to 3/4 inches
Sand	- Coarse	- 2mm to 5mm (dia. of pencil lead)
	- Medium	- 0.45mm to 2mm (dia. of broom straw)
	- Fine	- 0.075mm to 0.45mm (dia. of human hair)
Silt		- 0.005mm to 0.075mm (Cannot see particles)

COHESIVE SOILS
(Clay, Silt and Combinations)

Consistency	Field Identification	Unconfined Compressive Strength (tons/sq. ft.)
Very Soft	Easily penetrated several inches by fist	Less than 0.25
Soft	Easily penetrated several inches by thumb	0.25 – 0.5
Medium Stiff	Can be penetrated several inches by thumb with moderate effort	0.5 – 1.0
Stiff	Readily indented by thumb but penetrated only with great effort	1.0 – 2.0
Very Stiff	Readily indented by thumbnail	2.0 – 4.0
Hard	Indented with difficulty by thumbnail	Over 4.0

Classification on logs are made by visual inspection.

Standard Penetration Test – Driving a 2.0" O.D., 1 3/8" I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. It is customary to drive the spoon 6 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6 inches of penetration on the drill log (Example – 6/8/9). The standard penetration test results can be obtained by adding the last two figures (i.e. 8+9=17 blows/ft.). Refusal is defined as greater than 50 blows for 6 inches or less penetration.

Strata Changes – In the column "Soil Descriptions" on the drill log, the horizontal lines represent strata changes. A solid line (————) represents an actually observed change; a dashed line (— — — —) represents an estimated change.

Groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

APPENDIX C – INFILTRATION TESTING

GEOTECHNOLOGY
A Universal Engineering Sciences Company

FALLING HEAD FIELD INFILTRATION TEST WITHIN BOREHOLE/STANDPIPE

PROJECT NO.: J045355.01
CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
LOCATION: Dayton, Ohio
TEST NO.: 10
TEST LOCATION: B-19
SOIL DESCRIPTION: Dense Sand with Gravel

TEST START DATE: 3/22/2024
TEST END DATE: 3/22/2024
PERSONNEL: SB

Depth of Infiltration Surface below Ground Surface (ft.): 35
Depth to Water Table (ft.): 25
Borehole Depth (ft.): 35
Borehole Diameter (in.): 6.25
Standpipe Material: PVC
Standpipe Diameter (in.): 4
Standpipe Penetration Below Infiltration Surface (in.): 0
Infiltration Area (in.^{2}): 30.68

Infiltration Liquid Used: Water
Weather:
Air Temperature (°F):

Date	Time	Incremental Elapsed Time, Δt (min.)	Total Elapsed Time, t (min.)	Reference Water Measurement (in.)	Depth of Water Above Infiltration Surface, h (in.)	Infiltration Rate v (in./hr.)	Infiltration Rate v (cm/hr.)	Remarks
3/22/2024	8:18 AM	-	0	0.0	420.0	-	-	
"	8:33 AM	15	15	-0.6	419.4	2.4	6.1	
"	8:48 AM	15	30	-0.9	419.1	1.2	3.0	
"	9:03 AM	15	45	-1.2	418.8	1.2	3.0	
"	9:18 AM	15	60	-1.5	418.5	1.2	3.0	
"	9:48 AM	30	90	-1.8	418.2	0.6	1.5	
"	10:18 AM	30	120	-2.1	417.9	0.6	1.5	
"	11:18 AM	60	180	-19.8	400.2	17.7	45.0	
"	12:18 PM	60	240	-32.4	387.6	12.6	32.0	

GEOTECHNOLOGY
A Universal Engineering Sciences Company

FALLING HEAD FIELD INFILTRATION TEST WITHIN BOREHOLE/STANDPIPE

PROJECT NO.: J045355.01
CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
LOCATION: Dayton, Ohio
TEST NO.: 01
TEST LOCATION: B-5
SOIL DESCRIPTION: Very Stiff Silty Clay

TEST START DATE: 3/19/2024
TEST END DATE: 3/19/2024
PERSONNEL: SB

Depth of Infiltration Surface below Ground Surface (ft.): 25
Depth to Water Table (ft.): 20
Borehole Depth (ft.): 25
Borehole Diameter (in.): 6.25
Standpipe Material: PVC
Standpipe Diameter (in.): 4
Standpipe Penetration Below Infiltration Surface (in.): 0
Infiltration Area (in.^{2}): 30.68

Infiltration Liquid Used: Water
Weather:
Air Temperature (°F):

Date	Time	Incremental Elapsed Time, Δt (min.)	Total Elapsed Time, t (min.)	Reference Water Measurement (in.)	Depth of Water Above Infiltration Surface, h (in.)	Infiltration Rate v (in./hr.)	Infiltration Rate v (cm/hr.)	Remarks
3/19/2024	3:30 PM	-	0	0.0	300.0	-	-	
"	3:45 PM	15	15	-2.4	297.6	9.6	24.4	
"	4:00 PM	15	30	-2.4	297.6	0.0	0.0	
"	4:15 PM	15	45	-3.3	296.7	3.6	9.1	
"	4:30 PM	15	60	-3.6	296.4	1.2	3.0	
"	5:00 PM	30	90	-3.9	296.1	0.6	1.5	
"	5:30 PM	30	120	-4.2	295.8	0.6	1.5	
"	6:30 PM	60	180	-4.5	295.5	0.3	0.8	
3/20/2024	9:00 AM	870	1050	-5.4	294.6	0.1	0.2	

Filename: B-5_25FT_Falling Head Field Infiltration Test
Tab: Input

GEOTECHNOLOGY
A Universal Engineering Sciences Company

FALLING HEAD FIELD INFILTRATION TEST WITHIN BOREHOLE/STANDPIPE

PROJECT NO.: J045355.01
CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
LOCATION: Dayton, Ohio
TEST NO.: 04
TEST LOCATION: B-6
SOIL DESCRIPTION: Medium dense Sand with Gravel

TEST START DATE: 3/20/2024
TEST END DATE: 3/20/2024
PERSONNEL: SB

Depth of Infiltration Surface below Ground Surface (ft.): 20
Depth to Water Table (ft.): 20
Borehole Depth (ft.): 20
Borehole Diameter (in.): 6.25
Standpipe Material: PVC
Standpipe Diameter (in.): 4
Standpipe Penetration Below Infiltration Surface (in.): 0
Infiltration Area (in.^{2}): 30.68

Infiltration Liquid Used: Water
Weather:
Air Temperature (°F):

Date	Time	Incremental Elapsed Time, Δt (min.)	Total Elapsed Time, t (min.)	Reference Water Measurement (in.)	Depth of Water Above Infiltration Surface, h (in.)	Infiltration Rate v (in./hr.)	Infiltration Rate v (cm/hr.)	Remarks
3/20/2024	11:25 AM	-	0	0.0	240.0	-	-	
"	11:40 AM	15	15	-3.6	236.4	14.4	36.6	
"	11:55 AM	15	30	-5.4	234.6	7.2	18.3	
"	12:10 PM	15	45	-7.2	232.8	7.2	18.3	
"	12:25 PM	15	60	-9.0	231.0	7.2	18.3	
"	12:55 PM	30	90	-12.6	227.4	7.2	18.3	
"	1:25 PM	30	120	-16.2	223.8	7.2	18.3	
"	2:25 PM	60	180	-21.6	218.4	5.4	13.7	
"	3:25 PM	60	240	-27.6	212.4	6.0	15.2	

Filename: B-6_20FT_Falling Head Field Infiltration Test
Tab: Input

GEOTECHNOLOGY
A Universal Engineering Sciences Company

FALLING HEAD FIELD INFILTRATION TEST WITHIN BOREHOLE/STANDPIPE

PROJECT NO.: J045355.01
CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
LOCATION: Dayton, Ohio
TEST NO.: 04
TEST LOCATION: B-6
SOIL DESCRIPTION: Dense Sand with Gravel

TEST START DATE: 3/20/2024
TEST END DATE: 3/20/2024
PERSONNEL: SB

Depth of Infiltration Surface below Ground Surface (ft.): 25
Depth to Water Table (ft.): 20
Borehole Depth (ft.): 25
Borehole Diameter (in.): 6.25
Standpipe Material: PVC
Standpipe Diameter (in.): 4
Standpipe Penetration Below Infiltration Surface (in.): 0
Infiltration Area (in.^{2}): 30.68

Infiltration Liquid Used: Water
Weather:
Air Temperature (°F):

Date	Time	Incremental Elapsed Time, Δt (min.)	Total Elapsed Time, t (min.)	Reference Water Measurement (in.)	Depth of Water Above Infiltration Surface, h (in.)	Infiltration Rate v (in./hr.)	Infiltration Rate v (cm/hr.)	Remarks
3/20/2024	11:25 AM	-	0	0.0	300.0	-	-	
"	11:40 AM	15	15	-9.0	291.0	36.0	91.4	
"	11:55 AM	15	30	-13.2	286.8	16.8	42.7	
"	12:10 PM	15	45	-18.6	281.4	21.6	54.9	
"	12:25 PM	15	60	-24.0	276.0	21.6	54.9	
"	12:55 PM	30	90	-31.2	268.8	14.4	36.6	
"	1:25 PM	30	120	-38.4	261.6	14.4	36.6	
"	2:25 PM	60	180	-54.0	246.0	15.6	39.6	
"	3:25 PM	60	240	-67.2	232.8	13.2	33.5	

Filename: B-6_25FT_Falling Head Field Infiltration Test
Tab: Input

GEOTECHNOLOGY
A Universal Engineering Sciences Company

FALLING HEAD FIELD INFILTRATION TEST WITHIN BOREHOLE/STANDPIPE

PROJECT NO.: J045355.01
CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
LOCATION: Dayton, Ohio
TEST NO.: 03
TEST LOCATION: B-6
SOIL DESCRIPTION: Very Stiff Silt

TEST START DATE: 3/20/2024
TEST END DATE: 3/20/2024
PERSONNEL: SB

Depth of Infiltration Surface below Ground Surface (ft.): 30
Depth to Water Table (ft.): 20
Borehole Depth (ft.): 30
Borehole Diameter (in.): 6.25
Standpipe Material: PVC
Standpipe Diameter (in.): 4
Standpipe Penetration Below Infiltration Surface (in.): 0
Infiltration Area (in.^{2}): 30.68

Infiltration Liquid Used: Water
Weather:
Air Temperature (°F):

Date	Time	Incremental Elapsed Time, Δt (min.)	Total Elapsed Time, t (min.)	Reference Water Measurement (in.)	Depth of Water Above Infiltration Surface, h (in.)	Infiltration Rate v (in./hr.)	Infiltration Rate v (cm/hr.)	Remarks
3/20/2024	10:40 AM	-	0	0.0	360.0	-	-	
"	10:55 AM	15	15	-117.6	242.4	470.4	1194.8	
"	11:10 AM	15	30	-146.4	213.6	115.2	292.6	
"	11:25 AM	15	45	-158.4	201.6	48.0	121.9	
"	11:40 AM	15	60	-159.6	200.4	4.8	12.2	
"	12:10 PM	30	90	-163.2	196.8	7.2	18.3	
"	12:40 PM	30	120	-166.8	193.2	7.2	18.3	
"	1:40 PM	60	180	-171.6	188.4	4.8	12.2	
"	2:40 PM	60	240	-176.4	183.6	4.8	12.2	
"	3:40 PM	60	300	-181.2	178.8	4.8	12.2	

Filename: B-6_30FT_Falling Head Field Infiltration Test
Tab: Input

GEOTECHNOLOGY
A Universal Engineering Sciences Company

FALLING HEAD FIELD INFILTRATION TEST WITHIN BOREHOLE/STANDPIPE

PROJECT NO.: J045355.01
CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
LOCATION: Dayton, Ohio
TEST NO.: 02
TEST LOCATION: B-6
SOIL DESCRIPTION: Dense Sand with Gravel

TEST START DATE: 3/20/2024
TEST END DATE: 3/20/2024
PERSONNEL: SB

Depth of Infiltration Surface below Ground Surface (ft.): 40
Depth to Water Table (ft.): 20
Borehole Depth (ft.): 40
Borehole Diameter (in.): 6.25
Standpipe Material: PVC
Standpipe Diameter (in.): 4
Standpipe Penetration Below Infiltration Surface (in.): 0
Infiltration Area (in.^{2}): 30.68

Infiltration Liquid Used: Water
Weather:
Air Temperature (°F):

Date	Time	Incremental Elapsed Time, Δt (min.)	Total Elapsed Time, t (min.)	Reference Water Measurement (in.)	Depth of Water Above Infiltration Surface, h (in.)	Infiltration Rate v (in./hr.)	Infiltration Rate v (cm/hr.)	Remarks
3/20/2024	9:25 AM	-	0	0.0	480.0	-	-	
"	9:40 AM	15	15	-32.4	447.6	129.6	329.2	
"	9:55 AM	15	30	-49.2	430.8	67.2	170.7	
"	10:10 AM	15	45	-60.0	420.0	43.2	109.7	
"	10:25 AM	15	60	-70.8	409.2	43.2	109.7	
"	10:55 AM	30	90	-92.4	387.6	43.2	109.7	
"	11:25 AM	30	120	-103.2	376.8	21.6	54.9	
"	12:25 PM	60	180	-127.2	352.8	24.0	61.0	
"	1:25 PM	60	240	-145.2	334.8	18.0	45.7	
"	2:25 PM	60	300	-163.2	316.8	18.0	45.7	
"	3:25 PM	60	360	-175.2	304.8	12.0	30.5	

Filename: B-6_40FT_Falling Head Field Infiltration Test
Tab: Input

GEOTECHNOLOGY
A Universal Engineering Sciences Company

FALLING HEAD FIELD INFILTRATION TEST WITHIN BOREHOLE/STANDPIPE

PROJECT NO.: J045355.01
CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
LOCATION: Dayton, Ohio
TEST NO.: 09
TEST LOCATION: B-11
SOIL DESCRIPTION: Dense Sand with Gravel

TEST START DATE: 3/21/2024
TEST END DATE: 3/21/2024
PERSONNEL: SB

Depth of Infiltration Surface below Ground Surface (ft.): 20
Depth to Water Table (ft.): 20
Borehole Depth (ft.): 20
Borehole Diameter (in.): 6.25
Standpipe Material: PVC
Standpipe Diameter (in.): 4
Standpipe Penetration Below Infiltration Surface (in.): 0
Infiltration Area (in.^{2}): 30.68

Infiltration Liquid Used: Water
Weather:
Air Temperature (°F):

Date	Time	Incremental Elapsed Time, Δt (min.)	Total Elapsed Time, t (min.)	Reference Water Measurement (in.)	Depth of Water Above Infiltration Surface, h (in.)	Infiltration Rate v (in./hr.)	Infiltration Rate v (cm/hr.)	Remarks
3/21/2024	1:11 PM	-	0	0.0	240.0	-	-	
"	1:26 PM	15	15	-240.0	0.0	960.0	2438.4	
"	1:31 PM	5	20	-240.0	0.0	0.0	0.0	

Filename: B-11_20FT_Falling Head Field Infiltration Test
Tab: Input

GEOTECHNOLOGY
A Universal Engineering Sciences Company

FALLING HEAD FIELD INFILTRATION TEST WITHIN BOREHOLE/STANDPIPE

PROJECT NO.: J045355.01
CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
LOCATION: Dayton, Ohio
TEST NO.: 08
TEST LOCATION: B-11
SOIL DESCRIPTION: Dense Sand with Gravel

TEST START DATE: 3/21/2024
TEST END DATE: 3/21/2024
PERSONNEL: SB

Depth of Infiltration Surface below Ground Surface (ft.): 25
Depth to Water Table (ft.): 20
Borehole Depth (ft.): 25
Borehole Diameter (in.): 6.25
Standpipe Material: PVC
Standpipe Diameter (in.): 4
Standpipe Penetration Below Infiltration Surface (in.): 0
Infiltration Area (in.^{2}): 30.68

Infiltration Liquid Used: Water
Weather:
Air Temperature (°F):

Date	Time	Incremental Elapsed Time, Δt (min.)	Total Elapsed Time, t (min.)	Reference Water Measurement (in.)	Depth of Water Above Infiltration Surface, h (in.)	Infiltration Rate v (in./hr.)	Infiltration Rate v (cm/hr.)	Remarks
3/21/2024	1:14 PM	-	0	0.0	300.0	-	-	
"	1:29 PM	15	15	-300.0	0.0	1200.0	3048.0	
"	1:32 PM	3	18	-300.0	0.0	0.0	0.0	

Filename: B-11_25FT_Falling Head Field Infiltration Test
Tab: Input

GEOTECHNOLOGY
A Universal Engineering Sciences Company

FALLING HEAD FIELD INFILTRATION TEST WITHIN BOREHOLE/STANDPIPE

PROJECT NO.: J045355.01
CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
LOCATION: Dayton, Ohio
TEST NO.: 07
TEST LOCATION: B-11
SOIL DESCRIPTION: Medium Dense Sand with Gravel

TEST START DATE: 3/21/2024
TEST END DATE: 3/21/2024
PERSONNEL: SB

Depth of Infiltration Surface below Ground Surface (ft.): 30
Depth to Water Table (ft.): 20
Borehole Depth (ft.): 30
Borehole Diameter (in.): 6.25
Standpipe Material: PVC
Standpipe Diameter (in.): 4
Standpipe Penetration Below Infiltration Surface (in.): 0
Infiltration Area (in.^{2}): 30.68

Infiltration Liquid Used: Water
Weather:
Air Temperature (°F):

Date	Time	Incremental Elapsed Time, Δt (min.)	Total Elapsed Time, t (min.)	Reference Water Measurement (in.)	Depth of Water Above Infiltration Surface, h (in.)	Infiltration Rate v (in./hr.)	Infiltration Rate v (cm/hr.)	Remarks
3/21/2024	1:10 PM	-	0	0.0	360.0	-	-	
"	1:25 PM	15	15	-1.5	358.5	6.0	15.2	
"	1:40 PM	15	30	-2.4	357.6	3.6	9.1	
"	1:55 PM	15	45	-2.7	357.3	1.2	3.0	
"	2:10 PM	15	60	-3.0	357.0	1.2	3.0	
"	2:40 PM	30	90	-3.3	356.7	0.6	1.5	
"	3:10 PM	30	120	-3.6	356.4	0.6	1.5	
"	4:10 PM	60	180	-21.0	339.0	17.4	44.2	
"	5:10 PM	60	240	-35.4	324.6	14.4	36.6	

Filename: B-11_30FT_Falling Head Field Infiltration Test
Tab: Input

GEOTECHNOLOGY
A Universal Engineering Sciences Company

FALLING HEAD FIELD INFILTRATION TEST WITHIN BOREHOLE/STANDPIPE

PROJECT NO.: J045355.01
CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
LOCATION: Dayton, Ohio
TEST NO.: 06
TEST LOCATION: B-11
SOIL DESCRIPTION: Dense Sand with Gravel

TEST START DATE: 3/21/2024
TEST END DATE: 3/21/2024
PERSONNEL: SB

Depth of Infiltration Surface below Ground Surface (ft.): 40
Depth to Water Table (ft.): 20
Borehole Depth (ft.): 40
Borehole Diameter (in.): 6.25
Standpipe Material: PVC
Standpipe Diameter (in.): 4
Standpipe Penetration Below Infiltration Surface (in.): 0
Infiltration Area (in.^{2}): 30.68

Infiltration Liquid Used: Water
Weather:
Air Temperature (°F):

Date	Time	Incremental Elapsed Time, Δt (min.)	Total Elapsed Time, t (min.)	Reference Water Measurement (in.)	Depth of Water Above Infiltration Surface, h (in.)	Infiltration Rate v (in./hr.)	Infiltration Rate v (cm/hr.)	Remarks
3/21/2024	1:08 PM	-	0	0.0	480.0	-	-	
"	1:23 PM	15	15	-67.8	412.2	271.2	688.8	
"	1:38 PM	15	30	-91.2	388.8	93.6	237.7	
"	1:53 PM	15	45	-109.8	370.2	74.4	189.0	
"	2:08 PM	15	60	-124.8	355.2	60.0	152.4	
"	2:38 PM	30	90	-148.2	331.8	46.8	118.9	
"	3:08 PM	30	120	-166.8	313.2	37.2	94.5	
"	4:08 PM	60	180	-195.6	284.4	28.8	73.2	
"	5:08 PM	60	240	-219.0	261.0	23.4	59.4	

Filename: B-11_40FT_Falling Head Field Infiltration Test
Tab: Input

APPENDIX D – LABORATORY TEST DATA

Tabulation of Laboratory Tests

Particle-Size Analysis Test Forms

Liquid Limits

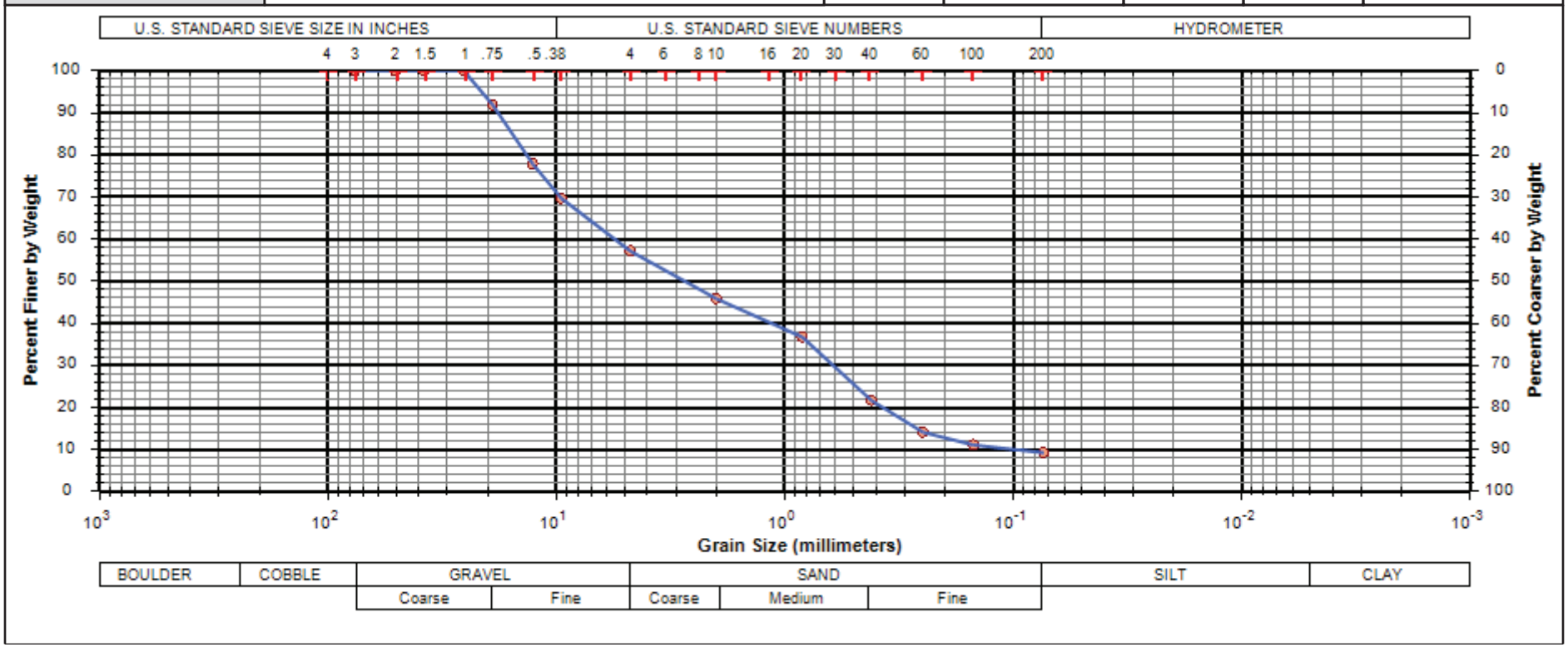
Dayton Miami Well Field
Dayton, OH
J045355.01

TABULATION OF LABORATORY TESTS

Boring No.	Sample No.	Depth (ft.)		Moisture Content (%)	Dry Unit Weight (pcf)	Atterberg Limits (%)			Gradation Analysis (%)				USCS Classification
		From	To			LL	PL	PI	Gravel	Sand	Silt	Clay	
B-1	SS-4	7.5	9.0						42.8	41.9	9.3	9.3	SP-SM
B-3	SS-9	25.0	26.5	11.5		22	15	7	4.5	32.6	34.2	28.7	CL-ML
B-4	SS-18	70.0	71.5	11.4					6.8	37.0	30.0	26.2	
B-4	SS-4	7.5	9.0						31.0	62.5	6.5	6.5	SP-SM
B-5	SS-9	25.0	26.5	11.5					10.2	28.8	30.4	30.6	
B-6	SS-3	5.0	6.5						55.7	28.0	16.3	16.3	GM
B-6	SS-8	20.0	21.5						25.8	69.4	4.8	4.8	SP
B-6	SS-10	30.0	31.5	12.7					1.2	29.6	43.1	26.1	
B-6	SS-12	40.0	41.5						40.2	50.3	9.5	9.5	SW-SM
B-7	SS-9	25.0	26.5						5.1	87.1	7.8	7.8	SP-SM
B-11	SS-3	5.0	6.5						53.0	39.2	7.8	7.8	GW-GM
B-11	SS-8	20.0	21.5						31.1	58.8	10.1	10.1	GS-SM
B-11	SS-10	30.0	31.5						34.5	65.6	9.9	9.9	SP-SM
B-11	SS-12	40.0	41.5						1.1	86.9	12.0	12.0	SW-SM
B-11	SS-18	70.0	71.5	10.3		20	13	7	6.0	39.3	54.7	54.7	CL-ML
B-19	SS-4	7.5	9.0						49.8	40.6	9.6	9.6	GW-GM
B-19	SS-11	35.0	36.5						24.2	65.8	10.0	10.0	SW-SM
B-19	SS-13	45.0	46.5						3.6	90.6	5.8	5.8	SP-SM
B-19	SS-16	60.0	61.5	10.6		22	14	8	3.2	33.8	32.8	30.2	CL

PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech							**Project No.:**	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH							**Date:**	03/27/2024
Boring No.:	1	**Sample No.:**	SS-4	**Depth (ft.):**	7.5	**Gravel (%)**	**Sand (%)**	**Silt & Clay (%)**	**USCS**
Sample Description:						42.8	47.9	9.3	SP-SM
						LL	**PL**	**PI** / **Group Index**	**WC (%)**



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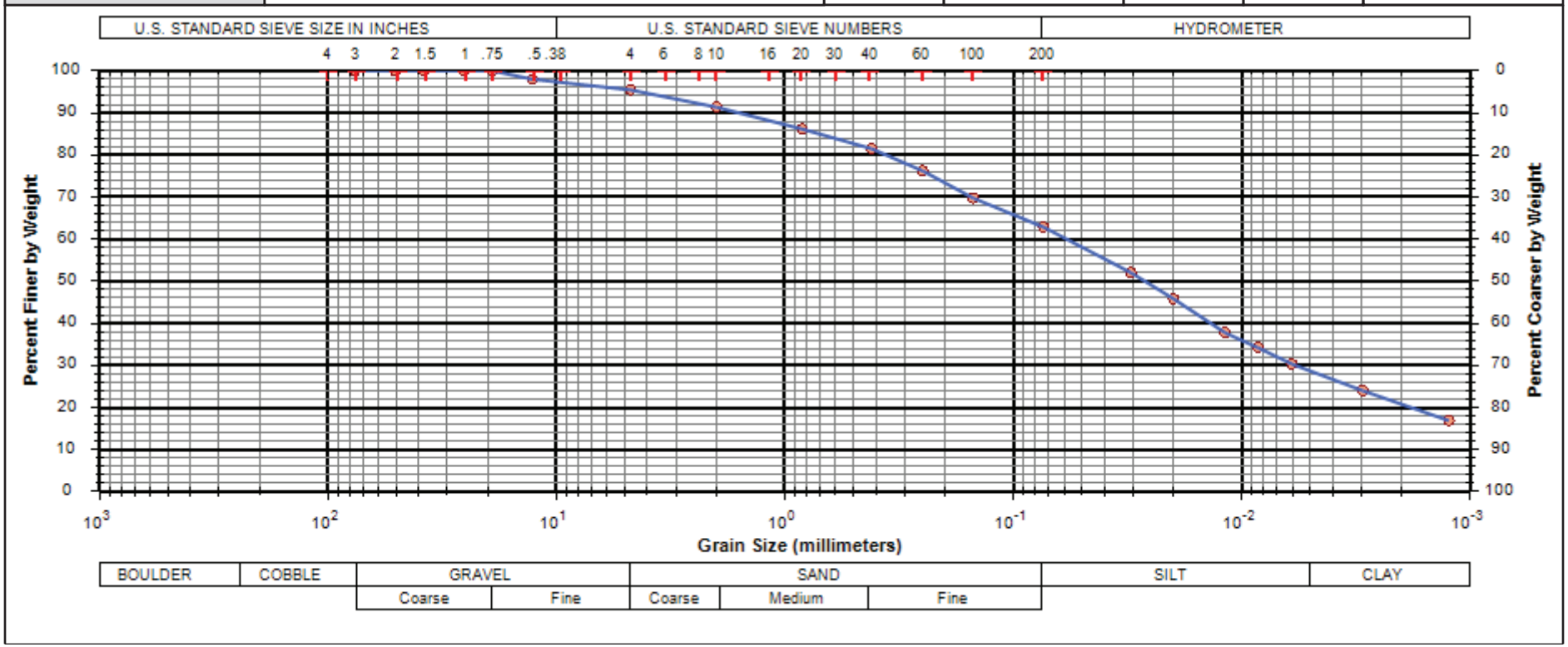
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech								**Project No.:**	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH								**Date:**	03/28/2024
Boring No.:	3	**Sample No.:**	SS-9	**Depth (ft.):**	25.0	**Gravel (%)**	**Sand (%)**	**Silt (%)**	**Clay (%)**	**USCS**
Sample Description:						4.5	32.6	34.2	28.7	CL-ML
						LL	**PL**	**PI**	**Group Index**	**WC (%)**
						22	15	7		11.5



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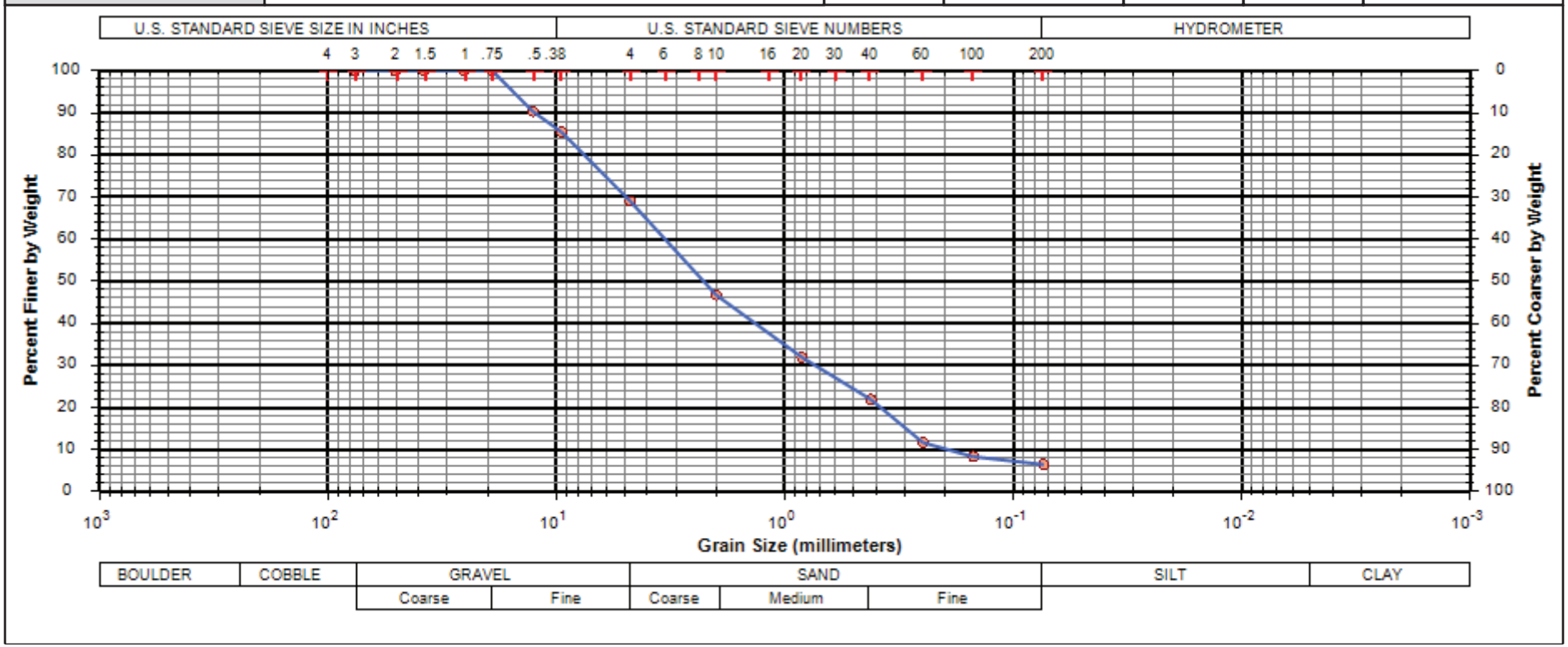
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech							**Project No.:**	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH							**Date:**	03/28/2024
Boring No.:	4	**Sample No.:**	SS-4	**Depth (ft.):**	7.5	**Gravel (%)**	**Sand (%)**	**Silt & Clay (%)**	**USCS**
Sample Description:						31.0	62.5	6.5	SP-SM
						LL	**PL**	**PI** / **Group Index**	**WC (%)**



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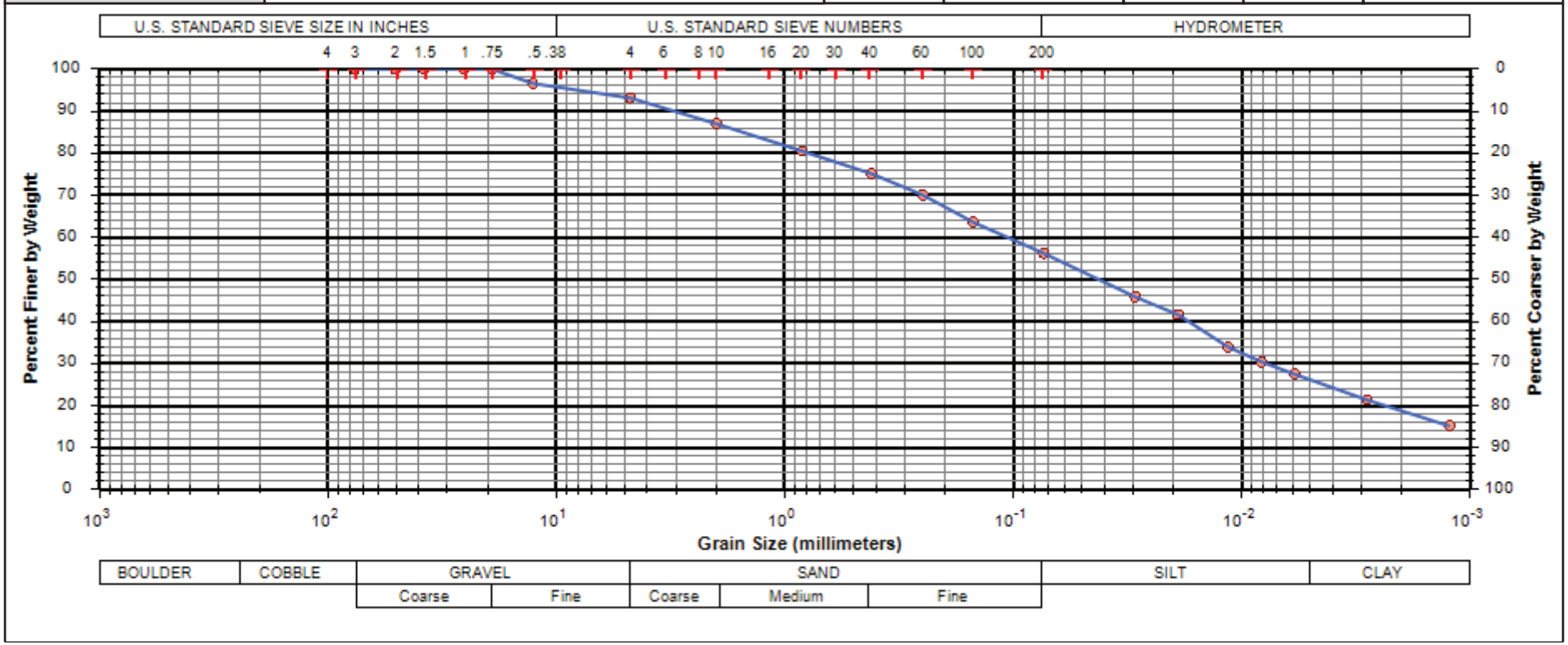
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech								**Project No.:**	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH								**Date:**	03/28/2024
Boring No.:	4	**Sample No.:**	SS-18	**Depth (ft.):**	70.0	**Gravel (%)**	**Sand (%)**	**Silt (%)**	**Clay (%)**	**USCS**
Sample Description:						6.8	37.0	30.0	26.2	-
						LL	**PL**	**PI**	**Group Index**	**WC (%)**
										11.4



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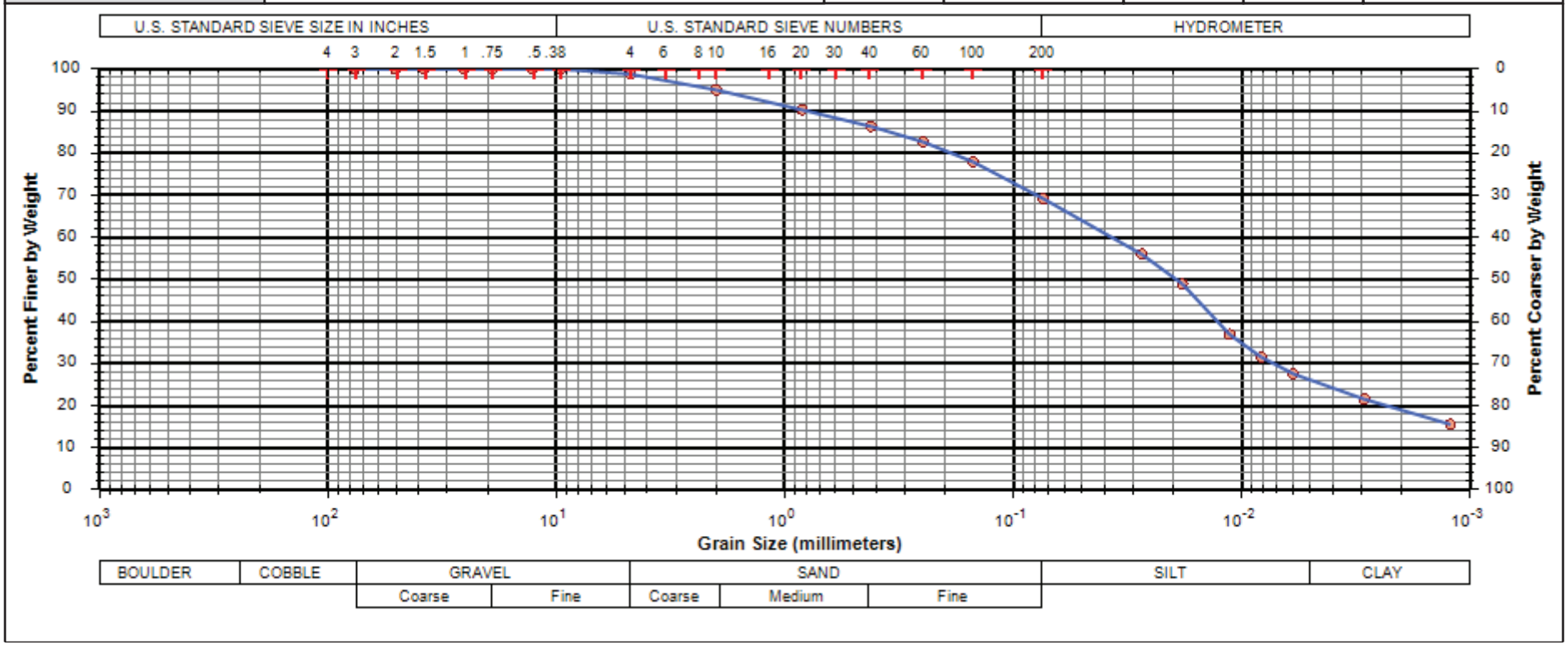
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech								Project No.:	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH								Date:	03/28/2024
Boring No.:	6	Sample No.:	SS-10	Depth (ft.):	30.0	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	USCS
Sample Description:						1.2	29.6	43.1	26.1	-
						LL	PL	PI	Group Index	WC (%)
										12.7



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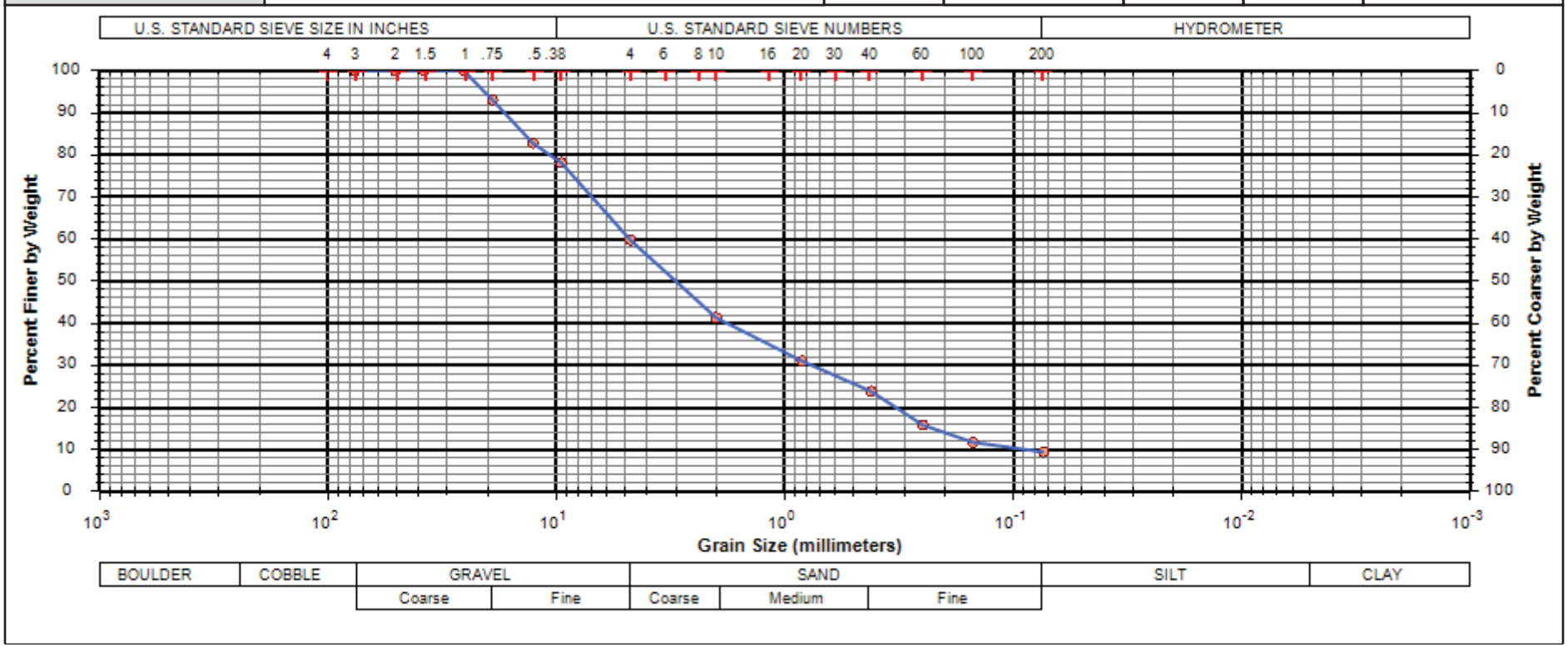
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech							Project No.:	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH							Date:	03/28/2024
Boring No.:	6	Sample No.:	SS-12	Depth (ft.):	40.0	Gravel (%)	Sand (%)	Silt & Clay (%)	USCS
Sample Description:						40.2	50.3	9.5	SW-SM
						LL	PL	PI / Group Index	WC (%)



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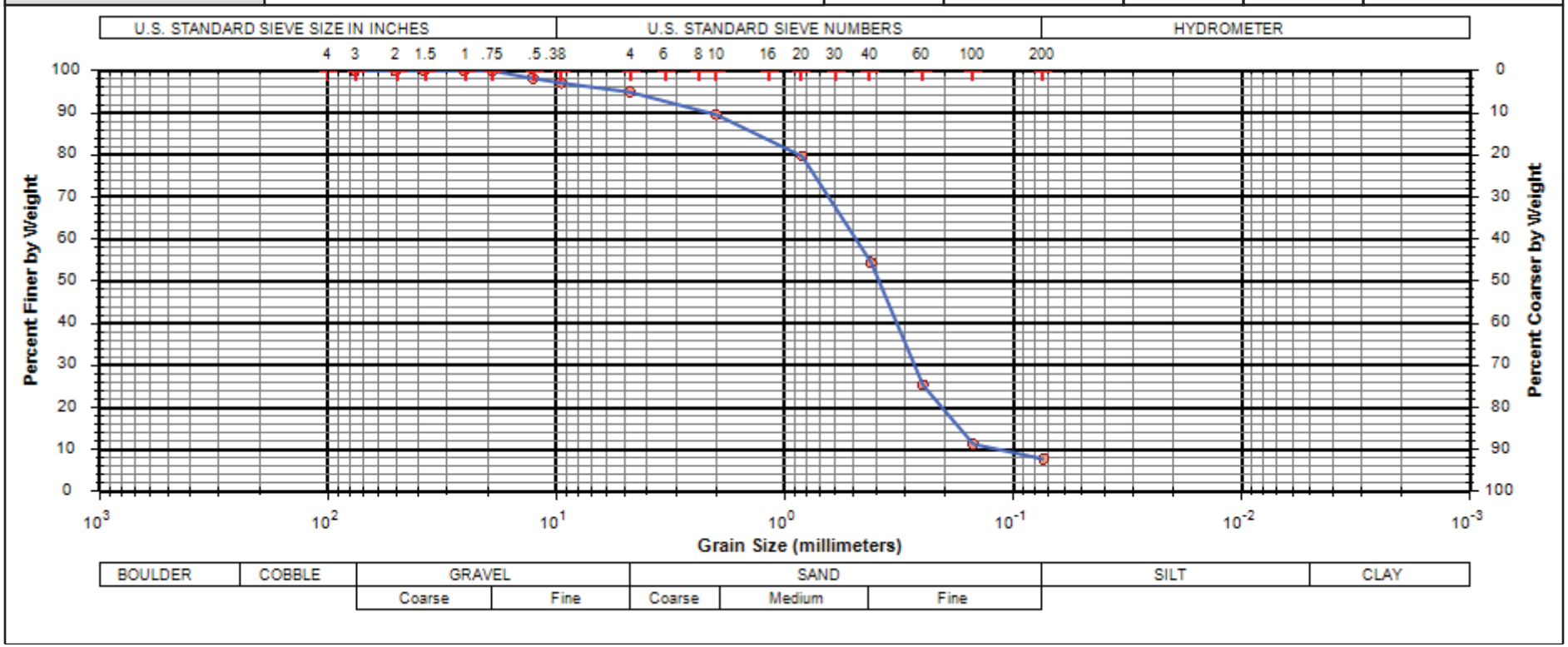
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech							Project No.:	J045355.01
Project:	Geotechnical Service, Dayton Miami Well Field Expansion, Dayton, OH							Date:	03/28/2024
Boring No.:	7	Sample No.:	SS-9	Depth (ft.):	25.0	Gravel (%)	Sand (%)	Silt & Clay (%)	USCS
Sample Description:						5.1	87.1	7.8	SP-SM
						LL	PL	PI	Group Index / WC (%)



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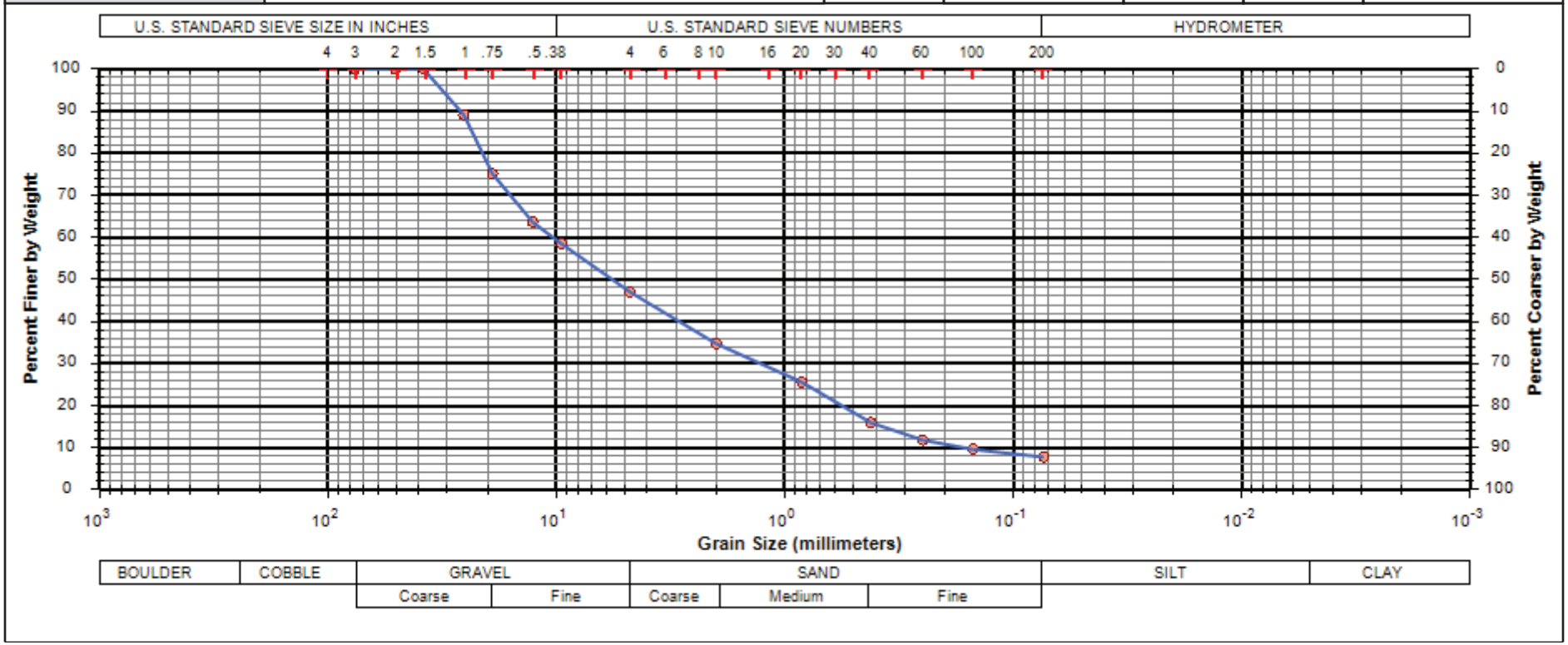
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech								**Project No.:**	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH								**Date:**	03/28/2024
Boring No.:	11	**Sample No.:**	SS-3	**Depth (ft.):**	5.0	**Gravel (%)**	**Sand (%)**	**Silt & Clay (%)**		**USCS**
Sample Description:						53.0	39.2	7.8		GW-GM
						LL	**PL**	**PI**	**Group Index**	**WC (%)**



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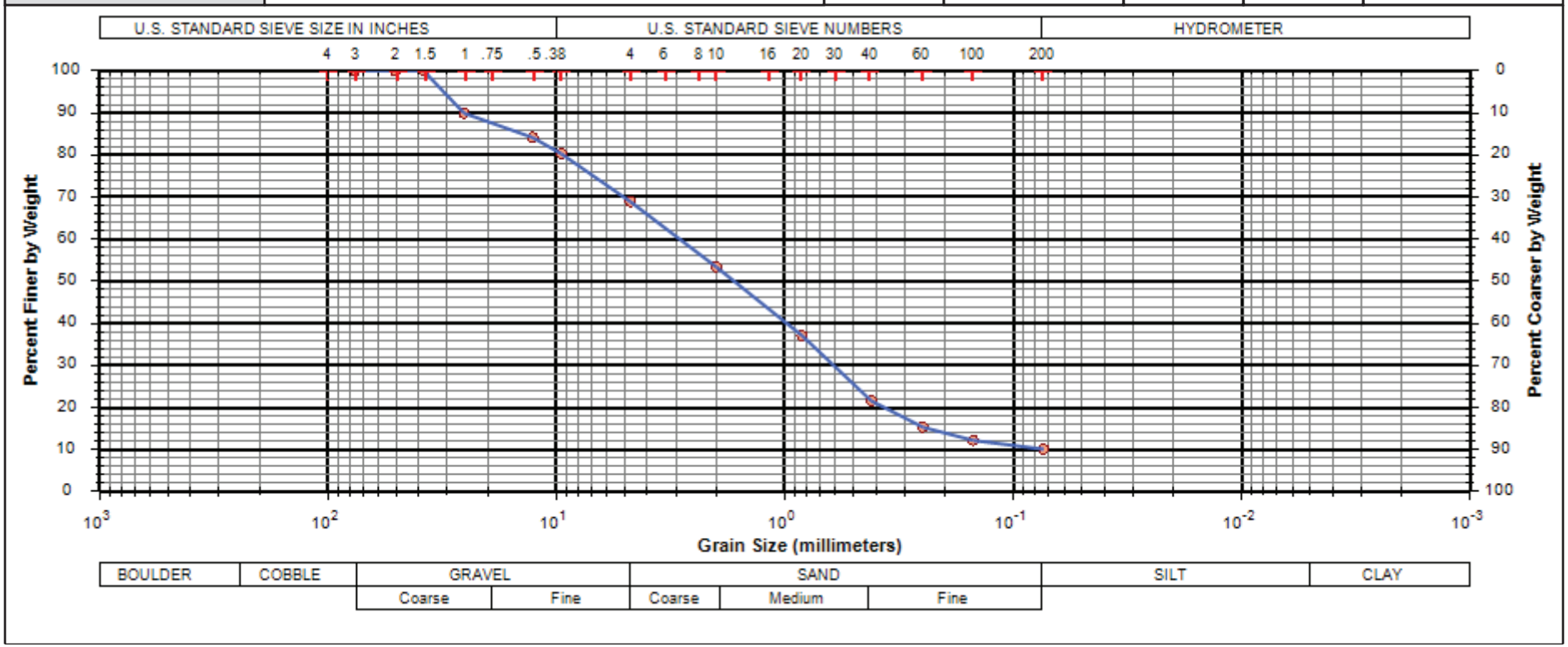
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech							Project No.:	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH							Date:	03/28/2024
Boring No.:	11	Sample No.:	SS-8	Depth (ft.):	20.0	Gravel (%)	Sand (%)	Silt & Clay (%)	USCS
Sample Description:						31.1	58.8	10.1	SW-SM
						LL	PL	PI	Group Index / WC (%)



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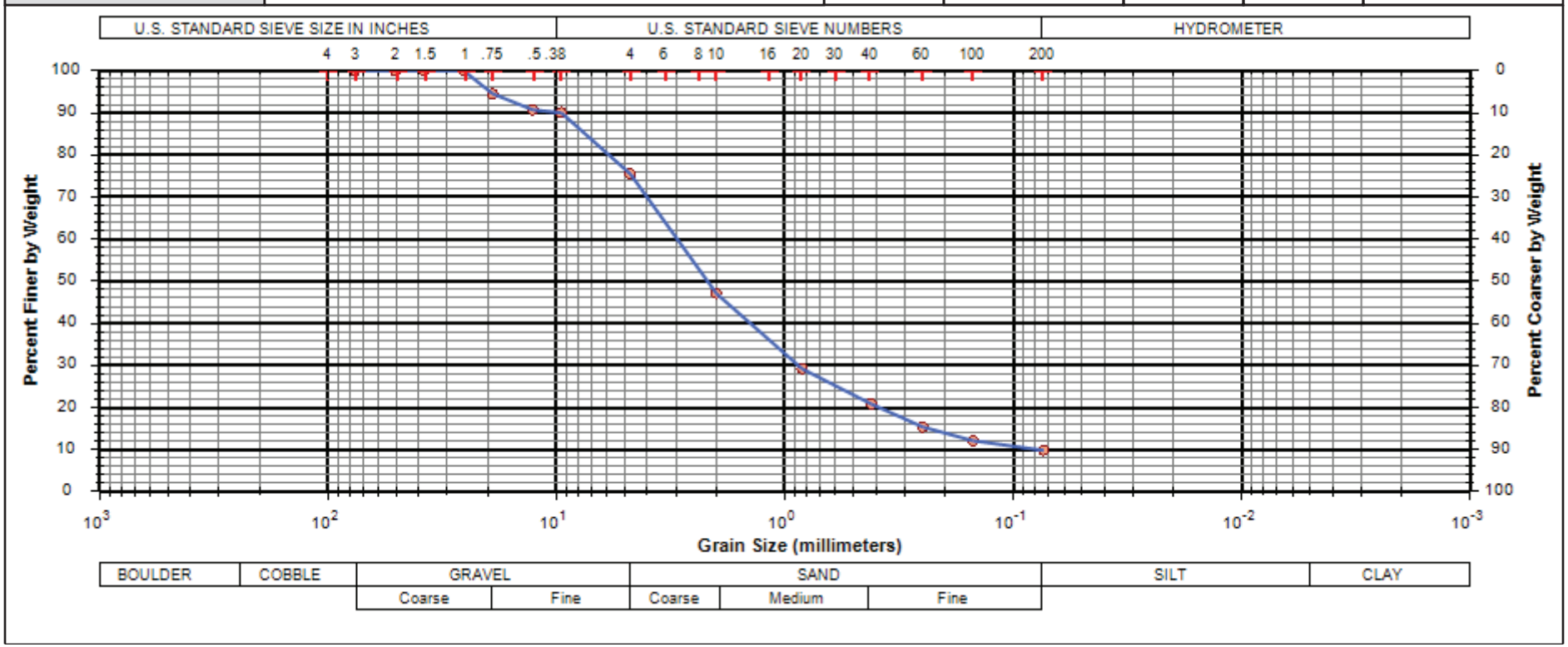
Client:	Tetra Tech							Project No.:	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH							Date:	03/28/2024
Boring No.:	11	Sample No.:	SS-10	Depth (ft.):	30.0	Gravel (%)	Sand (%)	Silt & Clay (%)	USCS
Sample Description:						24.5	65.6	9.9	SP-SM
						LL	PL	PI / Group Index	WC (%)



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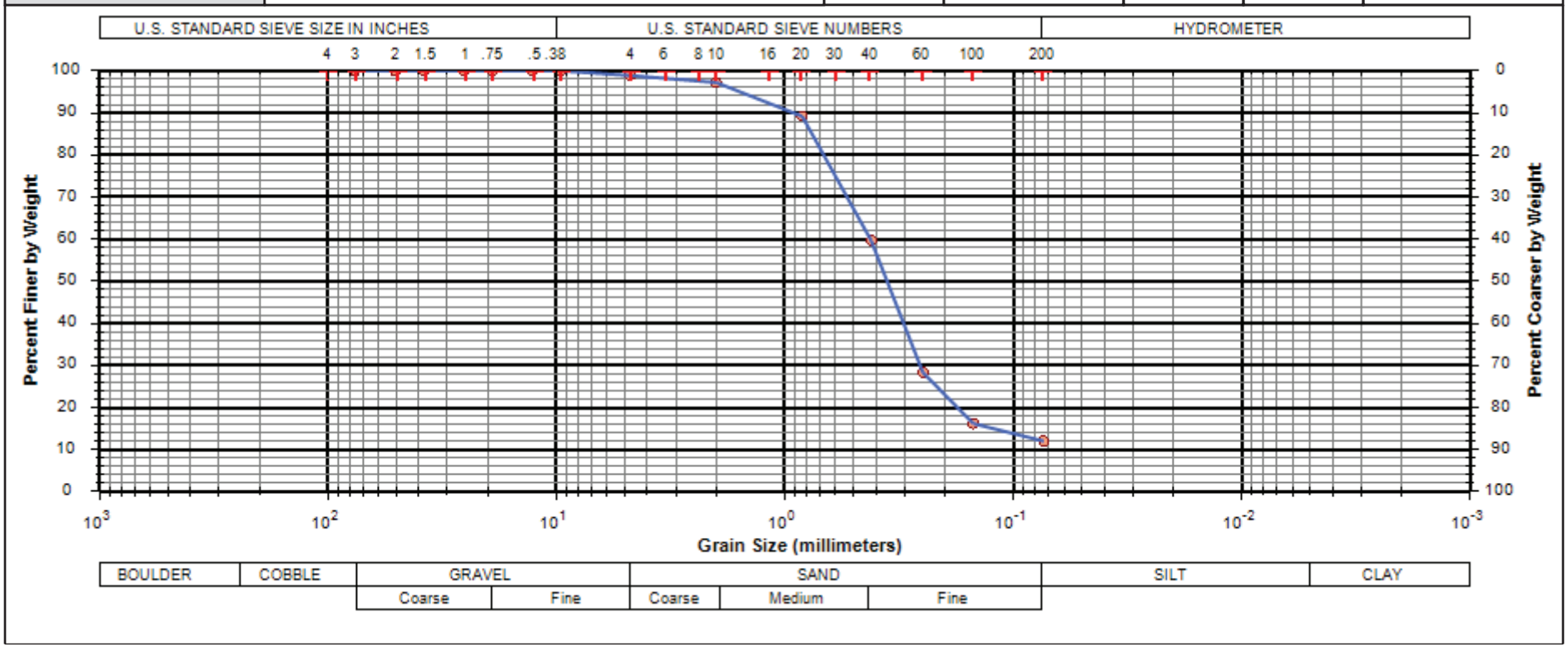
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech							**Project No.:**	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH							**Date:**	03/28/2024
Boring No.:	11	**Sample No.:**	SS-12	**Depth (ft.):**	40.0	**Gravel (%)**	**Sand (%)**	**Silt & Clay (%)**	**USCS**
Sample Description:						1.1	86.9	12.0	SW-SM
						LL	**PL**	**PI** / **Group Index**	**WC (%)**



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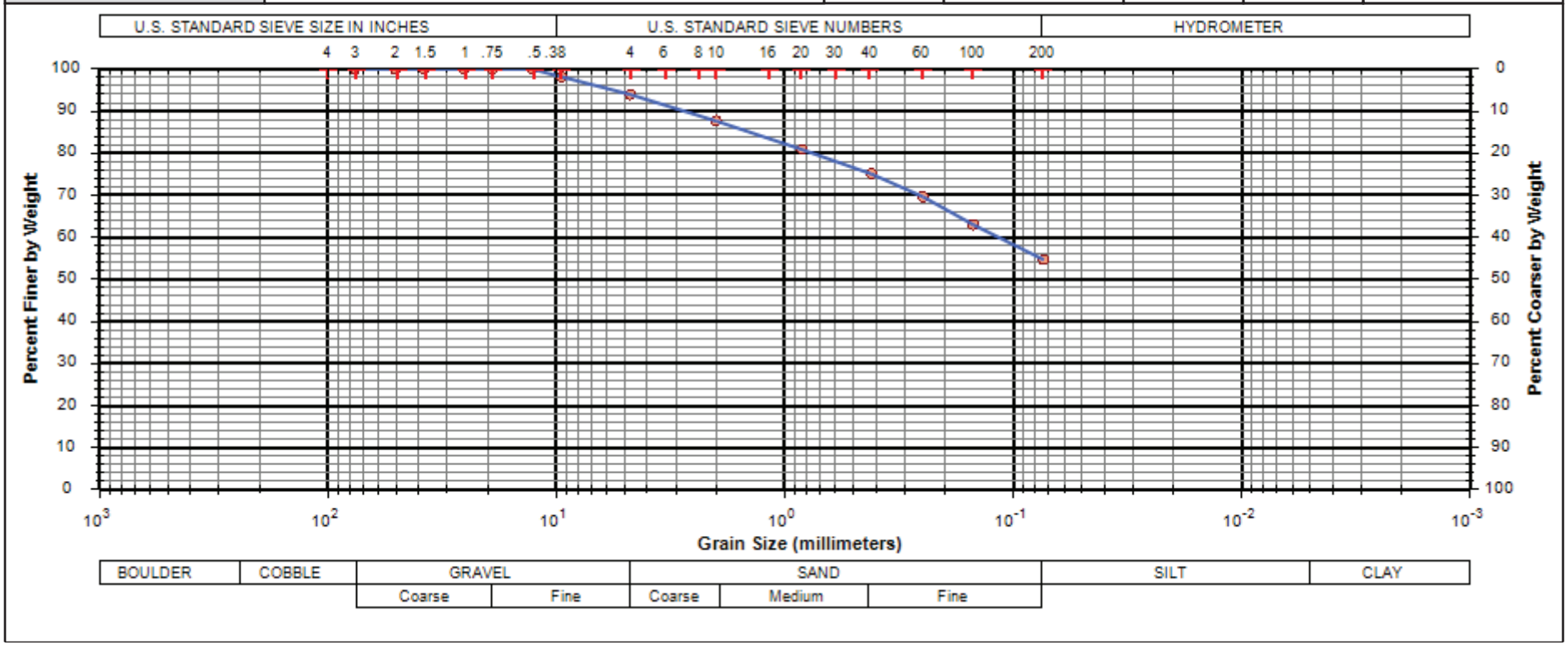
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech							Project No.:	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH							Date:	03/28/2024
Boring No.:	11	Sample No.:	SS-18	Depth (ft.):	70.0	Gravel (%)	Sand (%)	Silt & Clay (%)	USCS
Sample Description:						6.0	39.3	54.7	CL-ML
						LL	PL	PI	Group Index	WC (%)
						20	13	7		10.3



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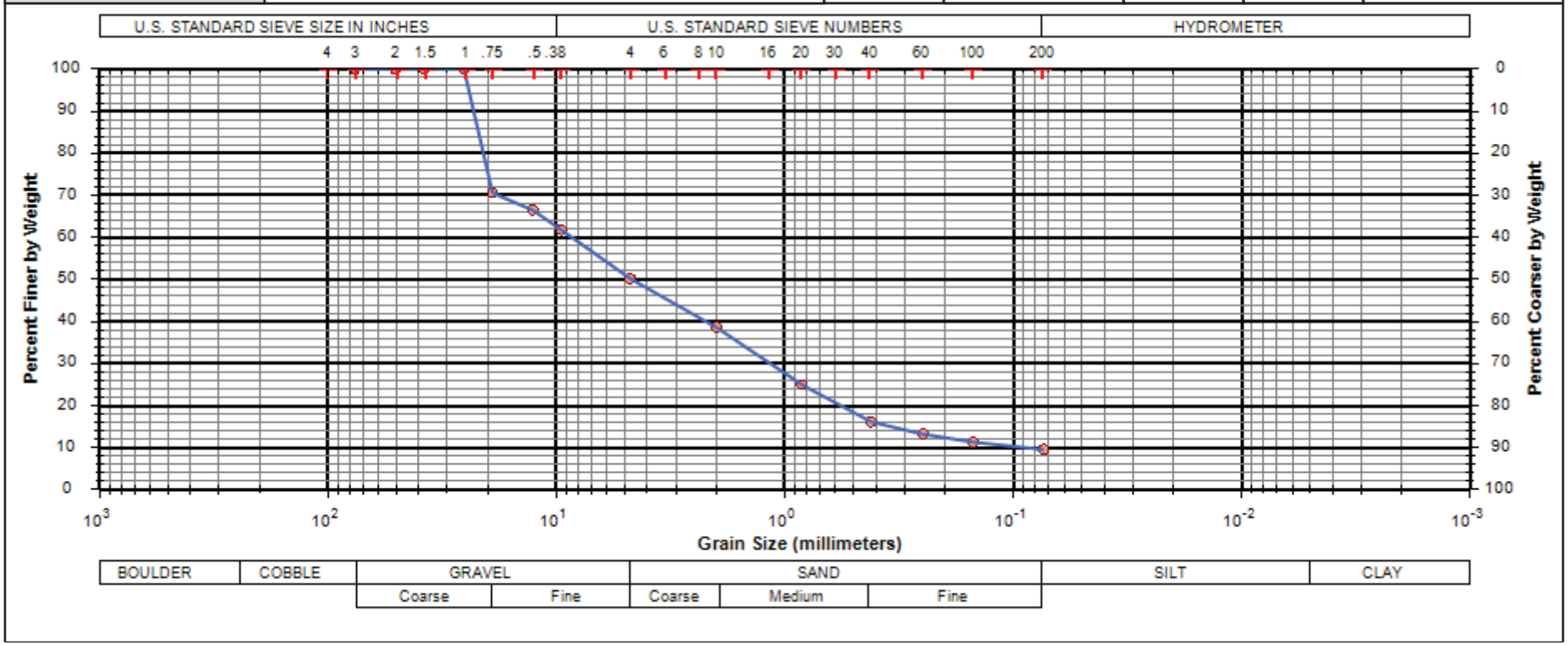
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech								**Project No.:**	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH								**Date:**	03/28/2024
Boring No.:	19	**Sample No.:**	SS-4	**Depth (ft.):**	7.5	**Gravel (%)**	**Sand (%)**	**Silt & Clay (%)**		**USCS**
Sample Description:						49.8	40.6	9.6		GW-GM
						LL	**PL**	**PI**	**Group Index**	**WC (%)**



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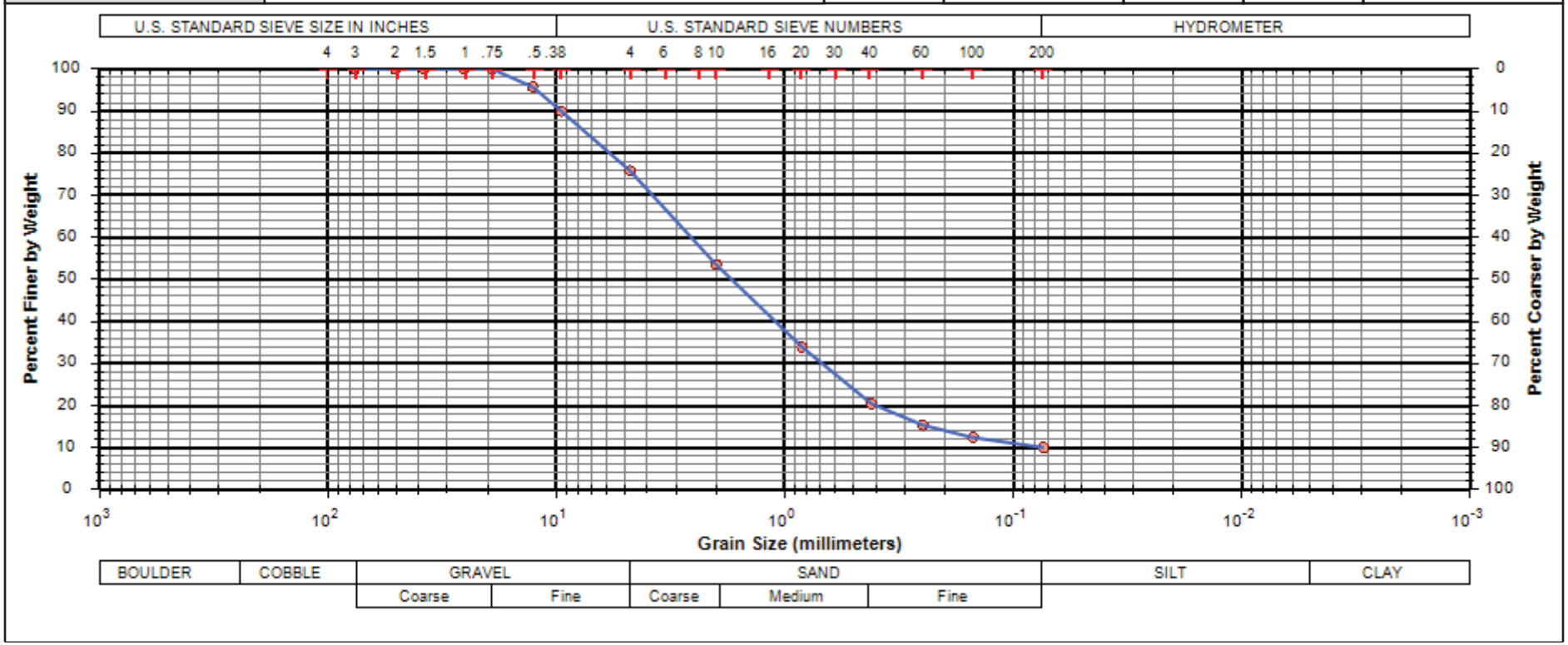
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech								**Project No.:**	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH								**Date:**	03/28/2024
Boring No.:	19	**Sample No.:**	SS-11	**Depth (ft.):**	35.0	**Gravel (%)**	**Sand (%)**	**Silt & Clay (%)**		**USCS**
Sample Description:						24.2	65.8	10.0		SW-SM
						LL	**PL**	**PI**	**Group Index**	**WC (%)**



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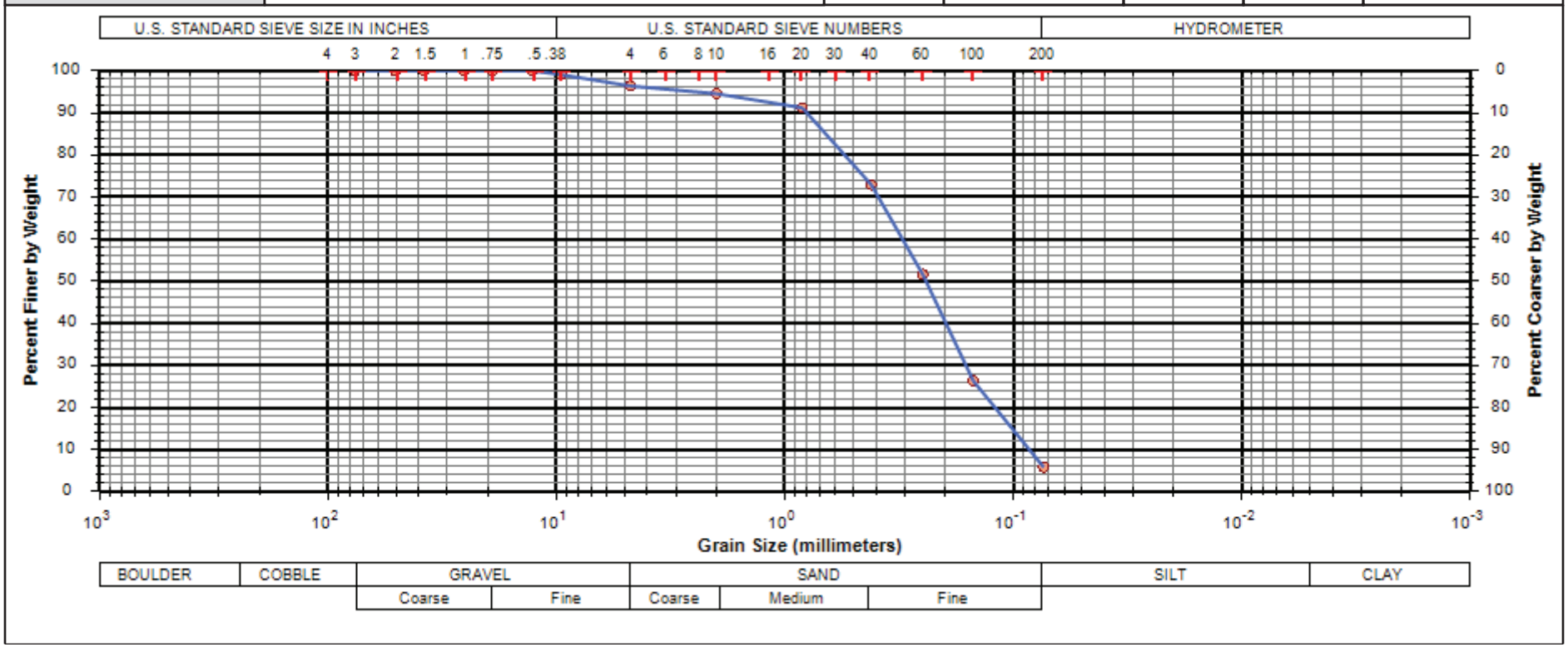
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech							Project No.:	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH							Date:	03/28/2024
Boring No.:	19	Sample No.:	SS-13	Depth (ft.):	45.0	Gravel (%)	Sand (%)	Silt & Clay (%)	USCS
Sample Description:						3.6	90.6	5.8	SP-SM
						LL	PL	PI / Group Index	WC (%)



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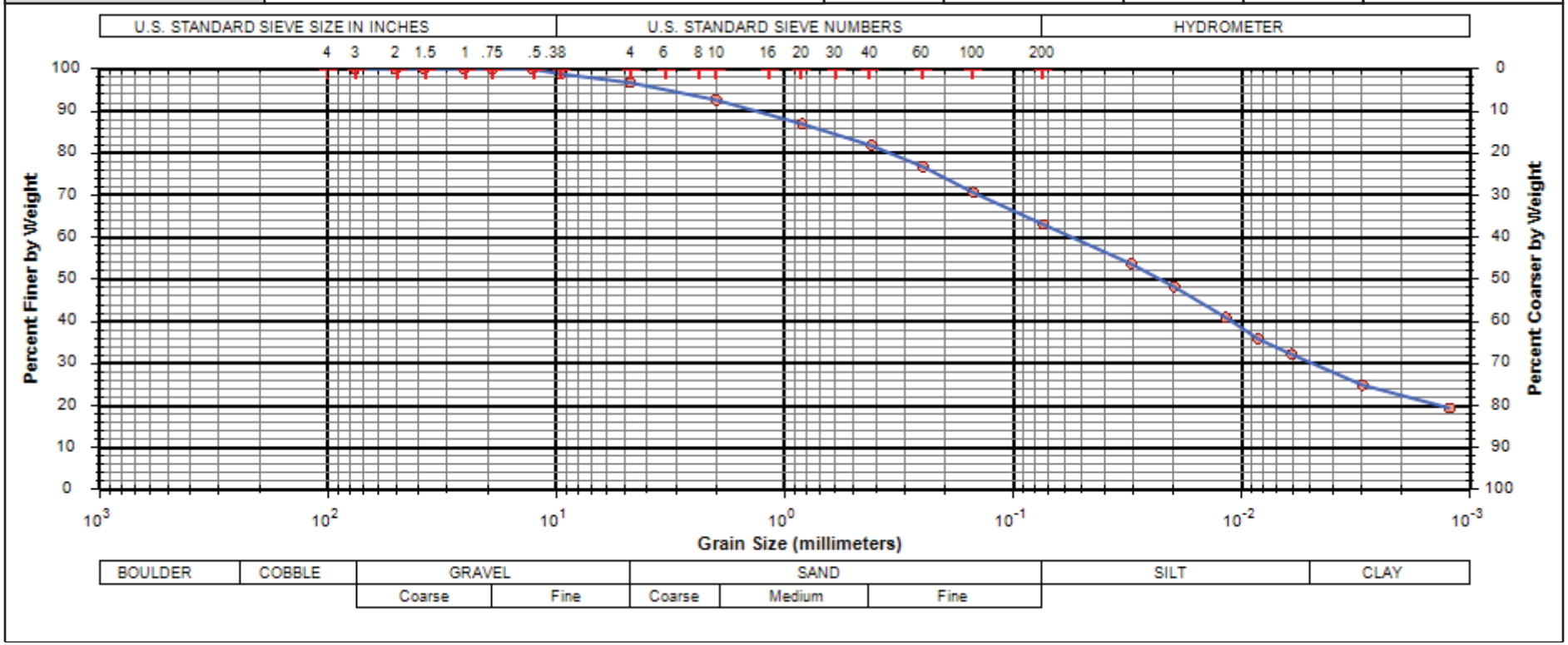
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech								Project No.:	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH								Date:	03/28/2024
Boring No.:	19	Sample No.:	SS-16	Depth (ft.):	60.0	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	USCS
Sample Description:						3.2	33.8	32.8	30.2	CL
						LL	PL	PI	Group Index	WC (%)
						22	14	8		10.6



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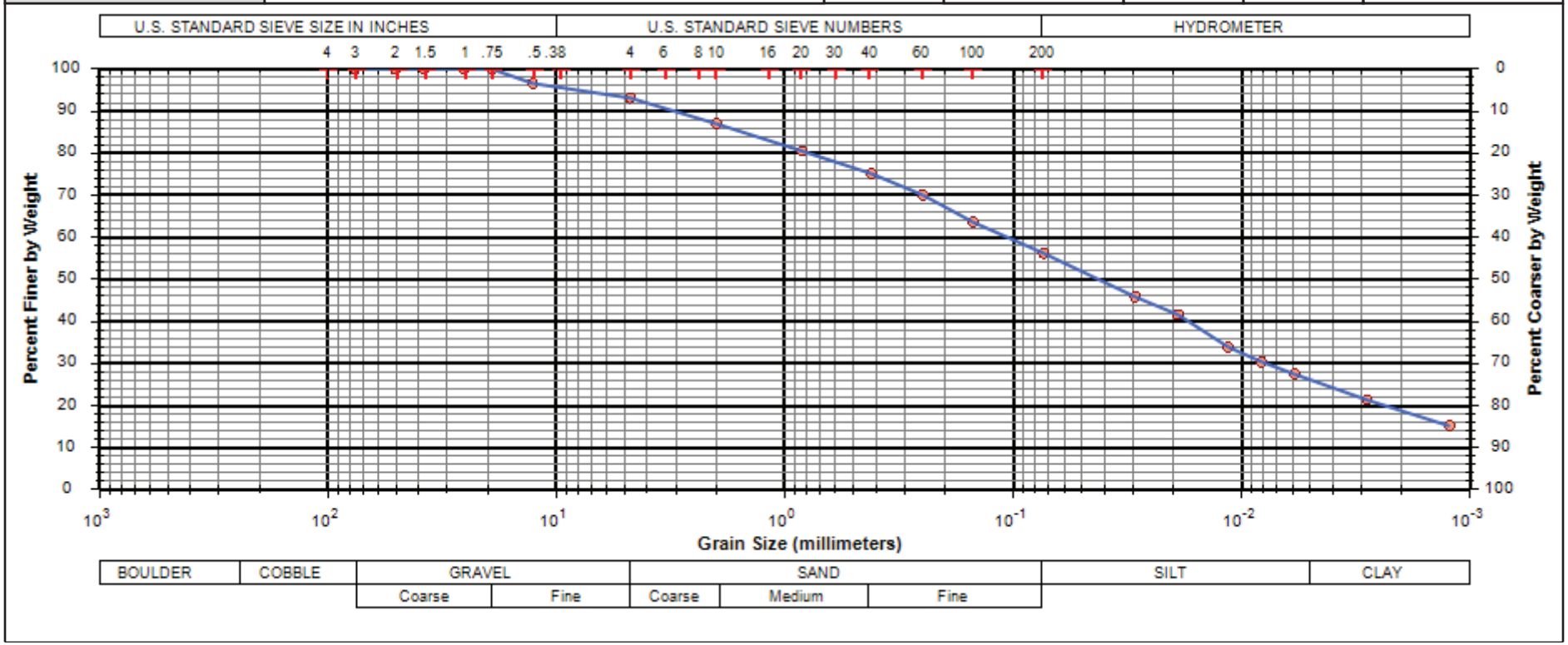
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech								**Project No.:**	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH								**Date:**	03/28/2024
Boring No.:	4	**Sample No.:**	SS-18	**Depth (ft.):**	70.0	**Gravel (%)**	**Sand (%)**	**Silt (%)**	**Clay (%)**	**USCS**
Sample Description:						6.8	37.0	30.0	26.2	-
						LL	**PL**	**PI**	**Group Index**	**WC (%)**
										11.4



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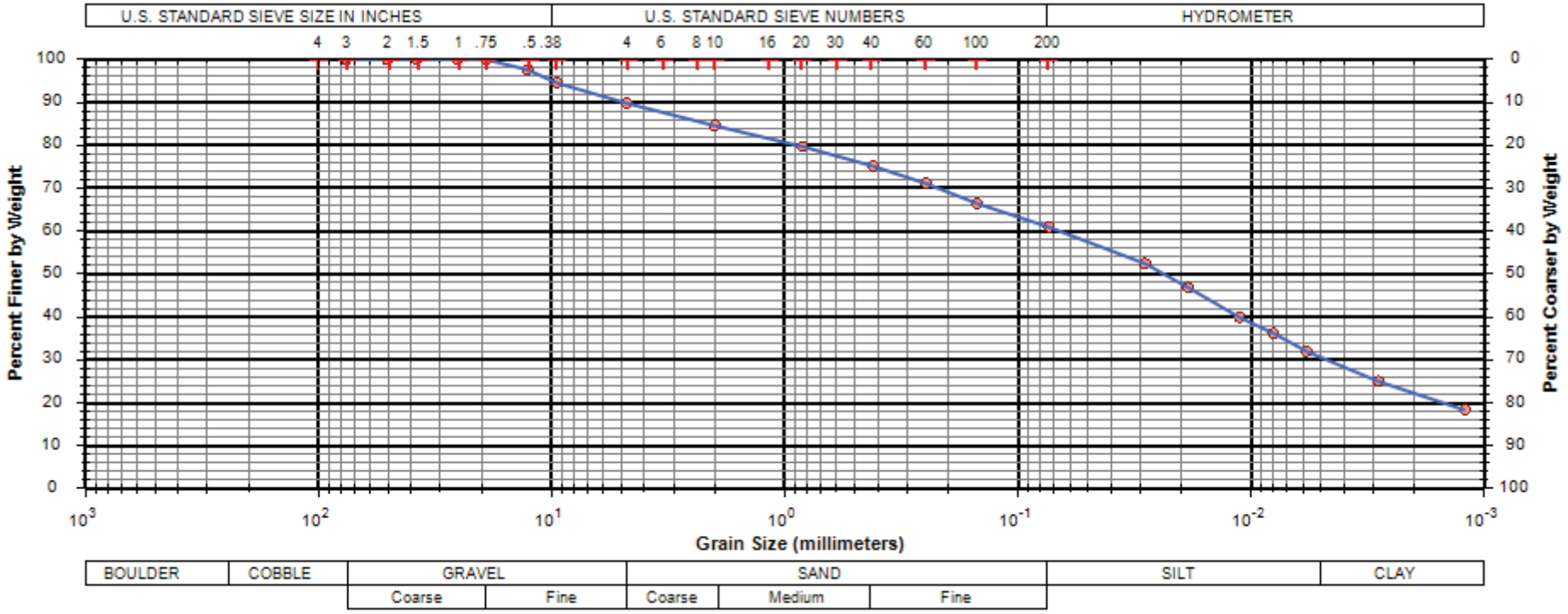
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech								Project No.:	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH								Date:	03/28/2024
Boring No.:	5	Sample No.:	SS-9	Depth (ft.):	25.0	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	USCS
Sample Description:						10.2	28.8	30.4	30.6	-
						LL	PL	PI	Group Index	WC (%)
										11.5



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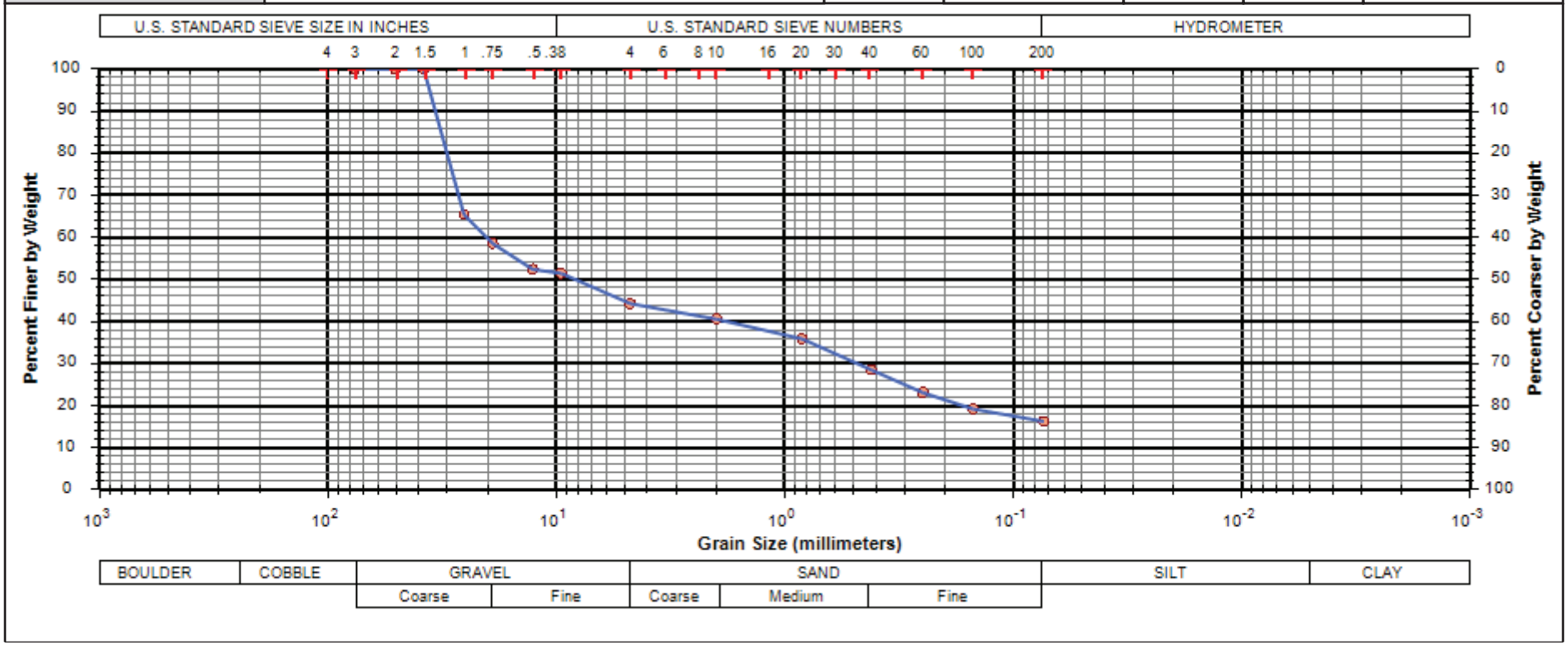
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech							**Project No.:**	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH							**Date:**	03/28/2024
Boring No.:	6	**Sample No.:**	SS-3	**Depth (ft.):**	5.0	**Gravel (%)**	**Sand (%)**	**Silt & Clay (%)**	**USCS**
Sample Description:						55.7	28.0	16.3	GM
						LL	**PL**	**PI**	**Group Index**	**WC (%)**



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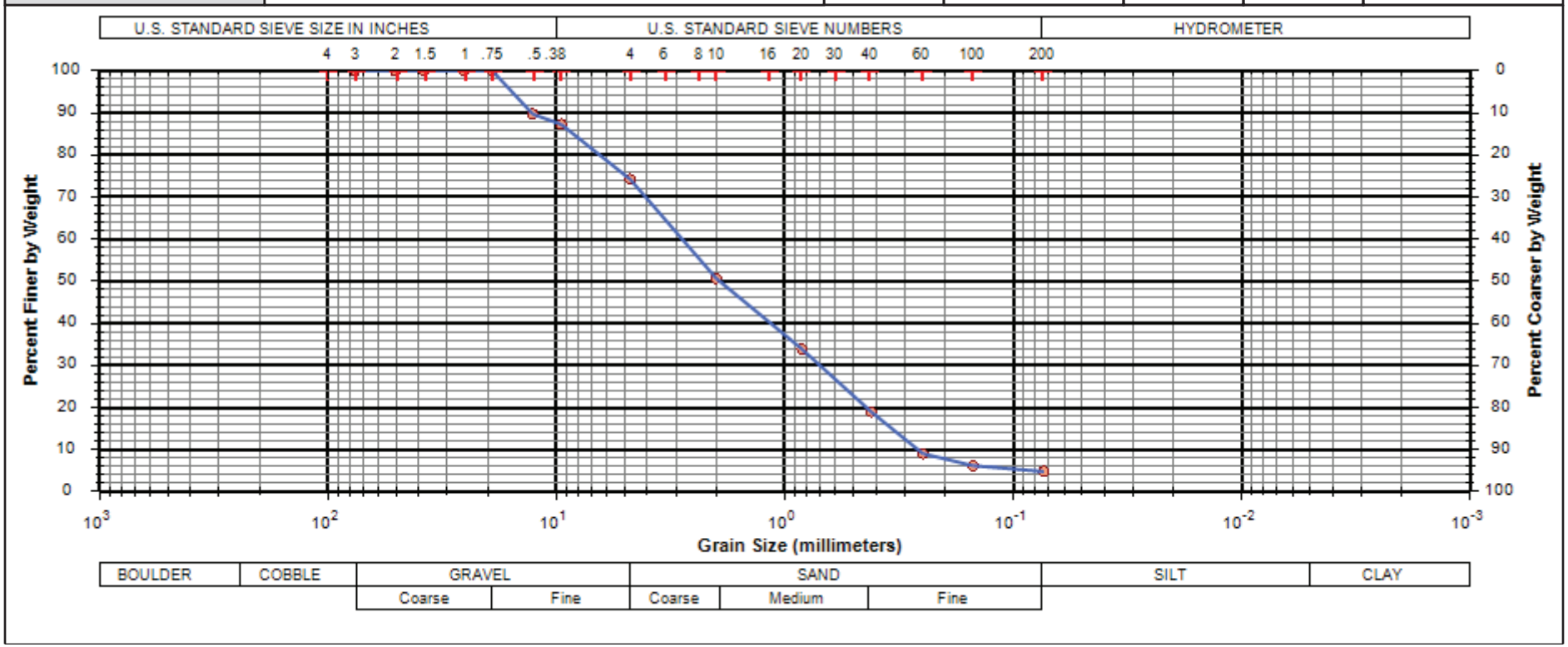
PARTICLE-SIZE ANALYSIS OF SOILS ASTM D-422

Client:	Tetra Tech							**Project No.:**	J045355.01
Project:	Geotechnical Exploration, Dayton Miami Well Field Expansion, Dayton, OH							**Date:**	03/28/2024
Boring No.:	6	**Sample No.:**	SS-8	**Depth (ft.):**	20.0	**Gravel (%)**	**Sand (%)**	**Silt & Clay (%)**	**USCS**
Sample Description:						25.8	69.4	4.8	SP
						LL	**PL**	**PI** / **Group Index**	**WC (%)**



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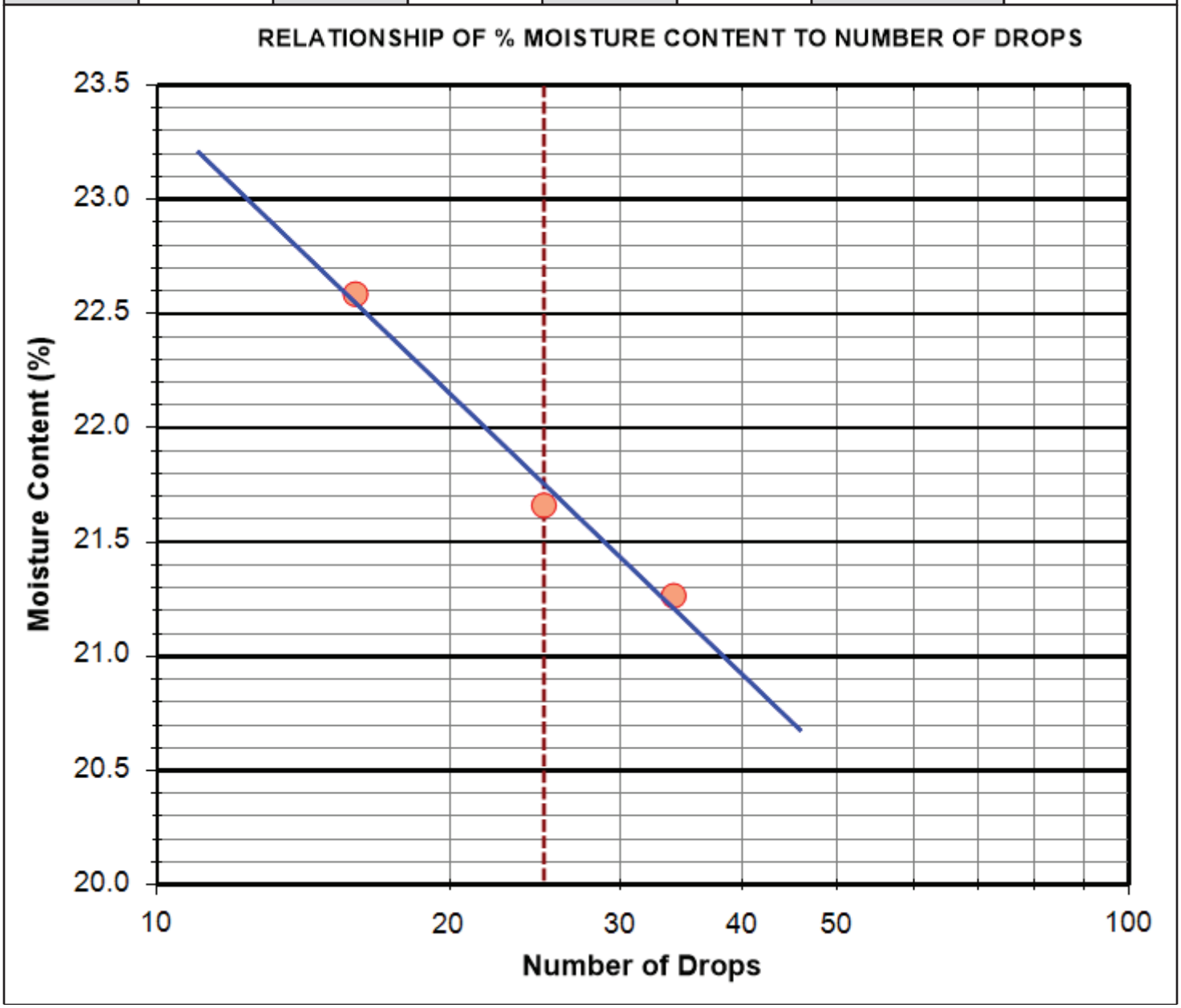
LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS ASTM D-4318

Client:	Tetra Tech					**Project No.:**	J045355.01
Project:	Dayton Miami Well Field Expansion, Dayton, OH					**Date:**	3/28/2024
Boring No.:	3	**Sample No.:**		**Depth (ft.):**	25.0	**Sample Preparation Condition:**	Air Dried
Sample Description:						**In Situ Moisture Content:**	11.5%
Liquid Limit:	22	**Plastic Limit:**	15	**Plastic Index:**	7	**USCS:**	CL-ML



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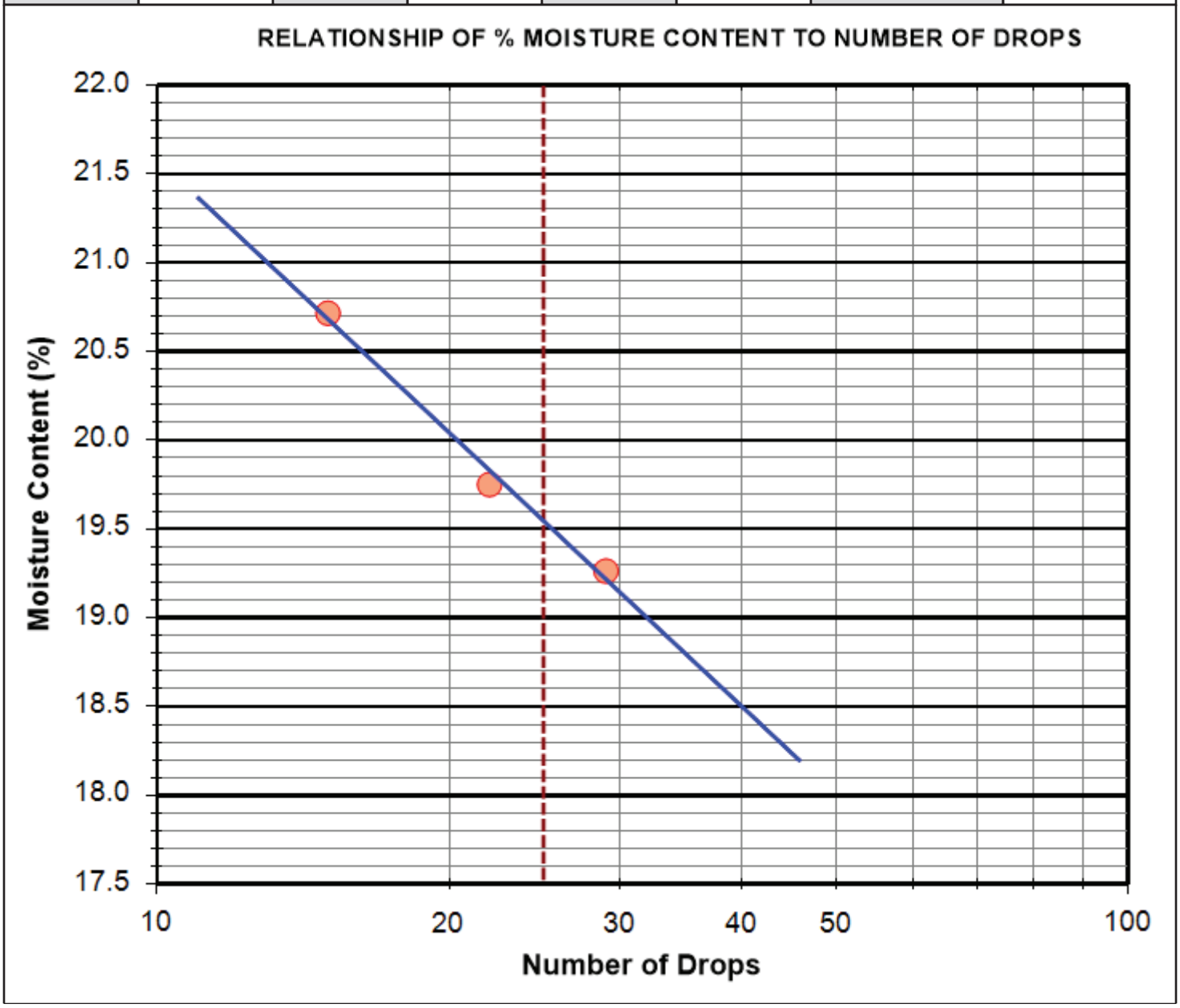
LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS ASTM D-4318

Client:	Tetra Tech					**Project No.:**	J045355.01
Project:	Dayton Miami Well Field Expansion, Dayton, OH					**Date:**	3/27/2024
Boring No.:	11	**Sample No.:**		**Depth (ft.):**	70.0	**Sample Preparation Condition:**	Air Dried
Sample Description:						**In Situ Moisture Content:**	10.3%
Liquid Limit:	20	**Plastic Limit:**	13	**Plastic Index:**	7	**USCS:**	CL-ML



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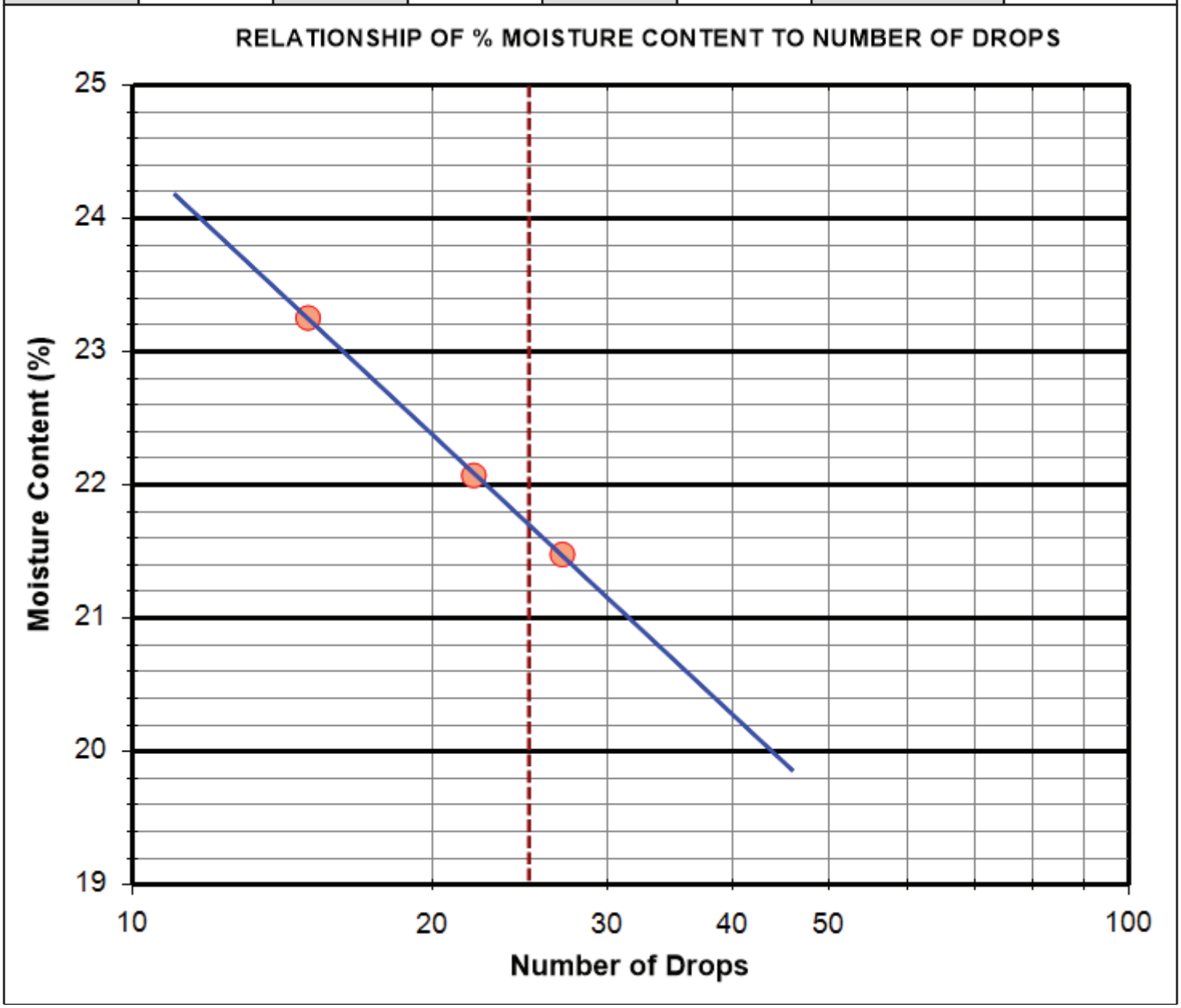
LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS ASTM D-4318

Client:	Tetra Tech					**Project No.:**	J045355.01
Project:	Dayton Miami Well Field Expansion, Dayton, OH					**Date:**	3/27/2024
Boring No.:	19	**Sample No.:**		**Depth (ft.):**	60.0	**Sample Preparation Condition:**	Air Dried
Sample Description:						**In Situ Moisture Content:**	10.6%
Liquid Limit:	22	**Plastic Limit:**	14	**Plastic Index:**	8	**USCS:**	CL



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APPENDIX E – IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL-ENGINEERING REPORT

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org

ATTACHMENT 2

December 11, 2024

Mr. James M. Brescol, PE
Tetra Tech
250 W. Court Street
Suite 200W
Cincinnati, Ohio 45202

Re: Geotechnical Exploration Addendum 1
Dayton Miami Well Field Expansion
Dayton, Ohio
Project No. J045355.01-Change Order No. 1

Dear Mr. Brescol:

Presented in this report is Addendum No. 1 to our April 25, 2024 geotechnical report, titled "Geotechnical Exploration Dayton Miami Well Field Expansion Dayton, Ohio" (April 2024 Geotechnical Report). This addendum is supplemental to, and to be used in conjunction with, our April 2024 Geotechnical Report.

As requested, additional borings (B-21 through B-23**)** were performed at Pond P-12. The borings were performed between November 12, 2024, and November 13, 2024 in the same manner as the previous borings using BD-1 drill rig. The energy transfer ratio of the rig used was 73%. The locations of these borings are shown on the exploration plans provided in Appendix A, and boring logs are provided in Appendix B. Laboratory testing, including moisture contents, Atterberg limits, particle-size analysis, and infiltration tests were performed on selected soil samples. The laboratory test results are presented in Appendix C. The field infiltration test results are presented in Appendix D.

Respectfully submitted,
UES

Diwakar K C, PhD, EIT
Project Engineer

Joseph S. Burkhardt, PE
Geotechnical Services manager

DKC/RES:dkc/res

Copies submitted: Tetra Tech (email)

STATE OF OHIO
JOSEPH S. BURKHARDT
E-72589
REGISTERED
PROFESSIONAL ENGINEER

1.0 SUBSURFACE CONDITIONS

1.1 Stratification

Generally, the existing ground surface was underlain by topsoil, fill and alluvium. More specific descriptions of the subsurface strata are provided below, and the boring logs containing detailed material descriptions are located in Appendix B.

1.1.1 Topsoil

Topsoil was encountered at the ground surface in each of the borings. The thickness of the topsoil in these borings was 6 inches.

1.1.2 Fill

Existing fill was encountered beneath the topsoil in Boring B-22 and B-23. The thickness of the fill in Boring B-22 was 2 feet and in Boring B-23 was 4.5 feet. The fill was medium stiff to stiff sandy lean clay, containing gravel, and root hairs. The moisture content in two fill samples were 14.9 and 24.8 percent.

1.1.3 Native Soils

Generally, the native soils were alluvium and glacial outwash soils alluvium consisting primarily of sand and gravel random cohesive layers. The cohesionless soils were medium dense to dense sand and gravel containing silt and clay. The cohesive soils were stiff to very stiff lean clay containing sand and gravel. The Atterberg Limits test was performed on three cohesive samples which yielded the results as lean clay (CL). Moisture content on native soil varied from 1.7 to 29.4 percent. More specific details on soil stratigraphy is given in boring logs in Appendix B.

1.2 Groundwater Conditions

Ground water observations were made in the borings during drilling, and immediately at the completion of drilling, and before backfilling the boring holes. These measurements are documented on the boring logs in Appendix B.

In general, groundwater was encountered in Borings B-21 and B-22 at 30 feet and in Boring B-23 at 25 feet below the existing ground surface during drilling. No water was encountered immediately at the completion of drilling and after 24 hours.

Based on the groundwater observations and our local experience, groundwater seepage is anticipated along the fill/native soil interface, in the saturated zones of fill or native soils that are within the perched groundwater zones, or that are below the groundwater table. Locally concentrated flow may occur due to saturated layers of fill or native soils (particularly the native alluvial silts, sands, or gravels). Additionally, groundwater levels, seepage amounts, and flow rates are expected to vary with time, location, season of the year, and amounts of precipitation.

2.0 CONCLUSIONS AND RECOMMENDATIONS

Based on our engineering reconnaissance of the site, the borings, the visual examination of the recovered samples, the laboratory test results, our understanding of the proposed project, our engineering analyses, and our experience as Geotechnical Engineers in the Dayton Area the following conclusions and recommendations are presented.

2.1 Excavation and Support Requirements

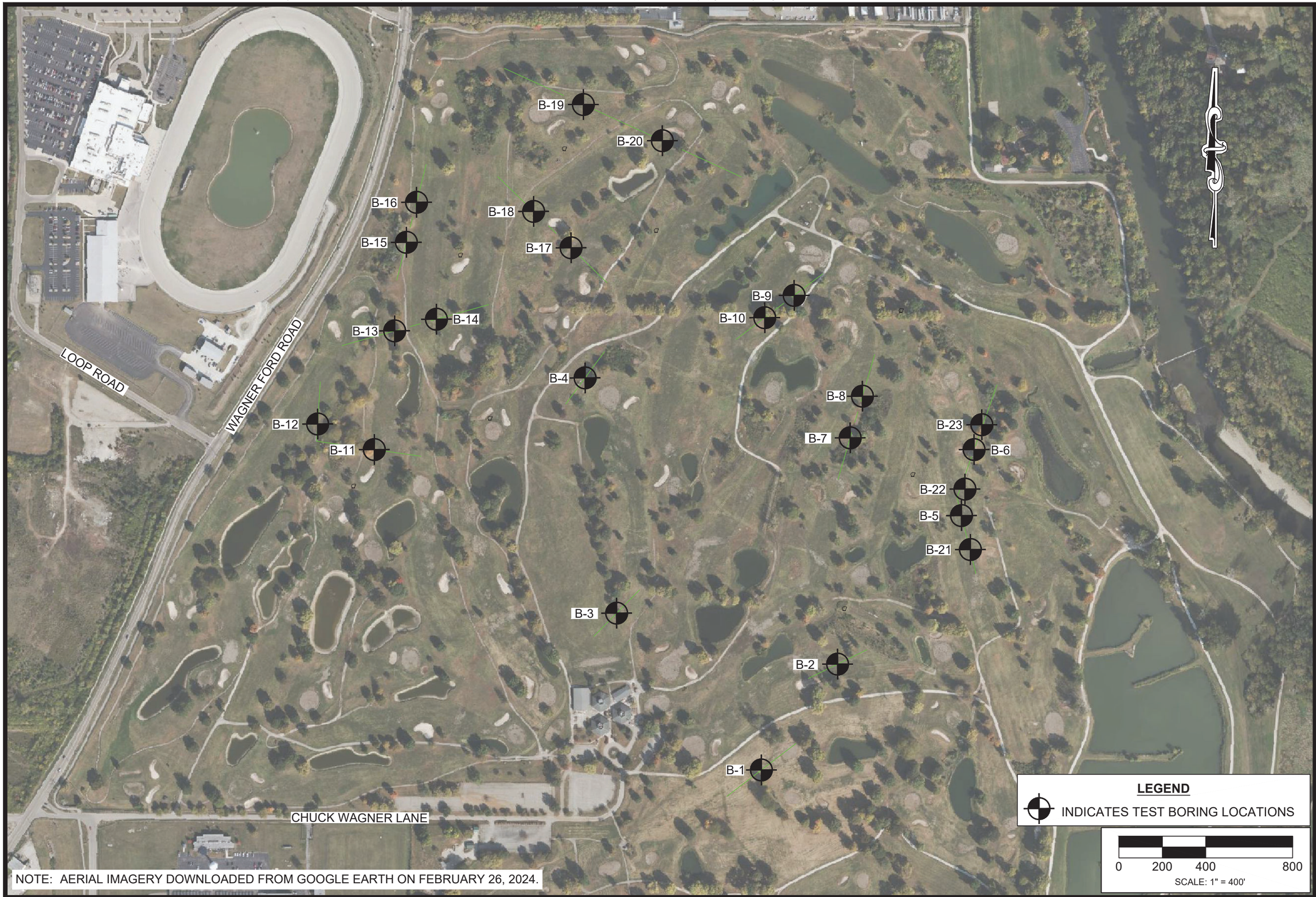
Excavation support should be the responsibility of the Contractor. Excavation support should be designed and implemented such that excavations are adequately ventilated and braced, shored, and/or sloped in order to protect and ensure the safety of workers within and near the excavations and to protect adjacent ground, slopes, structures, and infrastructure. Federal, state, and local safety regulations should be satisfied. The analyses, discussions, conclusions, and recommendations throughout this report are not to be interpreted as pre-engineering compliance with any safety regulation.

The soils at the site are predominantly sand and gravel with lesser components of silt and clay; and some random lean clay layers. Based on the dominant presence of granular soils within the test borings, the OSHA soil classification for soil excavations at this site is expected to be Type C. OSHA recommends maximum allowable backslope for temporary cut slopes of 20 feet of less in height to be 1.5H:1V for Soil Type C. Protection for excavations more than 20 feet in depth must be designed by a registered professional engineer. All excavation should comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P “Excavations” and its appendices, as well as other applicable codes.

APPENDIX A – PLANS

Exploration Plan, Sheet No. 1

Date Printed: 12/5/2024 10:26 AM Path: \\10.1.12.10\cin\data\Projects\J045\J045355.01-Dayton Miami Well Field Expansion\Draw\J045355.01 Exploration Plan (Single sheet).dwg



NOTE: AERIAL IMAGERY DOWNLOADED FROM GOOGLE EARTH ON FEBRUARY 26, 2024.

UES

Project: DAYTON MIAMI WELL FIELD EXPANSION

Location: DAYTON, OHIO

Title: EXPLORATION PLAN

Client: TETRA TECH

Date: 12/5/2024

Project No.: J045355.01

Sheet No.: 1

APPENDIX B – BORING INFORMATION

Boring Logs

Soil Classification Sheet

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field Additional Borings
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-21
PROJECT #: J045355.01 (PHASE-2)
PAGE #: 1 of 2
LAT,LON: 39.811540 ,-84.158296

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
759.8	Ground Surface	0.0	0					
759.3	Topsoil (6 Inches).	0.5						
	Brown, moist, stiff, Sandy Lean Clay, trace root hairs.			SS-1A 1B	3-5-7 *N=12*	15	78	1.0
				SS-2	9-6-4 *N=10*	12	67	1.0
754.8		5.0	5					
	Brown, moist, medium dense, Gravel and Sand, trace silt and clay. Gravel=48.7%, Sand=42.9%, Silt=7.3%, Clay=1.2% on SS-5			SS-3	5-9-18 *N=27*	33	67	
				SS-4	5-10-14 *N=24*	29	67	
			10	SS-5	3-5-14 *N=19*	23	56	
747.3		12.5						
	Brown, moist, medium dense, Gravel and Sand.			SS-6	10-11-12 *N=23*	28	44	
			15	SS-7	10-12-11 *N=23*	28	100	
739.8		20.0						
	Gray, moist, very stiff, Lean Clay (CL), trace gravel. LL=31%, PL=17%, PI=14% on SS-8		20	SS-8	5-5-12 *N=17*	21	100	2.5
			25	SS-9	6-13-18 *N=31*	38	100	3.5
729.8		30.0	30					

Elevation Ref.: Google Earth Pro
Surface Elevation: 759.8 ft.
Date Started/Completed: 11/13/2024-11/13/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: BD-1
Foreman: Gilbert
Engineer: Sunil Badam

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 30' during drilling
At Completion: Not Encountered
After: 24 hours Dry
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 73%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field Additional Borings
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-21
PROJECT #: J045355.01 (PHASE-2)
PAGE #: 2 of 2
LAT,LON: 39.811540 ,-84.158296

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
	Brown, wet, medium dense to dense, Sand, trace gravel.		30	SS-10	9-12-21 *N=33*	40	100	
			35	SS-11	3-7-10 *N=17*	21	100	
719.8		40.0	40	SS-12	10-18-16 *N=34*	41	100	
	Brown, wet, dense, Sand and Gravel .		45	SS-13	15-14-20 *N=34*	41	0	
			50	SS-14	12-12-20 *N=32*	39	100	
708.3		51.5						
	Bottom of test boring at 51.5 feet.		55					
			60					

Elevation Ref.: Google Earth Pro
Surface Elevation: 759.8 ft.
Date Started/Completed: 11/13/2024-11/13/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: BD-1
Foreman: Gilbert
Engineer: Sunil Badam

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 30' during drilling
At Completion: Not Encountered
After: 24 hours Dry
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 73%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field Additional Borings
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-22
PROJECT #: J045355.01 (PHASE-2)
PAGE #: 1 of 2
LAT,LON: 39.812302 ,-84.158404

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
761.0	Ground Surface	0.0	0					
760.5	Topsoil (6 Inches).	0.5						
	Brown, moist, stiff, Sandy Lean Clay, some gravel (Fill).			SS-1A 1B	3-6-7 ***N=13***	16	100	1.5
758.5		2.5						
	Brown, moist, medium dense to dense, Gravel and Sand.			SS-2	6-13-18 ***N=31***	38	67	
			5	SS-3	10-10-10 ***N=20***	24	0	
				SS-4	6-17-19 ***N=36***	44	67	
751.0		10.0	10					
	Brown, moist, medium dense, Sand and Gravel.			SS-5	3-5-6 ***N=11***	13	100	
				SS-6	3-9-13 ***N=22***	27	100	
746.0		15.0	15					
	Brown, moist, medium dense, Sand, trace gravel.			SS-7	3-5-6 ***N=11***	13	100	
740.5		20.5	20					
	Brown to Gray, moist, very stiff, Lean Clay (CL), trace sand and gravel. LL=25%, PL=11%, PI=14% on SS-8B LL=26%, PL=17%, PI=9% on SS-9			SS-8A 8B	9-13-17 ***N=30***	36	100	3.5
			25	SS-9	3-7-13 ***N=20***	24	100	2.5
731.0		30.0	30					

Elevation Ref.: Google Earth Pro
Surface Elevation: 761.0 ft.
Date Started/Completed: 11/12/2024-11/12/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: BD-1
Foreman: Gilbert
Engineer: Sunil Badam

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 30' during drilling
▼ At Completion: Not Encountered
After: 24 hours Dry
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 73%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field Additional Borings
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-22
PROJECT #: J045355.01 (PHASE-2)
PAGE #: 2 of 2
LAT,LON: 39.812302 ,-84.158404

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
726.0	Gray, wet, dense, Sand, trace gravel.	35.0	30	SS-10	5-19-29 ***N=48***	58	100	
	Gray, wet, medium dense to dense, Gravel and Sand.		35	SS-11	3-12-9 ***N=21***	26	100	
			40	SS-12	7-14-7 ***N=21***	26	0	
			45	SS-13	7-20-24 ***N=44***	54	100	
709.5		51.5	50	SS-14	13-15-30 ***N=45***	55	100	
	Bottom of test boring at 51.5 feet.		55					
			60					

Elevation Ref.: Google Earth Pro
Surface Elevation: 761.0 ft.
Date Started/Completed: 11/12/2024-11/12/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: BD-1
Foreman: Gilbert
Engineer: Sunil Badam

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 30' during drilling
At Completion: Not Encountered
After: 24 hours Dry
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 73%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field Additional Borings
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-23
PROJECT #: J045355.01 (PHASE-2)
PAGE #: 1 of 2
LAT,LON: 39.813120 ,-84.158147

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
761.4	Ground Surface	0.0	0					
760.9	Topsoil (6 Inches).	0.5						
	Brown, moist, stiff, Sandy Lean Clay, trace gravel and root hairs (Fill).			SS-1A 1B	3-4-5 ***N=9***	11	89	1.0
				SS-2	11-10-8 ***N=18***	22	67	1.5
756.4		5.0	5					
	Brown, moist, medium dense to dense, Gravel and Sand.			SS-3	7-12-21 ***N=33***	40	67	
				SS-4	7-12-12 ***N=24***	29	67	
			10	SS-5	2-5-10 ***N=15***	18	33	
				SS-6	7-12-23 ***N=35***	43	100	
746.4		15.0	15					
	Brown, moist, medium dense, Sand and Gravel.			SS-7	3-7-10 ***N=17***	21	56	
			20	SS-8	10-12-13 ***N=25***	30	56	
736.4		25.0	▽ 25					
735.4	Brown, wet, medium dense, Gravel and Sand.	26.0		SS-9A 9B	8-11-14 ***N=25***	30	100	2.0
	Brown, wet, stiff, Sandy Lean Clay, trace gravel.							
731.4		30.0	30					

Elevation Ref.: Google Earth Pro
Surface Elevation: 761.4 ft.
Date Started/Completed: 11/12/2024-11/13/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: BD-1
Foreman: Gilbert
Engineer: Sunil Badam

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
▽ First Noted: Groundwater level at 25' during drilling
▼ At Completion: Not Encountered
After: 24 hours Dry
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 73%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

LOG OF TEST BORING

CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field Additional Borings
Well field north of Chuck Wagner Lane
LOCATION OF BORING: Refer to attached Exploration Plan.

BORING #: B-23
PROJECT #: J045355.01 (PHASE-2)
PAGE #: 2 of 2
LAT,LON: 39.813120 ,-84.158147

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Type-Number	SPT* Blows/6"	N_{60}	Recovery (%)	HP (tsf)
726.4	Brown, wet, medium dense, Sand, trace silt, clay and gravel. Gravel=7.2%, Sand=87.4%, Silt=5.0%, Clay=0.4% on SS-10	35.0	30	SS-10	5-7-17 ***N=24***	29	100	
721.4	Brown, wet, medium dense, Sand, trace clay.	40.0	35	SS-11	3-5-7 ***N=12***	15	44	
716.4	Brown, wet, dense, Sand and Gravel.	45.0	40	SS-12	20-21-17 ***N=38***	46	100	
710.6	Brown, wet, dense, Sand, trace gravel.	50.8	45	SS-13	7-17-13 ***N=30***	36	89	
	Bottom of test boring at 50.8 feet.		50	SS-14	29-50/3"-		100	
			55					
			60					

Elevation Ref.: Google Earth Pro
Surface Elevation: 761.4 ft.
Date Started/Completed: 11/12/2024-11/13/2024
Boring Advancement Method: 3.25-inch hollow-stem augers

Drill Rig: BD-1
Foreman: Gilbert
Engineer: Sunil Badam

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
SS = Split-Spoon Sample
ST = Shelby Tube
RC = Rock Core

GROUNDWATER DEPTH
First Noted: Groundwater level at 25' during drilling
At Completion: Not Encountered
After: 24 hours Dry
Backfilled: Backfilled with auger cuttings and plastic hole plug

NOTES
Drill Rig ETR = 73%

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

SOIL CLASSIFICATION SHEET

NON COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

Density

Very Loose	- 4 blows/ft. or less
Loose	- 5 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft.
Very Dense	- 51 blows/ft. or more

Relative Properties

Descriptive Term	Percent
Trace	1 – 10
Little	11 – 20
Some	21 – 35
And	36 – 50

Particle Size Identification

Boulders	- 8 inch diameter or more	
Cobbles	- 3 to 8 inch diameter	
Gravel	- Coarse	- 3/4 to 3 inches
	- Fine	- 3/16 to 3/4 inches
Sand	- Coarse	- 2mm to 5mm (dia. of pencil lead)
	- Medium	- 0.45mm to 2mm (dia. of broom straw)
	- Fine	- 0.075mm to 0.45mm (dia. of human hair)
Silt		- 0.005mm to 0.075mm (Cannot see particles)

COHESIVE SOILS
(Clay, Silt and Combinations)

Consistency	Field Identification	Unconfined Compressive Strength (tons/sq. ft.)
Very Soft	Easily penetrated several inches by fist	Less than 0.25
Soft	Easily penetrated several inches by thumb	0.25 – 0.5
Medium Stiff	Can be penetrated several inches by thumb with moderate effort	0.5 – 1.0
Stiff	Readily indented by thumb but penetrated only with great effort	1.0 – 2.0
Very Stiff	Readily indented by thumbnail	2.0 – 4.0
Hard	Indented with difficulty by thumbnail	Over 4.0

Classification on logs are made by visual inspection.

Standard Penetration Test – Driving a 2.0" O.D., 1 3/8" I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. It is customary to drive the spoon 6 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6 inches of penetration on the drill log (Example – 6/8/9). The standard penetration test results can be obtained by adding the last two figures (i.e. 8+9=17 blows/ft.). Refusal is defined as greater than 50 blows for 6 inches or less penetration.

Strata Changes – In the column "Soil Descriptions" on the drill log, the horizontal lines represent strata changes. A solid line (————) represents an actually observed change; a dashed line (— — — —) represents an estimated change.

Groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

APPENDIX C LABORATORY TEST DATA

Tabulation of Laboratory Tests

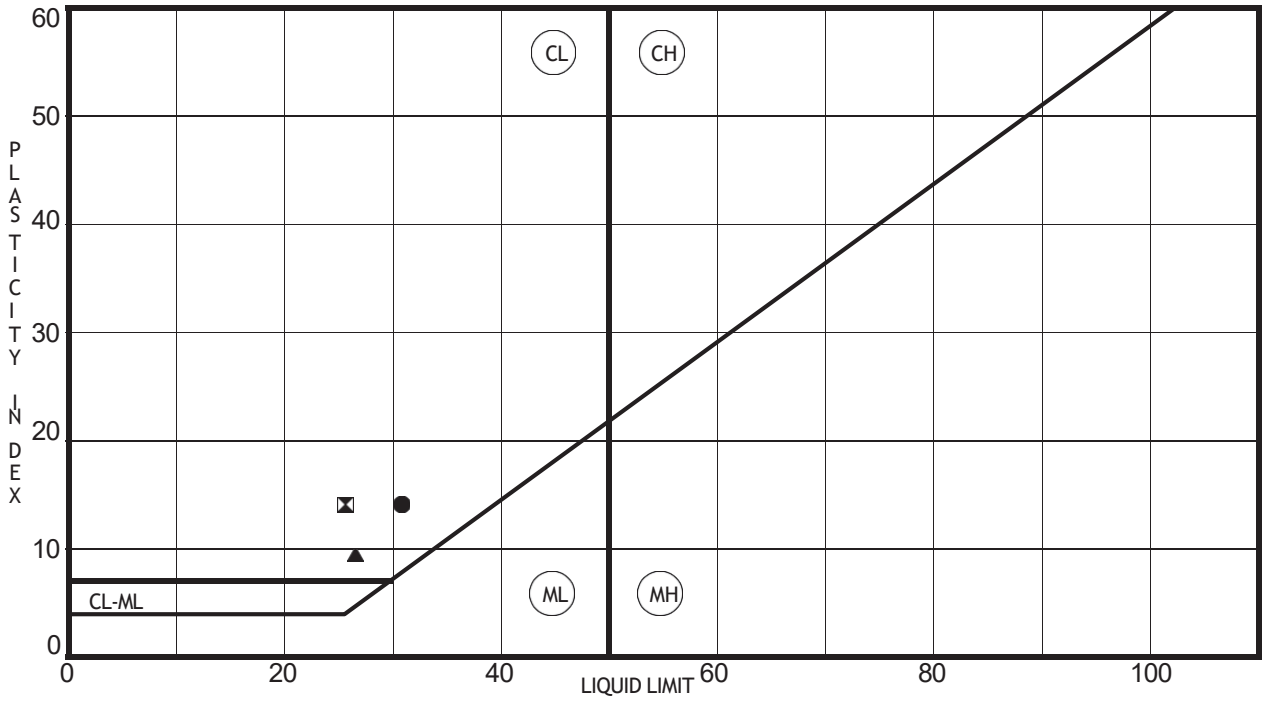
Atterberg Limits Test Forms

Particle-Size Analysis Test Forms

TABULATION OF LABORATORY TESTS

Boring No.	Sample No.	Depth (ft.)		Moisture Content (%)	Atterberg Limits (%)			Gradation Analysis (%)				USCS Classification
		From	To		LL	PL	PI	Gravel	Sand	Silt	Clay	
B-21	SS-1A	0.0	0.5	29.4								
	SS-3	5.0	6.5	4.3								
	SS-5	10.0	11.5	3.2				48.7	42.9	7.3	1.2	
	SS-7	15.0	16.5	4.3								
	SS-8	20.0	21.5	8.1	31	17	14					CL
	SS-9	25.0	26.5	10.3								
	SS-11	35.0	36.5	9.0								
	SS-14	50.0	51.5	13.0								
B-22	SS-1B	0.5	1.5	14.9								
	SS-3	5.0	6.5	1.7								
	SS-5	10.0	11.5	3.6								
	SS-7	15.0	16.5	4.5								
	SS-8A	20.0	21.5	4.5								
	SS-8B	20.0	21.5	10.7	25	11	14					CL
	SS-9	25.0	26.5	10.0	26	17	9					CL
	SS-11	35.0	36.5	17.0								
	SS-13	45.0	46.5	6.4								
B-23	SS-2	2.5	4.0	24.8								
	SS-4	7.5	9.0	3.8								
	SS-6	12.5	14.0	3.3								
	SS-8	20.0	21.5	4.7								
	SS-9B	25.0	26.5	13.6								
	SS-10	30.0	31.5	20.7				7.2	87.4	5.0	0.4	
	SS-12	40.0	41.5	9.5								
	SS-14	50.0	50.8	12.2								

Liquid and Plastic Limits Test Report



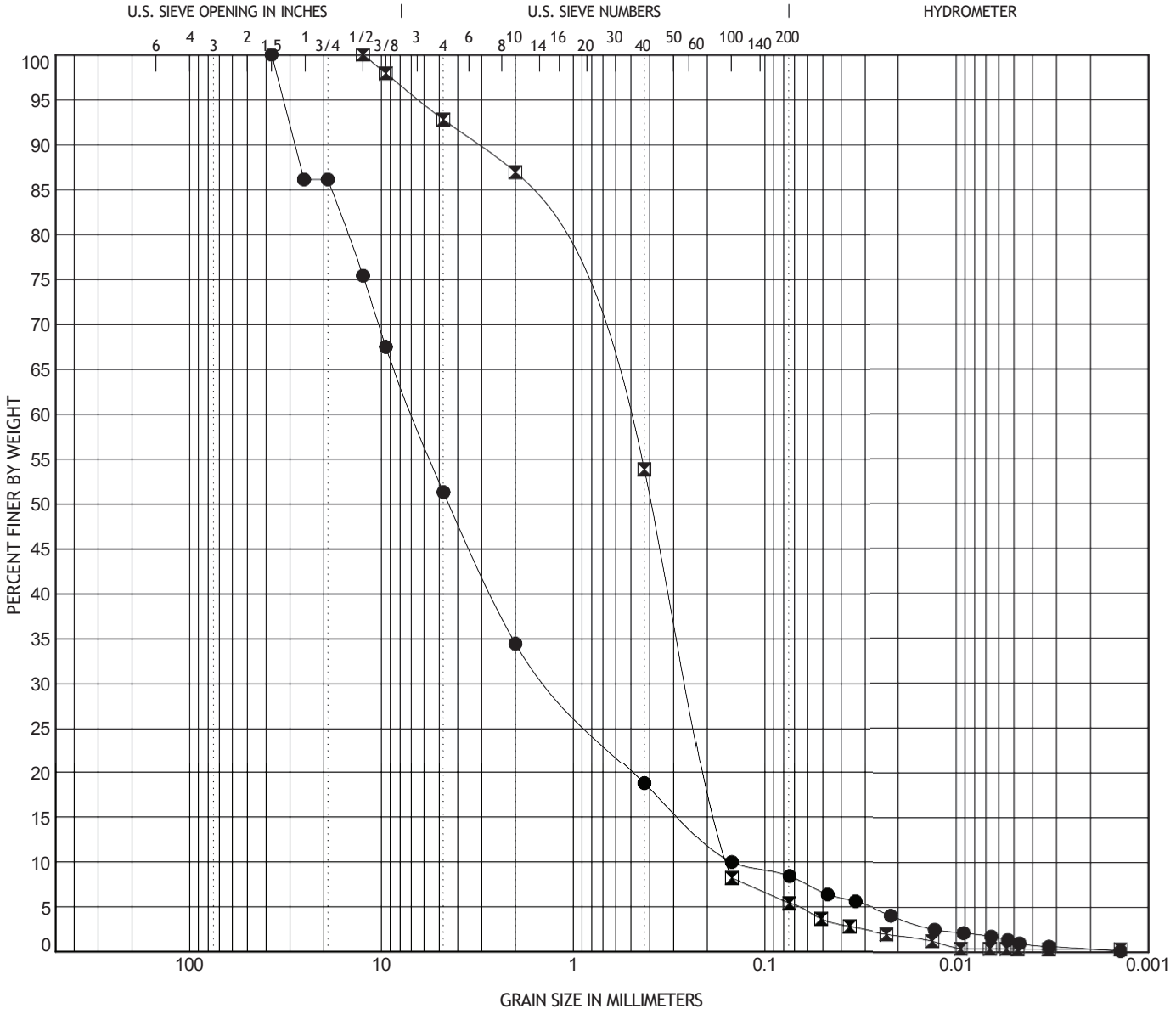
	Boring	Depth (ft)	LL	PL	PI	Water Content	% < #40	% < #200	USCS	Description
●	B-21	20.0	31	17	14	8.1			CL	Classification is based on Atterberg Limits tests
⧓	B-22	20.0	25	11	14	4.5			CL	Classification is based on Atterberg Limits tests
▲	B-22	25.0	26	17	9	10.0			CL	Classification is based on Atterberg Limits tests

CSI of Cincinnati
11785 Highway Drive
Cincinnati, OH 45241
Phone: 513.252.2059
Fax: 888.792.3121

PROJECT INFORMATION

Client: Tetra Tech
Project Name: Dayton Miami Wellfield - Additional Borings
Project Number: J045355.01
Project Location: Dayton, OH

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	B-21	10.0					1.60	45.87
⧓	B-23	30.0					0.69	3.63

	Boring	Depth (ft)	D95	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-21	10.0	32.595	6.892	4.439	1.288	0.15	48.7	42.9	7.3	1.2
⧓	B-23	30.0	6.419	0.567	0.389	0.247	0.156	7.2	87.4	5.0	0.4

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PROJECT INFORMATION

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APPENDIX D FIELD INFILTRATION TEST FORMS

GEOTECHNOLOGY
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FALLING HEAD FIELD INFILTRATION TEST WITHIN BOREHOLE/STANDPIPE

PROJECT NO.: J045355.01 (Phase-2)
CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
LOCATION: Dayton, Ohio
TEST NO.: 01
TEST LOCATION: B-21
SOIL DESCRIPTION: Very Stiff Silty Clay
GROUNDWATER LEVEL: 30'

TEST START DATE: 11/15/2024
TEST END DATE: 11/15/2024
PERSONNEL: SB

Depth of Infiltration Surface below Ground Surface (ft.): 20
Depth to Water Table (ft.): 30
Borehole Depth (ft.): 20
Borehole Diameter (in.): 6.25
Standpipe Material: PVC
Standpipe Diameter (in.): 4
Standpipe Penetration Below Infiltration Surface (in.): 0
Infiltration Area (in.^{2}): 30.68

Infiltration Liquid Used: Water
Weather:
Air Temperature (°F):

Date	Time	Incremental Elapsed Time, Δt (min.)	Total Elapsed Time, t (min.)	Reference Water Measurement (in.)	Depth of Water Above Infiltration Surface, h (in.)	Infiltration Rate v (in./hr.)	Infiltration Rate v (cm/hr.)	Remarks
11/15/2024	8:10 AM	-	0	0.0	240.0	-	-	
11/15/2024	8:25 AM	15	15	-170.4	69.6	681.6	1731.3	
11/15/2024	8:40 AM	15	30	-201.6	38.4	124.8	317.0	
11/15/2024	8:55 AM	15	45	-210.0	30.0	33.6	85.3	
11/15/2024	9:10 AM	15	60	-216.0	24.0	24.0	61.0	
11/15/2024	9:10 AM	0	0	0.0	240.0	-	-	
11/15/2024	8:40 AM	30	30	-218.4	21.6	436.8	1109.5	
11/15/2024	9:50 AM	0	0	0.0	240.0	-	-	
11/15/2024	10:20 AM	30	30	-218.4	21.6	436.8	1109.5	
11/15/2024	11:20 AM	60	90	-234.0	6.0	15.6	39.6	
11/15/2024	12:20 PM	60	150	-238.8	1.2	4.8	12.2	

GEOTECHNOLOGY
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FALLING HEAD FIELD INFILTRATION TEST WITHIN BOREHOLE/STANDPIPE

PROJECT NO.: J045355.01 (Phase-2)
CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
LOCATION: Dayton, Ohio
TEST NO.: 01
TEST LOCATION: B-22
SOIL DESCRIPTION: Very Stiff Lean Clay
GROUNDWATER LEVEL: 30'

TEST START DATE: 11/14/2024
TEST END DATE: 11/15/2024
PERSONNEL: SB

Depth of Infiltration Surface below Ground Surface (ft.): 21
Depth to Water Table (ft.): 30
Borehole Depth (ft.): 21
Borehole Diameter (in.): 6.25
Standpipe Material: PVC
Standpipe Diameter (in.): 4
Standpipe Penetration Below Infiltration Surface (in.): 0
Infiltration Area (in.^{2}): 30.68

Infiltration Liquid Used: Water
Weather:
Air Temperature (°F):

Date	Time	Incremental Elapsed Time, Δt (min.)	Total Elapsed Time, t (min.)	Reference Water Measurement (in.)	Depth of Water Above Infiltration Surface, h (in.)	Infiltration Rate v (in./hr.)	Infiltration Rate v (cm/hr.)	Remarks
11/14/2024	12:35 PM	-	0	0.0	252.0	-	-	
11/14/2024	12:50 PM	15	15	-18.0	234.0	72.0	182.9	
11/14/2024	1:05 PM	15	30	-21.6	230.4	14.4	36.6	
11/14/2024	1:20 PM	15	45	-25.2	226.8	14.4	36.6	
11/14/2024	1:35 PM	15	60	-30.0	222.0	19.2	48.8	
11/14/2024	2:05 PM	30	90	-32.4	219.6	4.8	12.2	
11/14/2024	2:35 PM	30	120	-32.4	219.6	0.0	0.0	
11/14/2024	3:35 PM	60	180	-33.0	219.0	0.6	1.5	
11/14/2024	4:35 PM	60	240	-33.0	219.0	0.0	0.0	
11/14/2024	5:35 PM	60	300	-33.0	219.0	0.0	0.0	
11/15/2024	7:49 PM	854	1154	-60.0	192.0	1.9	4.8	

GEOTECHNOLOGY
A Universal Engineering Sciences Company

FALLING HEAD FIELD INFILTRATION TEST WITHIN BOREHOLE/STANDPIPE

PROJECT NO.: J045355.01 (Phase-2)
CLIENT: Tetra Tech
PROJECT: Dayton Miami Well Field
LOCATION: Dayton, Ohio
TEST NO.: 01
TEST LOCATION: B-23
SOIL DESCRIPTION: Stiff Sandy Lean Clay
GROUNDWATER LEVEL: 25

TEST START DATE: 11/14/2024
TEST END DATE: 11/15/2024
PERSONNEL: SB

Depth of Infiltration Surface below Ground Surface (ft.): 27
Depth to Water Table (ft.): 25
Borehole Depth (ft.): 27
Borehole Diameter (in.): 6.25
Standpipe Material: PVC
Standpipe Diameter (in.): 4
Standpipe Penetration Below Infiltration Surface (in.): 0
Infiltration Area (in.^{2}): 30.68

Infiltration Liquid Used: Water
Weather:
Air Temperature (°F):

Date	Time	Incremental Elapsed Time, Δt (min.)	Total Elapsed Time, t (min.)	Reference Water Measurement (in.)	Depth of Water Above Infiltration Surface, h (in.)	Infiltration Rate v (in./hr.)	Infiltration Rate v (cm/hr.)	Remarks
11/14/2024	11:15 AM	-	0	0.0	324.0	-	-	
11/14/2024	11:30 AM	15	15	-5.7	318.3	22.8	57.9	
11/14/2024	11:45 AM	15	30	-8.2	315.8	10.0	25.4	
11/14/2024	12:00 PM	15	45	-9.3	314.7	4.4	11.2	
11/14/2024	12:15 PM	15	60	-10.0	314.0	2.8	7.1	
11/14/2024	12:45 PM	30	90	-10.1	313.9	0.2	0.5	
11/14/2024	1:15 PM	30	120	-10.1	313.9	0.0	0.0	
11/14/2024	2:15 PM	60	180	-10.1	313.9	0.0	0.0	
11/14/2024	3:15 PM	60	240	-10.1	313.9	0.0	0.0	
11/14/2024	4:15 PM	60	300	-10.1	313.9	0.0	0.0	
11/14/2024	5:15 PM	60	360	-10.1	313.9	0.0	0.0	
11/15/2024	7:45 AM	870	1230	-10.1	313.9	0.0	0.0	