
SECTION 5
SPECIFICATIONS

SECTION 011100 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 LOCATION OF THE PROJECT

- A. The project is located in the Village of Fairport Harbor, Lake County. The existing valve project site on the Fairport/Painesville Corp Line, just South and East of the SR 535 Bridge.
- B. The disconnection between the Fairport Harbor WTP and the Fairport water distribution system shall be at a location near the plant as marked on the plans. The precise location is to be determined between the Village and Contractor after the vault work is completed and verified to be properly working.

1.2 PROJECT DESCRIPTION

- A. The project consists of an improvement to the existing water vault that would incorporate an emergency waterline connection to the City of Painesville's water system. All of the existing pipe, valves, fittings, and appurtenances shall be removed and replaced with new 8" PRVs, an ultrasonic flow meter, and all pipe, fittings, appurtenances, and telemetry as noted and detailed on plans. Work shall also consist of adding electrical and telemetry to vault to connect PRVs and flow meter into City of Painesville SCADA. Contractor shall coordinate and work with City of Painesville, Village of Fairport Harbor, and City's system integration operator Pro-Tech Systems Group to incorporate the vault equipment into SCADA system and ensure proper operation before vault is online.
- B. Contractor shall physically disconnect connection of water distribution system to water plant in general area specified on plans. The water main in this area is expected to be 12" cast iron or ductile iron pipe. This work shall be scheduled after all work with the valve vault has been completed, tested, connected to SCADA system for City of Painesville, and verified to operating properly for a minimum of 30 days.

1.3 SPECIFICATIONS

- A. In general, these Specifications describe the work to be performed by the various trades, other than work specifically excluded. It shall be the responsibility of the Contractor and Subcontractors to perform all work incidental to their trade, whether or not specific mention is made of each item, unless such incidentals are included under another Item.
- B. It is advised that the Contractor and all Subcontractors familiarize themselves with the contents of the complete Specifications, particularly for the trades preceding, following, related or adjacent to their work.

1.4 DRAWING SCHEDULE

A. The work to be done under this Contract is shown on the following Drawings:

<u>Title</u>	<u>Sheet No.</u>
TITLE SHEET	1
GENERAL NOTES	2
STANDARD DETAILS	3
SITE PLAN/DEMOLITION PLAN	4
VALVE VAULT PLAN	5
ELECTRICAL PLAN	6

END OF SECTION 011100

SECTION 011419 – USE OF SITE

PART 1 - GENERAL

1.1 GENERAL

- A. The Contractor will be allowed the use of as much of the site designated for the improvements as is necessary for his operation.

1.2 USE OF STREETS

- A. During the progress of the work, the Contractor shall make ample provisions for both vehicle and pedestrian traffic on any public street and shall indemnify and save harmless the Owner from any expense whatsoever due to their operations over said streets. The Contractor shall also provide free access to all the fire hydrants, water, and gas valves located along the line of his work. Gutters and waterways must be kept open or other provisions made for the removal of storm water. Street intersections may be blocked only one-half at a time, and the Contractor shall lay and maintain temporary driveways, bridges and crossings, such as in the opinion of the Engineer are necessary to reasonably accommodate the public.
- B. In the event of the Contractor's failure to comply with these provisions, the Owner may cause the same to be done, and may deduct the cost of such work from any monies due the Contractor under this Agreement, but the performance of such work by the Owner at its instance shall serve in no way to release the Contractor from his general or particular liability for the safety of the public or the work.
- C. The Contractor shall repair at no cost to the Owner, all existing roads, parking areas, grassed areas that are damaged due to the execution of his work. The Contractor shall remove daily all mud, soil and debris that may be tracked onto existing streets, drives, or walks by his equipment or that of subcontractors or suppliers.

1.3 CLOSING STREETS TO TRAFFIC

The Contractor may with the approval of the Engineer, close streets, or parts of streets, to vehicular traffic. The streets are to remain closed as long as the construction work or the condition of the finished work requires or as determined by the Engineer. The Engineer shall be the judge of how many streets or parts of streets it is necessary for the Contractor to close at any time, and may refuse to permit the closing of additional streets to traffic until the majority of the work on the closed streets is completed and they are opened to traffic.

1.4 RIGHTS-OF-WAY

- A. Whenever it is required to perform work within the limits of public or private property or in rights-of-way, such work shall be done in conformity with all agreements between the Owner and the owners of such. Care shall be taken to avoid injury to the premises entered, which premises shall be left in a neat and orderly condition by the removal of

rubbish and the grading of surplus materials, and the restoration of said public or private property to the same general conditions as pertained at the time of entry for work to be performed under this contract.

- B. The Contractor shall not (except after consent from the proper parties) enter or occupy with men, tools or equipment, any land outside the rights-of-way or property of the Owner.
- C. When the Contractor performs construction within 10 ft. of a right-of-way or easement line, he shall place tall stakes properly identified at points of change in width or direction of the right-of-way or easement line and at points along the line so that at least two stakes can be seen distinctly from any point on the line.

1.5 EASEMENTS

- A. Where the work is to be constructed upon easements, such easements will be secured by the Owner without cost to the Contractor. The Contractor shall not enter upon or occupy any private property outside of the limits of the easements furnished.
- B. Care shall be taken to avoid injury to the premises entered, which premises shall be left in a neat and orderly condition by the removal of rubbish and the grading of surplus materials, and the restoration of said public or private property to the same general conditions as pertained at the time of entry for work to be performed under this contract.

1.6 PROTECTING EXISTING BUILDINGS, STRUCTURES AND ROADWAYS

- A. The Contractor shall, at his own expense, shore up and protect any buildings, roadways, utilities or other public or private structures which may be encountered or endangered in the prosecution of the work, and that may not be otherwise provided for, and he shall repair and make good any damages caused to any such property by reason of his operations. All existing fences removed due to the prosecution of the work shall be replaced by the Contractor. No extra payment will be made for said work or material, but the cost of this work must be included in the price stipulated for the work to be done under this contract.

1.7 SITE FACILITIES

- A. The Contractor shall furnish and place sufficient quantities of portable toilet facilities at locations convenient for use by the Contractor's personnel, Subcontractors, the Engineer, and the Owner.

1.8 RESTORATION

- A. The contractor shall restore all areas per the plans and specifications and if not specified, at least to the condition existing prior to the start of work.

END OF SECTION 011419

SECTION 011423 - ADDITIONAL WORK, OVERTIME

PART 1 - GENERAL

1.1 NIGHT, SUNDAY AND HOLIDAY WORK

- A. No work will be permitted at night, Sunday or legal holidays except as noted on the plans or in the case of emergency and then only upon written authorization of the Engineer. Where no emergency exists, but the Contractor feels it advantageous to work at night, Sunday or legal holidays, the Contractor shall notify the Engineer at least two (2) days in advance, requesting written permission. Any work performed during the absence of the Engineer will be done at the Contractor's risk and responsibility and may be subject to rejection upon later inspection.

END OF SECTION 011423

SECTION 012513 – PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 MATERIALS AND EQUIPMENT

- A. In the specifications and on the Engineer's drawings, are specified and shown certain pieces of equipment and materials deemed most suitable for the service anticipated. This is not done to eliminate other equipment and materials equally as good and efficient. The Contractor shall prepare his bid on the particular materials and equipment specified. Following the award of the contract, should the Contractor desire to use other equipment and materials, he shall submit to the Owner a written request for such change and state the advantage to the Owner and the savings or additional cost involved by the proposed substitution. The determination as to whether or not such change will be permitted rests with the Owner and the Engineer.
- B. Each major item of equipment shall be inspected by a manufacturer's representative during installation and upon completion of the work. The Contractor shall supply the Engineer with a certificate of such inspection.

END OF SECTION 012513

SECTION 013119 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 PRECONSTRUCTION MEETING

- A. Prior to the Contractor beginning any work on the project, the Owner will schedule and hold a preconstruction meeting to discuss all aspects of the contract work.
- B. The Contractor shall be present and be prepared to comment in detail on all aspects of his work.
- C. The Contractor shall bring to the preconstruction meeting a proposed construction progress schedule, erosion control plan, quality control program, concrete mix designs, asphalt mix designs (JMF), etc. Approval of each by the Engineer is required prior to the start of any work.
- D. Included in the construction progress schedule shall be an implementation sequence of the proposed erosion control efforts required by the contract.

1.2 PROGRESS MEETINGS

- A. Monthly progress meetings will be held at a location to be determined by the Owner on a regularly scheduled day mutually convenient to the Owner, Contractor, and Engineer.
- B. The Contractor shall provide an updated construction progress schedule and be prepared to comment in detail on all aspects of his work.

END OF SECTION 013119

SECTION 013216 – CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 PROGRESS SCHEDULE

- A. Immediately after signing the Contract, the General Construction Contractor shall prepare a graphic progress schedule, indicating the work to be executed during each month and the rate of expected progress to secure completion on the agreed-upon completion date. The progress schedule shall be approved by the Engineer and Owner prior to starting work on the site. Copies of such graphic progress charts, upon which has been indicated the actual progress, shall be furnished to the Engineer with each requisition for payment.

This progress schedule must follow these general time frames (may vary with project):

1. Chip seal, paving fabric and/or the leveling course must start within 7 calendar days from the date of milling.
 2. Casting adjustments and/or curb replacements must start within 7 calendar days from the completion of the chip seal, intermediate course and/or fabric.
 3. Surface course asphalt concrete must begin installation within 7 calendar days from the completion of the casting adjustments and/or curb replacement.
 4. Traffic paint, temporary or permanent must be installed within a time period as deemed adequate and desirable for each location.
- B. Should the rate of progress fall materially behind the scheduled rate of progress, and unless the delay is authorized by the Engineer, each offending Contractor shall furnish additional labor, work overtime, or take other necessary means required for completion of the work on the scheduled date. No additional compensation beyond the set Contract price shall be paid for action taken or overtime expense incurred in maintaining scheduled progress.

END OF SECTION 013216

02/01/22

SECTION 013223 – SURVEY AND LAYOUT DATA

PART 1 - GENERAL

1.1 STAKING

- A. The Contractor shall hire a surveyor licensed in the state the work is to be installed to provide all reference points not already established and staking. The Contractor shall protect and preserve the established staking and reference points as long as required for installation of the work and field verifications by any party. The Contractor's surveyor shall replace and accurately relocate all staking and reference points so lost, destroyed or moved.

1.2 LAYOUT OF WORK

- A. The Contractor shall lay out his work and be responsible for correct locations, elevations and dimensions of all work executed by him under this Contract. The Contractor must exercise proper precautions to verify the figures shown on the Drawings before laying out the work and will be held responsible for any error resulting from his failure to exercise such precaution. The Contractor shall insure the new construction aligns with any existing work.

END OF SECTION 013223

SECTION 013233 – PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 PROGRESS PHOTOGRAPHS

- A. The General Construction Contractor shall have two (2) color photographs made of the project every three (3) weeks it is in progress. The photographs shall be of such views and taken at such times as the Engineer directs.
- B. All photographed work shall be done by a qualified, established, commercial photographer. Two (2) glossy prints of each photograph shall be furnished the Engineer and two (2) to the Owner. Prints shall be approximately 7-1/2 in. X 10 in. in size. Prints shall be inserted in transparent sheet protectors provided with punching for a 3-ring binder. Suitable binders shall be provided by the Contractor.
- C. Each photograph shall have a permanent negative title block in the lower right hand corner or on the back, approximately 2-1/4 in. wide x 1-3/4 in. high, and stating therein in neat lettering:
 - 1. Owner's Name
 - 2. Contract Description
 - 3. Contractor's Name
 - 4. Description of View
 - 5. Photo No. _____, Date _____
 - 6. Consulting Engineer
- D. The arrangement of and the information in the title block, shall be subject to the Engineer's approval. The cost for all photographs shall be paid for by the General Construction Contractor.

END OF SECTION 013233

SECTION 013236 – VIDEO MONITORING AND DOCUMENTATION

PART 1 - GENERAL

1.1 SCOPE

- A. Provide all labor, materials, equipment, and services, and perform all operations necessary to furnish to the Owner a complete color audio-video DVD record of the surface features within the proposed construction zone of influence. This record shall include, but not be limited to, all audio-video DVDs, storage cases, video logs, and indexes. The purpose of this coverage shall be to accurately document the pre-construction condition of these surface features.

1.2 QUALIFICATIONS

- A. The video DVD documentation shall be done by a responsible commercial firm known to be skilled and regularly engaged in the business of pre-construction color audio-video DVD documentation. The firm shall furnish such information as the Owner deems necessary to determine the ability of that firm to perform the work in accordance with the Contract specifications.

1.3 PRODUCTS

- A. The color audio-video recording delivered to the Owner shall be on a high quality DVD format.

END OF SECTION 013236

SECTION 013319 - FIELD TEST REPORTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes, but is not limited to, services performed by an independent testing laboratory. Laboratory services covered under this section are for testing materials used for field constructed elements of the work. Performance testing of manufactured items and shop fabricated materials shall be covered under their respective specification section.
- B. All testing performed under this item shall be for the protection and benefit of the Owner and shall not be construed by the Contractor as a comprehensive quality control program intended to protect the Contractor, his subcontractors, or his suppliers. The testing frequency and types of testing shall be at the discretion of the Owner.
- C. Inspections, tests, and related actions specified in this section and elsewhere in the contract documents are not intended to limit the Contractor's own quality control procedures and testing, which facilitate overall compliance with requirements of the contract documents. Requirements for the Contractor to provide quality control services as required by the Engineer, the Owner, governing authorities, or other authorized entities are not limited by the provisions of this Section.
- D. The Contractor is required to cooperate with the (*independent*) testing laboratories performing required inspections, test, and similar services and the Engineer or his representative.
- E. Materials and installed work may require testing or retesting at any time during progress of work. Retesting of rejected materials or installed work shall be done at Contractor's expense.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.
- B. The Contract Documents may include testing requirements furnished under other Sections. Work elements which may include other testing requirements are:
 - 1. Earthwork
 - 2. Asphalt and concrete paving
 - 3. Storm sewer systems.

1.3 SELECTION AND PAYMENT

- A. The Contractor will employ an independent testing laboratory to perform specified testing. Payment shall be incidental to the related work bid item. The laboratory shall be mutually agreed upon by the Owner, Engineer, and Contractor.
- B. Employment of testing laboratory in no way relieves the Contractor of the obligation to perform work in accordance with requirements of the contract documents.
- C. The testing laboratory and their personnel shall be under the direction of the Engineer's on-site representative, regardless of who employs their services.

1.4 REFERENCES

- A. AASHTO T-19, Standard Method of Test for Unit Weight and Voids in Aggregate.
- B. AASHTO T-37, Standard Method of Test for Sieve Analysis of mineral Filler for Road and Paving Materials.
- C. AASHTO T-230, Standard Method of Test for Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures.
- D. ASTM C-29, Standard Method of Test for Unit Weight and Voids in Aggregate.
- E. ASTM C-31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- F. ASTM C-33, Standard Specification for Concrete Aggregates.
- G. ASTM C-39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- H. ASTM C-40, Test Method for Organic Impurities in Fine Aggregates for Concrete.
- I. ASTM C-42, Standard Test Methods for Obtaining and Testing Drilled Cored and Sawed Beams of Concrete.
- J. ASTM C-88, Standard Test Method for Soundness of Aggregate by use of Sodium Sulfate or Magnesium Sulfate.
- K. ASTM C-94, Standard Specification for Ready-Mixed Concrete.
- L. ASTM C-117, Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.
- M. ASTM C-136, Standard Method for Sieve Analysis of Fine and Course Aggregate.

- N. ASTM C-142, Test Method for Clay Lumps and Friable Particles in Aggregate.
- O. ASTM C-143, Standard Test Method for Slump of Hydraulic Cement Concrete.
- P. ASTM C-172, Standard Practice for Sampling Freshly Mixed Concrete.
- Q. ASTM C-173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- R. ASTM C-231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- S. ASTM C-535, Standard Test Method for Resistance to Degradation of Large-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.
- T. ASTM C-1064, Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.
- U. ASTM D-698, Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb. (2.49-kg) Rammer and 12-inc. (305-mm) Drop.
- V. ASTM D-2487, Standard Test Method for Classification of Soils for engineer purposes.
- W. ASTM D-2940, Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.
- X. ASTM D-4253, Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
- Y. ASTM D-4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
- Z. ASTM D-4832, Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
- AA. ODOT Supplement 1021, Method of Test for Determination of the Percent of Fractured Pieces in Gravel.
- AB. ODOT Supplement 1029, Method of Test for Determining the Percentage of Deleterious Materials in Course Aggregate.
- AC. ODOT Supplement 1036, Method of Test for Determination of Percent Air Voids in Compacted Dense Bituminous Paving Mixtures.
- AD. ODOT Supplement 1044, Mix Design Method for Bituminous Aggregate Base.

- AE. Uni-Bell PVC Pipe Association UNI-B-6-98 for Low Pressure Air Testing of Installed Sewer Pipe.
- AF. ASTM – C969 – Standard practice for infiltration and exfiltration acceptance of installed concrete sewer pipe.

1.5 SUBMITTALS

- A. Prior to the start of work, submit testing laboratory name, address, and telephone number, and names of full-time specialist and responsible officer.
- B. Submit copy of the testing laboratory's evaluation report issued by one of the evaluation authorities identified in Article 1.6 of this Section with memorandum of remedies of any deficiencies reported by the inspection.
- C. Submit the chain of custody and other QA/QC procedures for each test to be utilized by the laboratory.
- D. Submit a sample test report for review by the Engineer to demonstrate conformance with Article 3.2 herein.

1.6 QUALITY ASSURANCE

- A. Except as otherwise indicated, the testing laboratory engaged shall be prequalified by the Ohio Department of Transportation for the types of services specified herein.
- B. The field personnel utilized to perform all field-testing and preparation shall be certified for those tests being performed.

1.7 RESPONSIBILITIES

- A. Testing Laboratory Responsibilities:
 - 1. Provide qualified personnel at the site. Cooperate with the Engineer and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with the specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of the contract documents.
 - 4. Immediately notify the Engineer and Contractor of observed irregularities or nonconformance of work or products.
 - 5. Perform additional tests required by the Engineer.
 - 6. Testing personnel are to report to the Engineer or his representative upon arrival on site for instructions and requirements. Prior to leaving the site, furnish the Engineer or his representative all test results whether in a formal or informal format.
 - 7. Attend preconstruction meetings and progress meetings.

- B. Contractor Responsibilities:
1. Provide access to materials proposed to be used which require testing.
 2. Cooperate with laboratory personnel and provide access to the work.
 3. Provide incidental labor and facilities:
 - a. To provide access to work to be tested.
 - b. To obtain and handle samples at the site or at the source of products to be tested.
 - c. To facilitate tests.
 - d. To provide storage and curing of test samples as required by the testing laboratory.
 4. Notify the Engineer and laboratory 24 hours prior to expected time for operations requiring testing services for scheduling purposes. Materials will not be permitted to be placed without the proper testing being performed in conformance with this Section.

1.8 LIMITS OF LABORATORY AUTHORITY

- A. The laboratory may not release, revoke, alter, or enlarge the requirements of the contract documents.
- B. The laboratory may not approve or accept any portion of the work.
- C. The laboratory may not assume any duties of the Contractor.
- D. The laboratory has no authority to stop the work.

1.9 SCHEDULE OF TESTS

Testing anticipated on this project shall include, but is not limited to:

- A. Earthwork
 1. Special backfill material sieve analysis per ASTM C-136, one test per source.
 2. On-site trench backfill analysis per ASTM D-2487, as directed by Engineer.
 3. Pipe bedding and cover sieve analysis per ASTM C-136, one test per source.
 4. Drainage fill sieve analysis per ASTM C-136, one test per source.
 5. Soil compaction per ASTM D-698.
 - a. Embankment testing shall be at least one (1) test/5,000 S.F. of each lift;
 - b. Trench backfill testing shall be at least one (1) test/50 L.F. of each lift;
 - c. Subgrade and/or subbase testing shall be at least one (1) test/200 L.F. of pavement or 5,000 S.F. of slabs subject to greater frequency due to soil conditions or Engineer's direction.
 6. Backfill compaction per ASTM D-4253 and D-4254, one test per 50 L.F. of each lift.
 7. Low Strength Mortar testing per ASTM D-4832.

B. Concrete

1. Concrete aggregate deleterious substances per ASTM C-40, ASTM C-117, and ASTM C-142, one test per source.
2. Concrete aggregate abrasion per ASTM C-535, one test per source.
3. Sodium sulfate soundness of coarse aggregate per ASTM C-88, one test per source.
4. Sampling Fresh Concrete: ASTM C-172, except modified for slump to comply with ASTM C 94.
 - a. When cylinders and/or beam samples are made, the slumps and air test shall be made using concrete from the same batch.
 - b. Slump: ASTM C-143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
 - c. Air Content: ASTM C-173, volumetric method of lightweight concrete; ASTM C-231 pressure method for normal weight concrete; at least one for each pour of each type of air-entrained concrete, and each time a set of compression test specimens is made.
 - d. Concrete Temperature: ASTM C-1064, test hourly when air temperature is 40° F. (4° C.) and below, and when 80° F. (27° C.) and above; and each time a set of compression test specimens is made.
 - e. Compression Test Specimen: ASTM C-31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
 - f. Compressive Strength Tests: ASTM C-39; one set for each day's pour exceeding 5 cubic yards plus additional sets for each 50 cubic yards over and above the first 25 cubic yards of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days.
 - i. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
 - ii. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
 - g. Two (2) tests beams shall be made for each 250 square yards of concrete pavement and/or slabs on grade placed.
 - i. For traffic to be allowed on pavement or slab, the modulus of rupture shall be a minimum of 600 psi for Class C concrete or 400 psi for ODOT Class MS or FS.

- g. The Contractor or subcontractor performing the test shall be experienced and qualified to perform deflection testing with the equipment and procedures utilized. The contractor shall provide all labor, materials, tools and equipment necessary to clean and test all sections of sewer pipe, locate deficient areas, repair, deficient areas, and retest all repaired areas.
 - h. All sewer runs shall be cleaned prior to testing.
 - i. The acceptance test shall be performed without mechanical pulling devices.
 - j. All pipe failing the deflection test shall be exposed, repaired or replaced and retested at no additional cost to the Owner.
2. Leakage Testing
- a. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
 - b. The Contractor shall perform sufficient tests to determine that the installation of all pipe materials have been as specified and that test results are in accordance with those required for approval of the installation.
 - c. The Contractor shall furnish all pressure gauges, suitable pump or pumps, pipes, test heads, and any other apparatus and materials used for these tests. These tests are to be considered as part of the work, and no additional compensation shall be made.
 - d. The tests shall be conducted under the direction of the Engineer or an appointed agent. Any testing done without direction and supervision as specified shall not be considered as a proper means of approval.
 - e. The Contractor may obtain water for testing as may be required by observing the rules and regulations enforced in the municipality in which the work is being done.
 - f. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.
3. Infiltration and Exfiltration Testing
- a. All sewers shall be tested using an exfiltration test or, where specifically allowed in writing by the Engineer, an infiltration test.
 - b. All sewers shall be tested. No visible leakage in the sewers or manholes shall be permitted.
 - c. Bulkheads shall be used to isolate the test sections as required to perform the work. All service laterals, stubs and fittings shall be plugged or capped at the connection to the test section.
 - d. Each manhole run shall be tested separately.
4. Exfiltration Testing
- a. The test shall be performed first with a minimum head of water of three (3) feet above the top of the high end of the sewer or two (2) feet above the high end of the highest lateral in the section or sections to be tested, or three (3) feet above the existing groundwater elevation, whichever is higher.

- b. The exfiltration test shall be conducted between two manholes by sealing the downstream end of the test section and all inlet sewers at the upstream manhole with pipe stoppers.
- c. The average internal pressure in the system shall not exceed 11.6 feet of water or 5 psi and the maximum internal pipe pressure at the lowest end shall not exceed 23 feet of water or 10 psi.
- d. Water shall be added to the pipe section at a steady rate from the upstream manhole to allow air to escape from the sewer until the water is at the specified level above the crown of the pipe. The water may stand in the pipe and manhole up to seventy-two (72) hours prior to measurement of leakage to allow for absorption by the pipe and bleeding of air. After absorption into the pipe and manhole has stabilized, the water in the upstream manhole shall be brought to test level.
- e. The leakage rate shall be determined by measurement of the drop in water elevation measured in the upstream manhole and the loss of water calculated. The test period shall be a minimum of sixty (60) minutes duration. Use the following table to determine loss of water as measured in the manhole:

Water Level Change in Test Manhole		Volume of Leakage	
		4 Ft. Dia. MH	5 Ft. Dia. MH
(Inches)	(Feet)	(Gals.)	(Gals.)
1/8	0.01	0.98	1.53
1/4	0.02	1.96	3.06
3/8	0.03	2.94	4.59
1/2	0.04	3.92	6.12
5/8	0.05	4.90	7.65
3/4	0.06	5.87	9.18
7/8	0.07	6.85	10.71
1	0.08	7.83	12.24
1-1/8	0.09	8.81	13.77
1-1/4	0.10	9.79	15.30
1-3/8	0.11	10.77	16.83
1-1/2	0.12	11.75	18.36
1-5/8	0.13	12.72	19.89
1-3/4	0.14	13.71	21.42
1-7/8	0.16	14.69	22.90
2	0.17	15.67	24.48

5. Infiltration Testing

- a. An infiltration test shall be conducted for all sections of sewer, only when the ground water level is two (2) feet or more above the elevation of the inside crown of pipe at the upstream limit of the section being tested.
- b. The use of well point pumps or other dewatering devices shall have been discontinued for 24 hours prior to testing to permit the groundwater table to return to a static condition.

- c. The leakage rate shall be measured by a weir, by determination of the time required to fill a container of known volume, or other measuring device approved by the Engineer in the lower end of the sewer section to be tested.
 - d. The incoming sewer or sewers in the upper end of the test section shall be securely sealed.
6. Allowable Leakage
- a. The maximum allowable leakage for either infiltration or exfiltration shall be 50 gallons per inch of internal pipe diameter per mile per day.
 - b. If actual leakage measured exceeds the limits specified, the Contractor must locate and repair or remove and replace the defective pipe sections to the satisfaction of the Engineer and retest the section accordingly at no additional cost to the Owner.
 - c. All sanitary manholes shall be tested separately by using an exfiltration test (or infiltration test where groundwater conditions permit) to two (2) feet above the highest joint with no measurable leakage for a one hour test.
7. Low Pressure Air Testing
- a. PVC sanitary sewers 54-inch diameter and less may be air tested as specified. If the groundwater level is two (2) feet or more above the top of the pipe at the upstream end or if the air pressure required for the test is greater than 5 psig, the air test method should not be used for RCP sanitary sewers.
 - b. Each manhole run shall be tested separately, unless otherwise approved by the Engineer, as the construction progresses. Backfill shall be brought to final grade before testing. Testing shall be done prior to surface restoration, and preferably with not more than four (4) manhole runs constructed ahead of testing.
 - c. Test equipment consists of valves and pressure gages to control airflow and to monitor pressure within the test section.
 - d. The sewer shall be flushed and cleaned prior to testing to clean out any debris. The pipe surface should be wet for more consistent results.
 - e. The section of pipe to be tested shall be plugged at each end and the ends of laterals, stubs and fittings to be included in the test section shall be plugged and securely braced to prevent air leakage, and possible blowouts.
 - f. Equipment used shall meet the following minimum requirements and be approved by the Engineer:
 - i. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
 - ii. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
 - iii. All air used shall pass through a single control panel.

- iv. Three (3) individual hoses shall be used for the following connections:
 - a). From control panel to pneumatic plugs for inflation.
 - b). From control panel to sealed line for introducing the low pressure air.
 - c). From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

- g. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be used for the test. The sealed pipe shall be pressurized to 9 psig. The plugs must hold against this pressure without having to be braced. No persons shall be allowed in the alignment of the pipe during plug testing.
- h. After a manhole to manhole run of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole. Low pressure air shall be slowly introduced into this sealed line until the internal air pressure reaches approximately 4 psig greater than the average groundwater back pressure, but not greater than 9 psig for PVC pipe or 5 psig for RCP.
- i. In areas where groundwater is known to exist, the Contractor must determine the average groundwater back pressure. The Contractor shall install a 1/2-inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one of the sanitary sewer lines entering the manhole. See Figure No. 1. This shall be done at the time the sanitary sewer line is installed or install an 8-inch diameter stand pipe outside of the manhole backfilled with a column of clean stone of 2-inch minimum diameter to subgrade. Immediately prior to the performance of the low pressure air test, the ground water back pressure shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The plastic tube shall be vertical and a measurement of the height, in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. This height, divided by 2.307, will equal the average groundwater back pressure.
- j. At least two (2) minutes shall be allowed for the air to stabilize when the specified internal air pressure has been obtained. When the pressure has stabilized and is at or above 3.5 psig, the air hose from the control panel to the air supply shall be disconnected. The portion of the line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average groundwater back pressure calculated) shall not be less than the time in the tables in Reference Table 1.

- k. If a one (1) psi drop in pressure does not occur within the test time, the line has passed. If the pressure drop is more than one (1) psi during the test time, the line is presumed to have failed the test. If the line fails the test, segmented testing may establish the location of any leaks.
 - l. The Contractor must repair the leak or remove and replace the defective pipe section and re-test the section to the satisfaction of the Engineer at no additional cost to the Owner.
 - m. The pneumatic plugs must be installed in such a way as to prevent blowouts. Inasmuch as a force of 250 pounds is exerted on an 8-inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or a plug, which is partially deflated before the pipe pressure is released, can be dangerous.
 - n. The Contractor should internally restrain or externally brace the plugs to the manhole wall as an added safety precaution throughout the test.
 - o. Pressurizing equipment shall include a regulator or relief valve set at no higher than 9 psig for PVC pipe or 5 psig for RCP pipe to avoid over-pressurizing and damaging an otherwise acceptable line.
 - p. No one shall be allowed in the trench or manholes during testing.
 - q. Plugs shall not be removed until all pressure has been released.
 - r. All sanitary manholes shall be tested separately by using an exfiltration test (or infiltration test where groundwater conditions permit) to two (2) feet above the highest joint with no measurable leakage for a one hour test.
 - s. The air test data sheet marked Exhibit "A" at the end of this section shall be filled out for each section of piping tested in this manner.
 - t. Testing concrete pipe sewer lines by the low pressure air test method will be per ASTM C924-02 and C1103.
8. Manhole Vacuum Testing
- a. Temporarily plug all pipe entering the manhole. Each plug must be installed at a location beyond the manhole/pipe gasket (i.e. outside the manhole wall), and shall be braced to prevent the plug or pipe from being drawn into the Manhole.
 - b. The test head shall be placed inside the rim of the cast iron frame at the top of the manhole and inflated, in accordance with the manufacturer's recommendations.
 - c. A vacuum of at least 10 inches of mercury (10" Hg) shall be drawn on the manhole. Shut the line on the vacuum line to the manhole and shut off the pump or disconnect the vacuum line from the pump.
 - d. The pressure gauge shall be liquid filled, having a 3.5" diameter face with a reading from zero to thirty inches of mercury.
 - e. The manhole shall be considered to pass the vacuum test if the vacuum reading does not drop more than 1" Hg (i.e from 10" to 9" Hg) during the Table 1 minimum test time.

- f. If a manhole fails the vacuum test, the manhole shall be repaired with non-shrinkable grout or other material or method approved by the engineer. The manhole surfaces shall be properly prepared prior to any repairs. Once the repair material has cured according to the manufacturer's recommendations, the vacuum test shall be repeated. This process shall continue until a satisfactory test is obtained.
- g. All temporary plugs and braces shall be removed after each test.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.1 SEQUENCING AND SCHEDULING

- A. The Contractor shall coordinate the sequence of work activities so as to accommodate required testing and shall allow sufficient time for testing of materials by the laboratory so as to cause no delay in the work or the work of any other Contractor. In addition, the Contractor shall coordinate his work so as to avoid the necessity of removing and replacing work to accommodate inspections and tests.

3.2 LABORATORY TEST RESULTS

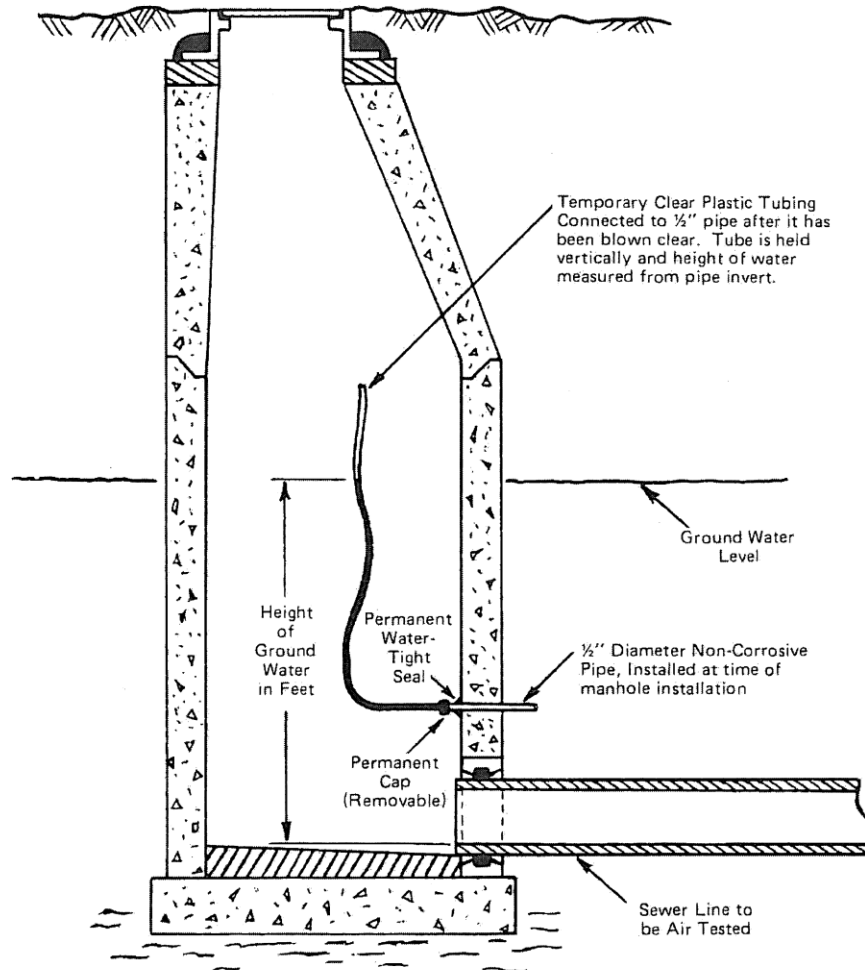
- A. The testing laboratory shall submit a certified written report of each inspection, test, or similar service concurrently to the Owner, Engineer, and Contractor.
- B. Written reports of each inspection, test, or similar service shall include, but not be limited to, the following:
 - 1. Name of testing laboratory.
 - 2. Project name and construction contract reference number.
 - 3. Dates and locations of samples and tests or inspections.
 - 4. Date of report.
 - 5. Names of individuals making the inspection or test.
 - 6. Designation of the work and test method.
 - 7. Test results.
 - 8. Notation of significant ambient conditions at the time of sample taking and testing.

END OF SECTION 013319

UNI-B-6-98

FIGURE NO. 1

**MANHOLE CROSS-SECTIONAL VIEW
OF THE PROPER METHOD FOR
DETERMINING GROUND WATER HEIGHT**



**AIR TEST DATA SHEET
PIPE TESTING FORM**

NOTE: Pressurize pipe to 4.5 P.S.I.F. and let stabilize for 5 minutes. Pressure should then be backed off to 4.0 P.S.I.G. and test time started.

JOB NAME: SANITARY STORM DATE: _____
JOB LOCATION: _____ TEST COMPANY: _____
JOB NO. _____ PROJECT REP: _____
SPECIFIED PRESSURE DROP () P.S.I.G. _____ PIPE MATERIAL: _____
BASE PRESSURE: 4.0 P.S.I.G. _____
 (See Table I or Table II for Reference) (Note: No test shall exceed 9.0 P.S.I.G.)

PIPE SECTION UNDER TEST					TEST START TIME	TEST STOP TIME	TEST TIME ELAPSED	PASS FAIL P or F
UPSTREAM MH/STATION	DN-STREAM MH/STATION	PIPE DIAMETER	PIPE LENGTH	GROUND WATER DEPTH				

*Identify any section(s) that failed:

*Leak (was) (was not) located. Method used:

REMARKS:

TABLE IMinimum specified time required for a 1.0 P.S.I.G. Pressure Drop

1 Pipe Diameter (Inches)	2 Minimum Time (Min:Sec)	3 Length for Minimum Time (Ft.)	4 Time for Longer Length (Sec)	Specification Time for Length (L) Shown (Min:Sec)								
				100 Ft.	150 Ft.	200 Ft.	250 Ft.	300 Ft.	350 Ft.	400 Ft.	450 Ft.	
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24	
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48	
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38	
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41	
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31	
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33	
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48	
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15	
33	31:10	72	28.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53	
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46	
42	39:48	57	41.883 L	69:48	104:42	139:37	174:30	209:24	244:19	279:13	314:07	
48	45:34	50	54.705 L	91:10	136:45	182:21	227:55	273:31	319:06	364:42	410:17	
54	51:02	44	69.236 L	115:24	173:05	230:47	288:29	346:11	403:53	461:34	519:16	
60	56:40	40	85.476 L	142:28	213:41	284:55	356:09	427:23	498:37	569:50	641:04	

for size and length of pipe indicated for Q = 0.0015

NOTE: If there has been no leakage, (zero P.S.I.G. drop), after one hour of testing, the test shall be accepted and the test complete. (See Section 7.5)

TABLE II

Minimum specified time required for a 0.5 P.S.I.G. Pressure Drop
for size and length of pipe indicated for $Q = 0.0015$

1 Pipe Diameter (Inches)	2 Minimum Time (Min:Sec)	3 Length for Minimum Time (Ft.)	4 Time for Longer Length (Sec)	Specification Time for Length (L) Shown (Min:Sec)							
				100 Ft.	100 Ft.	100 Ft.	100 Ft.	100 Ft.	100 Ft.	100 Ft.	100 Ft.
4	1:53	597	.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23
42	19:54	57	20.942 L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04
48	22:47	50	27.352 L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	205:09
54	25:31	44	34.618 L	57:42	86:33	115:24	144:15	173:05	201:56	230:47	259:38
60	28:20	40	42.738 L	71:14	106:51	142:28	178:05	213:41	249:18	284:55	320:32

NOTE: If there has been no leakage, (zero P.S.I.G. drop), after one hour of testing, the test shall be accepted and the test complete. (See Section 7.5)

**CT CONSULTANTS, INC.
HYDROSTATIC LEAKAGE TEST**

JOB. NO. _____ PROJECT: _____

CONTRACTOR: _____ CLIENT: _____

WATERLINE TESTED AT: _____
(Street Name) (Station of Gauge)

FROM STATION _____ TO STATION _____ ON _____

WATERLINE SIZE _____ TYPE _____

TESTED _____ AT _____ FOR _____
TOTAL L.F. PIPE SIZE PSI DURATION

ALLOWABLE LEAKAGE _____ PER 1,000 L.F. OR _____ PER _____
GALS./HR. TOTAL GALS. TOTAL L.F.

1ST TEST _____ AND _____
PASS / FAIL PRESSURE LOST GALLONS LOST

2ND TEST _____ AND _____
PASS / FAIL PRESSURE LOST GALLONS LOST

APPROVED BY _____
(INSPECTOR)

COMMENTS: _____

ALLOWABLE LEAKAGE PER 1,000 FEET OF WATERMAIN:

<u>PIPE SIZE INCH DIAMETER</u>	<u>ALLOWABLE LEAKAGE GALS. / 1,000 FEET</u>
6	1
8	1.3
10	1.6
12	1.9
16	2.5
20	3.2
24	3.8
30	4.8
36	5.7

NOTE: IN NO CASE SHALL THE TESTED SECTION EXCEED 2,000 FEET IN LENGTH.



PROJECT: _____ **SHEET NO. 1 OF** _____

JOB NO. _____ **STREET:** _____

CONTRACTOR: _____ **PROJECT REP:** _____

MANHOLE VACUUM TEST

M.H. NO.	M.H. Diameter (in.)	M.H. Depth (ft.) (btm.m.h. cover to shelf)	Vacuum Required (in Hg)	Vacuum Attained (in Hg)	Vacuum Drop (in Hg)	Holding Time Required (sec.)	Pass/Fail	Date Tested	Contractor Attest	Engineer Attest	Remarks

TABLE 1 – Minimum Test Times for Various Manhole Diameter

Depth (ft)	30	33	36	42	48	54	60	66	72
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	29	34	40	46	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	64	78	87	97
26	36	39	46	55	64	75	85	94	105
39	42	42	49	59	69	81	91	101	113
42	45	45	53	63	74	87	98	108	121

Note: Allowable drop equals 1 in. Hg for time shown

PROJECT REP: _____ **DATE:** _____

SECTION 013323 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.1 GENERAL

- A. The Contractor shall submit detailed drawings, acceptable catalog data, specifications and material certifications for all equipment and materials specified or required for the proper completion of the work.
- B. The intent of these items is to demonstrate compliance with the design concept of the work and to provide the detailed information necessary for the fabrication, assembly and installation of the work specified. It is not intended that every detail of all parts of manufactured equipment be submitted, however sufficient detail will be required to ascertain compliance with the specifications and establish the quality of the equipment proposed.

Shop Drawings shall be sufficiently clear and complete to enable the Engineer/Architect and Owner to determine that items proposed to be furnished conform to the specifications and that items delivered to the site are actually those that have been reviewed.

- C. It is emphasized that the Engineer/Architect's review of Contractor's submitted data is for general conformance to the contract drawings and specifications but subject to the detailed requirements of drawings and specifications. Although the Engineer/Architect may review submitted data in detail, such review is an effort to discover errors and omissions in Contractor's drawings. The Engineer/Architect's review shall in no way relieve the Contractor of his obligation to properly coordinate the work and to Engineer/Architect the details of the work in such manner that the purposes and intent of the contract will be achieved. Such review by the Engineer/Architect shall not be construed as placing on him or on the Owner any responsibility for the accuracy and for proper fit, functioning or performance of any phase of the work included in the contract.
- D. Shop Drawings shall be submitted in proper sequence and with due regard to the time required for checking, transmittal and review so as to cause no delay in the work. The Contractor's failure to transmit appropriate submittals to the Engineer/Architect sufficiently in advance of the work shall not be grounds for time extension.
- E. The Contractor shall submit Shop Drawings for all fabricated work and for all manufactured items required to be furnished in the Contract in accordance with the General Provisions and as specified herein. Shop Drawings shall be submitted in sufficient time to allow at least twenty-one (21) calendar days after receipt of the Shop Drawings from the Contractor for checking and processing by the Engineer/Architect.
- F. It is the responsibility of each Prime Contractor to furnish to all other Prime Contractors and especially the General Construction Contractor reviewed Shop Drawings for guidance in interfacing the various trades; i.e., sleeves, inserts, anchor bolts, terminations, and space requirements.

- G. No work shall be performed requiring Shop Drawings until same have been reviewed by Engineer/Architect.
- H. Accepted and reviewed Shop Drawings shall not be construed as approval of changes from Contract plan and specification requirements.
- I. The Engineer/Architect will review the first and second Shop Drawing item submittals at no cost to the Contractor. Review of the third submittal and any subsequent submittal will be at the Contractor's expense. Payment will be deducted from the Contract amount at a rate of 2.8 times direct labor cost plus expenses.

1.2 SUBMITTAL PROCEDURE

- A. All required submissions shall be made to the Engineer/Architect by the Prime Contractor(s) only. Any data prepared by subcontractors and suppliers and all correspondence originating with subcontractors, suppliers, etc., shall be submitted through the Contractor.
- B. Contractor shall review and approve all Shop Drawings prior to submission. Contractor's approval shall constitute a representation to Owner and Engineer/Architect that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each Shop Drawing or sample with the requirements of the work and the Contract Documents.
- C. Submittal Preparation: Mark each submittal with a permanent label or page for identification. Provide the following information on the label for proper processing and recording of action taken:
 - 1. Location
 - 2. Project Name
 - 3. Contract
 - 4. Name and Address of Engineer/Architect
 - 5. Name and Address of Contractor
 - 6. Name and Address of Subcontractor
 - 7. Name and Address of Supplier
 - 8. Name of Manufacturer
 - 9. Number and Title of appropriate Specification Section
 - 10. Drawing Number and Detail References, as appropriate.
 - 11. Submittal Sequence or Log Reference Number.
 - a. Provide a space on the label for the Contractor's review and approval markings and a space for the Engineer/Architect's "Action Stamp".
- D. Each Shop Drawing, sample and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor:

Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements.

Signature

Date

Company

- E. Shop Drawings shall be submitted in not less than six (6) copies to the Engineer/Architect at the address specified at the Preconstruction Conference. Single mylar or sepia reproducible copies of simple Shop Drawings may be submitted with prior approval of the Engineer/Architect.
- F. At the time of each submission, Contractor shall in writing identify any deviations that the Shop Drawings or samples may have from the requirements of the Contract Documents.
- G. Drawings shall be clean, legible and shall show necessary working dimensions, arrangement, material finish, erection data, and like information needed to define what is to be furnished and to establish its suitability for the intended use. Specifications may be required for equipment or materials to establish any characteristics of performance where such are pertinent. Suitable catalog data sheets showing all options and marked with complete model numbers may, in certain instances, be sufficient to define the articles which it is proposed to furnish.
- H. For product which require submittal of samples, furnish samples so as not to delay fabrication, allowing the Engineer reasonable time for the consideration of the samples submitted. Properly label samples, indicating the material or product represented, its place of origin, the names of the vendor and Contractor and the name of the project for which it is intended. Ship samples prepaid. Accompany samples with pertinent data required to judge the quality and acceptability of the sample, such as certified test records and, where required for proper evaluation, certified chemical analyses.

1.3 REVIEW PROCEDURE

- A. Engineer/Architect will review with reasonable promptness all properly submitted Shop Drawings. Such review shall be only for conformance with the design concept of the Project and for compliance with the information given in the plans and specifications and shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
- B. The review of a separate item as such will not constitute the review of the assembly in which the item functions. The Contractor shall submit entire systems as a package.
- C. All Shop Drawings submitted for review shall be stamped with the Engineer/Architect's action and associated comments.

- D. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer/Architect will review each submittal, mark to indicate action taken, and return accordingly. Compliance with specified characteristics is the Contractor's responsibility.

Action Stamp: The Engineer/Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

1. If Shop Drawings are found to be in general compliance, such review will be indicated by marking the first statement.
 2. If only minor notes in reasonable number are needed, the Engineer/Architect will make same on all copies and mark the second statement. Shop Drawings so marked need not be resubmitted.
 3. If the submitted Shop Drawings are incomplete or inadequate, the Engineer/Architect will mark the third statement, request such additional information as required, and explain the reasons for revision. The Contractor shall be responsible for revisions, and/or providing needed information, without undue delay, until such Shop Drawings are acceptable. Shop Drawings marked with No. 3 shall be completed resubmitted.
 4. If the submitted Shop Drawings are not in compliance with the Contract Documents, the Engineer/Architect will mark the fourth statement. The Contractor will be responsible to submit a new offering conforming to specific products specified herein and/or as directed per review citations.
- E. No submittal requiring a Change Order for either value or substitution or both, will be returned until the Change Order is approved or otherwise directed by the Owner.

APPLICATION FOR USE OF SUBSTITUTE ITEM

TO: _____

PROJECT: _____

SPECIFIED ITEM:

Page	Paragraph	Description
A.		The undersigned requests consideration of the following as a substitute item in accordance with Article 6.05 of the General Conditions.
B.		Change in Contract Price (indicate + or -) \$ _____
C.		Attached data includes product description, specifications, drawings, photographs, references, past problems and remedies, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified. For consideration of the attached data as SHOP DRAWINGS, submittal shall be in accordance with requirements of Section 013323.
D.		Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments are correct:

1. The proposed substitute does not affect dimensions shown on Drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse affect on other contractors, the construction schedule, or specified warranty requirements. (If proposed substitution affects construction schedule, indicate below using + or -)

_____ CONSECUTIVE CALENDAR DAYS

4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item, and agrees to reimburse the OWNER for the charges of the ENGINEER for evaluating this proposed substitute item.

E. Signature:

Firm:

Address:

Telephone:

Date:

Attachments:

For use by ENGINEER:

_____ Accepted as evidenced by affixed SHOP DRAWING REVIEW stamp.

_____ Accepted as evidenced by included CHANGE ORDER.

_____ Not accepted as submitted. See Remarks.

_____ Acceptance requires completion of submittal as required for SHOP DRAWINGS.

_____ Not accepted. Do not resubmit.

By:

Date:

Remarks:

APPLICATION FOR USE OF "OR-EQUAL" ITEM

TO: _____

PROJECT: _____

SPECIFIED ITEM:

Page	Paragraph	Description
------	-----------	-------------

A. The undersigned requests consideration of the following as an "or-equal" item in accordance with Article 6.05 of the General Conditions.

B. Change in Contract Price (indicate + or -) \$ _____

C. Attached data includes product description, specifications, drawings, photographs, references, past problems and remedies, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified. For consideration of the attached data as SHOP DRAWINGS, submittal shall be in accordance with requirements of Section 013323.

D. Signature:

Firm: _____

Address: _____

Telephone: _____

Date: _____

Attachments: _____

For use by ENGINEER:

_____ Accepted as evidenced by affixed SHOP DRAWING REVIEW stamp.

_____ Accepted as evidenced by included CHANGE ORDER.

_____ Not accepted as submitted. See Remarks.

_____ Acceptance requires completion of submittal as required for SHOP DRAWINGS.

_____ Not accepted. Do not resubmit.

By: _____ Date: _____

Remarks: _____

END OF SECTION 013323

SECTION 013326 – PRODUCT TESTING AND CERTIFYING

PART 1 - GENERAL

1.1 QUALITY OF MATERIALS

- A. Where the specifications call for mill or shop tests, the Contractor shall furnish duplicate copies of attested manufacturer's certificates showing details of quality or performance sufficient to demonstrate conformity to contract requirements. Mill, shop or witness tests shall be subject to view by the Engineer's representative, but the Engineer's representation shall not relieve the Contractor from the necessity of furnishing certificates specified. The Engineer shall be notified by the Contractor in writing, sufficiently in advance of the time of making tests, so that proper arrangements may be made. Waiving of witness of tests by the Engineer may be in writing only by the Engineer. All costs for travel, lodging, food and transportation that are necessary for the Engineer's representative and the Owner's representative to attend witness tests shall be included in the Contractor's bid for those item(s) specifically designated as being subject to witness testing.
- B. Unless otherwise specified, all materials, equipment and articles shall be erected, installed, applied, or connected, used, cleaned and conditioned in accordance with the printed instructions and directions of the manufacturer.
- C. The installation shall be so made that its several component parts will function together as a workable system. It shall be complete with all accessories necessary for its operation and shall be left with all equipment properly adjusted and in working order.
- D. The work shall be executed in conformity with the best practice and so as to contribute to efficiency of operation, minimum maintenance, accessibility and sightliness. It shall also be executed so that the installation will conform and accommodate itself to the building structure, its equipment and usage.
- E. Whenever in the contract documents a particular brand, make of material, device or equipment is shown or specified, such brand, make of material, device or equipment is to be regarded merely as a standard and such trade name shall be followed by "or equal".

1.2 QUALITY ASSURANCE

- A. The equipment and materials to be furnished under this Contract shall be the products of well established and reliable firms which have had ample experience for at least five (5) years in the manufacture of equipment or materials similar in design and of equal quality to that specified. If required, the manufacturer shall submit a list of installations of similar equipment which have been in successful operation for at least five (5) years.

1.3 EXPERIENCE CLAUSE REQUIREMENT AND PERFORMANCE BONDS FOR MANUFACTURER

- A. For every piece of equipment furnished under this Contract, the manufacturer will be required to have a minimum of five (5) years of experience in providing this specific type of equipment. In lieu of this experience requirement, the manufacturer will be required to provide performance bond(s) for the faithful performance of the equipment and guarantee payment in a sum of not less than one hundred and fifty percent (150%) of the total equipment price for the completed work for that item. In the absence of verifiable experience, the manufacturer will be required to provide the performance bond(s) for the same number of years that the manufacturer was found lacking in experience from the specified five (5) year period. The performance bond(s) shall be from an approved surety company, to the satisfaction of the Owner's Law Director.
- B. Agents of bonding companies which write bonds for the performance and payment of the contract shall furnish power of attorney bearing the seal of the company, evidencing such agent's authority to execute the particular type of bond to be furnished, and evidencing also the right of the surety company to do business in the State of Ohio. Copy of this proof shall be attached to each copy of the contract.
- C. The bond shall be purchased through a surety company with a local agent upon whom service of process can be made.
- D. In event of failure of surety or co-surety, the manufacturer shall immediately furnish a new bond, as required herein. The manufacturer's bond will not be released until all provisions of the contract have been fulfilled.
- E. The surety used for the bid bond and performance bond shall be listed in the latest U.S. Treasury Circular 570 and the Penal Sums shall be within the maximum specified for such company in said Circular 570.

END OF SECTION 013326

SECTION 013326.01 - QUALITY CONTROL PLAN

PART 1 - GENERAL

1.1 QUALITY CONTROL

- A. The Contractor shall be responsible for the quality of all materials incorporated into the project work and shall be responsible for all costs of testing and certification of same. The Contractor shall provide the City Engineer a list of three (3) local qualified firms for the City to select from to be the Contractor's testing firm.
- B. The Contractor shall provide the Engineer with a Quality Control Plan in which his testing methods/procedures are defined. Said Plan shall meet with the approval of the Engineer and include identification of laboratories, types of testing, and the tentative amount and scheduling of each.

All certifications of tests and/or gradations for materials to be utilized in the work and all quality control testing shall be performed by an independent laboratory (not affiliated with, owned by, or managed by the Contractor). The laboratory shall be accredited by the AASHTO Materials Reference Laboratory for the type of testing performed.

- C. The Owner may perform field Quality Assurance testing; however, such testing shall not relieve the Contractor from the responsibility of Quality Control testing or from supplying certificates from manufacturers or suppliers to demonstrate compliance with the specifications. It is intended that the testing by the Contractor and the Owner be complimentary toward a quality project; however, the Contractor may not assume the Owner will test or that any tests will be done in lieu of the Contractor's own Quality Control testing. In the same sense, the Contractor may not rely on Owner Quality Assurance testing as a basis of acceptance or approval of his work nor may any Owner performed testing be reflected in his submitted plan.

1.2 TEST CRITERIA

- A. The following tests at a minimum shall be included with the Contractor's Quality Control Plan in accordance with the specifications:
 - 1. Aggregates
 - a. For each material and/or different source, the laboratory shall perform soundness, gradation, and other tests for all parameters specified. Aggregates incorporated into concrete or asphalt mixes shall also be tested for moisture content daily.
 - 2. Compaction Tests
 - a. Compaction tests or field density tests shall be taken on all embankment, trench backfill, subgrade, and subbase materials.
 - b. Minimum testing shall be as follows:

Embankment testing shall be at least one (1) test/5000 S.F. of each lift;
Trench backfill testing shall be at least one (1) test/50 L.F. of each lift;
Subgrade and/or subbase testing shall be at least one (1) test/200 L.F. of pavement or /5000 S.F. of slabs; subject to greater frequency due to soil conditions or Engineer's direction.

- c. Proctors or relative density tests shall be performed as often as necessary for the differing soils or granular materials utilized. Proctors shall be run with a minimum of 5 points. Test reports shall show the wet (bulk) weight, dry weight, wet (bulk) density, dry density, moisture content weight and moisture content percentage. Both the dry curve and the wet curve shall be plotted. The source materials shall be tested for gradation, Atterberg limits, shore-hydrometer and moisture content.

3. Concrete Mix Design

- a. For each type of concrete, the laboratory shall perform the necessary mix design providing all test data as required by the specifications.

4. Concrete Field and Laboratory Tests

- a. The laboratory shall cast concrete cylinders and test beams:
 - 1) One set of four cylinders per 50 C.Y. with a minimum of two sets per day. The cylinders shall be broken: one at 7 days, two at 28 days, one at 56 days, unless otherwise directed by the Engineer.
 - 2) One beam per 50 C.Y. with a minimum of two beams per day.
- b. Temperature and unit weight shall be run on fresh concrete at intervals sufficient for the type of structure being placed and a minimum of once per day. Bulk weight, bucket weight, (tare), net weight, bucket factor (bucket volume) and unit weight shall be recorded on the fresh concrete report. Show all batch weights for yield calculations. Slump and air content tests shall be taken a minimum of one test per 20 C.Y. and at least once per day.
- c. All field and laboratory testing shall be performed by technicians certified by the American Concrete Institute (ACI) for the type of testing performed.
- d. Initial cure of all cylinders shall be in a temperature controlled cure box or temperature controlled water tank with a hi-low thermometer. Hi-low temperature readings shall be recorded on the fresh concrete report.

5. Asphalt Mix Design

- a. For each type of asphalt mix, submit job mix formula (JMF) prepared by an ODOT pre-qualified laboratory from tests performed on the aggregates proposed for use.
- b. Sample and test for gradation and bitumen content as per ODOT 441.
- c. Asphalt compaction, thickness, and temperature tests shall be performed during asphalt placement per ODOT Item 448.

1.3 LABORATORY REPORTS

- A. Reports of laboratory and field tests will be distributed to the Engineer, Owner, and Suppliers within 24 hours of completion.

END OF SECTION 013326.01

SECTION 013543 - ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.1 UNNECESSARY NOISE, DUST AND ODORS

- A. The Contractor's performance of this contract shall be conducted so as to eliminate all unnecessary noise, dust and odors.

1.2 SEWAGE, SURFACE AND FLOOD FLOWS

- A. The Contractor shall take whatever action is necessary to provide all necessary tools, equipment and machinery to adequately handle all sewage, surface flows and flood flows which may be encountered during the performance of the work. The entire cost of and liability for handling such flows is the responsibility of the Contractor and shall be included in the price for the appropriate item.

1.3 WORK IN FREEZING WEATHER

- A. Written permission from the Engineer shall be obtained before any work is performed which, in the judgment of the Engineer, may be affected by frost, cold, or snow. When work is performed under such conditions, the Contractor shall provide facilities for heating the materials and for protecting the finished work.

1.4 POLLUTION CONTROL

- A. It shall be the responsibility of the Contractor to prevent or limit pollution of air and water resulting from his operations.
- B. The Contractor shall perform work required to prevent soil from eroding or otherwise entering onto all paved areas and into natural watercourses, ditches, and public sewer systems. This work shall conform to all local ordinances and/or regulations, if any, and if not otherwise regulated by local ordinances or regulations shall at a minimum conform to the Ohio EPA General Storm Water NPDES Permit for Construction Activities and the Ohio Department of Natural Resources Rainwater and Land Development manual. This work may consist of but not be limited to construction and continual maintenance of silt fence, bio bag filters, sedimentation traps, stilling basins, check dams, temporary seeding, temporary mulching, erosion mats and other means to clarify waters containing suspended materials from excavations, embankments, cleared and grubbed or stripped areas, stockpiles, well points, and disposal sites and shall be commensurate with the contractor's schedule, sequence of work, means and methods. If a SWPPP plan is not required for the project, the contractor shall at a minimum submit a plan of his proposed erosion control prevention methods for approval by the Owner and/or other regulatory authorities having jurisdiction prior to starting any construction activities which may cause erosion.

- C. The Contractor shall perform work required to prevent dust attributable to his operations from entering the atmosphere. Dust on unsurfaced streets or parking areas and any remaining dust on surfaced streets shall be controlled with water and/or calcium chloride dust palliative as needed.
- D. Any material removed from sanitary or storm sewers shall be disposed in accordance with all applicable regulations.

END OF SECTION 013543

SECTION 014126 - GENERAL REGULATIONS AND PERMITS

PART 1 - GENERAL

1.1 REGISTRATION

All Contractors and subcontractors shall be registered with the Building Department having jurisdiction. Contact the Building Department for additional registration information.

1.2 PERMITS

The Contractor shall apply for and pay for all permits from the Owner and/or other authorities having jurisdiction.

1.3 ARCHAEOLOGICAL DISCOVERIES

Contractors and subcontractors are required under Ohio Revised Code (O.R.C.) Section 149.53, to notify Ohio's State Historic Preservation Office (SHPO), and to cooperate with that office in archaeological and historic surveys and mitigation efforts if such discoveries are uncovered within the project area.

Contact: Ohio's State Historic Preservation Office
Diana Welling, Resource Protection & Review Department Manager
Phone: 1-614-298-2000
Email: dwelling@ohiohistory.org

Should archaeological discoveries or other activities delay progress of the work, an adjustment in contract time will be made.

END OF SECTION 014126

SECTION 014223 - INDUSTRY STANDARDS

PART 1 - GENERAL

1.1 ABBREVIATIONS

- A. Abbreviations, as used, designate the following:

AASHTO	-	American Association of State Highway and Transportation Officials
ACI	-	American Concrete Institute
AIEE	-	American Institute of Electrical Engineers
AISC	-	American Institute of Steel Construction
ANSI	-	American National Standards Institute
ASTM	-	American Society of Testing and Materials
AWWA	-	American Water Works Association
CMS	-	Construction and Material Specifications
NEMA	-	National Electrical Manufacturers Association
ODOT	-	Ohio Department of Transportation
ORC	-	Ohio Revised Code
UL	-	Underwriters Laboratories, Inc.

1.2 REFERENCE TO OTHER SPECIFICATIONS

- A. Where reference is made to specifications such as ASTM, AWWA or AASHTO, the latest edition shall be used, unless otherwise noted on the plans or in the specifications.

1.3 CODES AND STANDARDS

- A. All work provided for by these specifications must be installed according to the provisions of the State and local building codes, subject to inspection and acceptance by the State and local inspectors.

END OF SECTION 014223

SECTION 014323 – QUALIFICATIONS OF TRADESMEN

PART 1 - GENERAL

1.1 CHARACTER OF WORKMEN AND EQUIPMENT

- A. The Contractor shall employ competent and efficient workmen for every kind of work. Any person employed on the work who shall refuse or neglect to obey directions of the Owner or his representative, or who shall be deemed incompetent or disorderly, or who shall commit trespass upon public or private property in the vicinity of the work, shall be dismissed when the Owner so orders, and shall not be re-employed unless express permission be given by the Owner. The methods, equipment and appliances used on the work and the labor employed shall be such as will produce a satisfactory quality of work, and shall be adequate to complete the contract within the specified time limit.

- B. In hiring of employees for the performance of work under this Contract, or any Subcontract hereunder, no Contractor or Subcontractor, nor any person acting on behalf of such Contractor or Subcontractor, shall, by reason of race, sex, creed or color, discriminate against any citizen of the State of Ohio in the work to which the employment relates. No Contractor, Subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this contract on account of race, creed, sex or color.

END OF SECTION 014323

SECTION 015136 - TEMPORARY WATER AND DISTRIBUTION

PART 1 - GENERAL

1.1 WATER

- A. The Contractor shall be responsible for an adequate supply of water suitable for his use for construction and drinking. At his own expense, he shall provide and maintain adequate supplies and supply lines in such locations and installed in such a manner as may be satisfactory to the Engineer.

END OF SECTION 015136

SECTION 016600 - PRODUCT HANDLING AND PROTECTION

PART 1 - GENERAL

1.1 DELIVERY AND STORAGE OF MATERIALS

- A. The Contractor shall be responsible for delivery and storage of all materials.
- B. The Contractor shall coordinate with the Engineer on the arrangement for storing construction materials and equipment. Deliveries of all construction materials and equipment should be made at suitable times.
- C. The Contractor shall store all materials required for the performance of this contract at sites designated by the Engineer.
- D. All stockpiles shall be neat, compact, completely safe, and barricaded with warning lights if necessary.
- E. Precautions shall be taken so that no shade trees, shrubs, flowers, sidewalks, driveways or other facilities will be damaged by the storage of materials. The Contractor shall be responsible for the restoration of all stockpile sites to their original condition.
- F. Materials, tools and machinery shall not be piled or placed against shade trees, unless they shall be amply protected against injury therefrom. All materials, tools, machinery, etc. stored upon public thoroughfares must be provided with red lights at night time so as to warn the traffic of such obstruction.
- G. Materials shall be so stored as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, shall again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection. Approved portions of the construction site may be used for storage purposes and for the placing of the Contractor's plant and equipment, but any additional space required therefore must be provided by the Contractor at his expense. Private property shall not be used for storage purposes without written permission of the property owner or lessee, and copies of such written permission shall be furnished the Engineer. All storage sites shall be restored to their original condition by the Contractor at his expense.

END OF SECTION 016600

SECTION 017517 - STARTING OF SYSTEMS/COMMISSIONING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. This Section includes general requirements for the commissioning of the Work and start-up and operation of systems and equipment.

1.2 SUMMARY

- A. Starting, testing, and operating the completed Work including systems and equipment until Substantial Completion is achieved and operation of the completed Work including systems or equipment are accepted by the Owner. Contractor shall cooperate and coordinate with the Owner in the operation, maintenance, and adjustment of the Work.

1.3 RELATED SECTIONS

- A. Section 013323, Shop Drawings, Product Data and Samples
- B. Section 017901, Operational Demonstration
- C. Section 017902, Instruction of Owner's Personnel
- D. Section 017823, Maintenance Manuals

1.4 DEFINITIONS

- A. **Commissioning:** Commissioning is the series of activities, or process, necessary to ensure that systems and equipment are designed, installed, functionally tested, started up and capable of being operated and maintained to perform in conformity with the design intent for the facility improvements. Commissioning includes, but is not limited to factory testing, field testing, dry testing, wet testing, performance testing, manufacturer's checkout, start-up, and Operational Demonstration.
- B. **Factory Testing:** Factory Testing is performance testing, operation testing, or documentation verification conducted in the production facilities, or specialized test facilities, of the equipment supplier. Such testing shall conform to the requirements of the individual sections of the Contract Documents.

"Witnessed" Factory Testing shall mean that the testing is witnessed by the Owner or his designated representative.

- C. Field Testing: Field Testing is performance testing, operation testing, or documentation verification conducted in the field after installation, to provide comparison with the results obtained in the Factory Testing.
- D. Dry Testing: Dry Testing is performed by the Contractor without introducing either process material or other test material into the component, system, or unit process.
- E. Wet Testing: Wet Testing is testing performed by the Contractor utilizing test material in the component, system, or unit process. Tankage shall be filled with test material to operating level.
- F. Performance Testing: Performance Testing is performed by the Contractor to demonstrate system performance in accordance with the Project Manual requirements.
- G. Manufacturer's Check-Out: Field inspection, testing, adjustments, and sign off by the approved representative of the Manufacturer, indicating that the component, system, or unit process meets the manufacturer's requirements.
- H. Start-Up: Narrowly defined as placing a component, system, or unit process on-line. Start-up can be a commissioning activity or a normal operating activity.
- I. Operational Demonstration: A commissioning activity performed by the Contractor wherein the Contractor operates and maintains a fully functional component, system, or unit process for a period of time after stable operation has been achieved.

1.5 SUBMITTALS

- A. Quality Control Submittals:
 - 1. Field Installation Reports – Submit reports by Manufacturer's Representative in accordance with Paragraph 3.4 of this Section.
- B. Commissioning Documentation: Contractor shall prepare and submit all documentation for review and approval. The documentation shall include, but not be limited to, the following:
 - 1. Certification by the preparer that he/she is the person responsible for the data, and that the data is authentic and accurate.
 - 2. Certification by the Contractor or equipment or unit process systems supplier that the equipment or the unit process systems were operated continuously for the specified period and that the equipment or unit process systems operated in compliance with the specified operating conditions, parameters and performance: and that the equipment or unit process systems are suitable for Performance Testing.

3. Pertinent background information shall include, but not be limited to, the following:
 - a. Equipment or unit process systems Started-Up and Commissioned
 - b. Start-Up and Commissioning dates
 - c. Items or performance criteria tested clearly showing requirements and field data that verify requirements were met.
 - d. Names of witnesses for Start-Up and Commissioning.
 - e. Any repairs, corrections, or modifications required for the equipment or unit process systems to successfully complete Start-Up and Commissioning.
 - f. Loop diagrams accurately depicting the installed condition of instrumentation and controls.
 - g. Any other important background information.

4. Appendix
 - a. A summary of all data used in the calculation, including source, formulas with all terms defined.
 - b. Calculations for all data submitted, fully defined.
 - c. Copies of all raw field data sheets, including those indicating sampling point locations, and notes.
 - d. Production and/or operational data.
 - e. Calibration procedures and worksheets for sampling equipment.
 - f. Copies of calibration records for instrumentation.
 - g. PLC Ladder logic documented with comments.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION AND VERIFICATION OF CONDITION

- A. The Contractor shall inspect systems and equipment prior to each start-up and verify their readiness for start-up. Conditions hazardous to equipment or personnel shall be corrected by the Contractor prior to start-up of equipment.
 1. Start-up operations shall not proceed using temporary power or temporary instrumentation and control wiring. All electrical and control connections shall be permanent and complete, and all such electrical components and equipment fully functional.
 2. Use of repair parts during start-up operations shall not be permitted, except in such situations where the actual on-site verification of such repair parts' operability is specified.

3. The Contractor shall verify that all initial copies of the Maintenance and Operating Instructions have received an acceptable disposition as defined in Section 013323, and the only outstanding item is the field verification of the Instructions.
- B. On successful completion of Start-up, process flows and solids shall be used for commissioning the equipment and unit process systems to show the equipment and unit process systems function properly. Commissioning shall confirm the proper operation of the equipment and unit process systems with process fluids and process solids, adjustment shall be made, and the equipment or unit process systems shall be optimized and brought into compliance with design criteria in preparation for Operational Demonstration.
 - C. The Contractor shall coordinate all Start-up and Commissioning activities for equipment and unit processes. The Contractor shall develop a detailed start-up and commissioning plan that includes the following as a minimum:
 1. Description of the overall general start-up and commissioning process.
 2. List of equipment and unit process systems included for start-up and commissioning activities.
 3. Detailed start-up and commissioning sequence of activities.
 4. Listing of staff and responsibilities for activities.
 5. Contractor shall use a form that will be provided by the Owner.

3.2 PREPARATION

- A. Prior to start-up of equipment or systems, all necessary test equipment shall be in place and operable.
- B. Approved representative(s) of the Manufacturer and Contractor shall be present for the initial start-up of systems or equipment.
- C. The Contractor shall request permission to start-up equipment, including electrical gear, and notify the Owner using a standard Start-Up Request form.
 1. The Start-Up Request shall be submitted to the Owner a minimum of 72 hours before the scheduled start-up. Requests shall be made during normal working hours.
 2. The Contractor shall provide all information in the first Section of the Start-Up Request form.
 3. The Owner will indicate approval or disapproval of the request.
 4. Approval of the request is based solely on impact on plant operations. Approval does not relieve the Contractor of any responsibility for plant and personnel safety.

5. The Contractor shall obtain the approved Start-Up Request prior to the system or equipment start-up.
 6. If training is to be conducted in conjunction with the start-up this should be indicated on the Start-Up Request form. All requirements of Section 019215, Instruction of Owner's Personnel must be met for training sessions.
 7. Start-ups performed at the direction of the Contractor, per paragraph 3.3(G) of this Section, do not require advance notification to the Engineer.
- D. Normal installation checks, such as for rotation, are not considered start-ups and do not normally require start-up notification. For all equipment and systems so designated in the Contract Documents, or so designated by the Engineer, such checks shall be under the supervision of the approved representative of the manufacturer, and shall be reviewed by the Engineer.
1. All electrical apparatus which is energized shall be clearly marked.

3.3 CONDUCT OF START-UP AND COMMISSIONING

A. Start-up:

1. All initial start-ups of equipment or systems shall be performed under the technical direction of the approved representative of the manufacturer.
 2. Any lack of readiness of associated systems or failure of a system or equipment previously started prior to the date of Final Completion of the Project shall require additional initial start-up service to be performed, under the direction of the approved representative of the manufacturer.
 3. The Contractor shall repair, replace or modify any equipment or system which fails to perform as specified in the Contract Documents. Such repair, replacement or modification of deficient work shall be performed under the terms of the General Conditions.
 4. During the Operational Demonstration period per Section 019214, Operational Demonstration and at other times when the system is on-line and an integral part of the Wastewater Treatment Plant operations and process, start-ups shall be performed as required by the Contractor.
- B. The Contractor shall be responsible for commissioning all work. Final acceptance shall be by the Owner.
- C. The Contractor is responsible for the performance and operation of the systems and equipment during commissioning.

- D. When Owner personnel are operating systems or equipment, the Contractor shall make available, at all times, persons knowledgeable about the systems or equipment to direct the Owner personnel in its operation.
- E. The Contractor shall make all adjustments and corrections necessary to achieve normal, stable operation of systems. Adjustment and corrections shall be in accordance with Section 016617, Maintenance.
- F. Any failures of equipment or systems operated under the direction of the Contractor shall be considered deficiencies and shall be corrected in accordance with the General Conditions.
- G. During the Operational Demonstration period as defined in Section 019214, Operational Demonstration and at other times, the work will be on-line and an integral part of the Wastewater Treatment Plant operations and process. The Owner maintains control of Wastewater Treatment Plant operations and processes at all times. Therefore:
 - 1. The Contractor shall not commence, resume, terminate, or suspend the operations without the permission of the Owner and only in a sequence and manner suitable to the Owner.
 - 2. The Contractor shall immediately, on a 24-hour per day, 7-day per week basis, adjust or repair any malfunction in the work which in the opinion of the Owner jeopardizes or may jeopardize the proper operation of the Wastewater Treatment Plant.
 - 3. The Contractor shall not start-up, shut down, adjust, or otherwise alter the operation of any component, system, or unit process without the permission of the Owner except in the case of an emergency and in accordance with the General Conditions.

3.4 QUALITY CONTROL

- A. Reports of the Approved Representative of the Manufacturer:
 - 1. The approved representative of the manufacturer shall prepare a daily report on each site visit for each system or item of equipment inspected, adjusted, started-up, or worked on.
 - 2. The report shall state the purpose of the visit, the representative's observations and conclusions, and recommendations for further visits or action.
 - 3. The reports shall be submitted in accordance with Section 013323, Shop Drawings, Product Data and Samples within three (3) days of the visit.

END OF SECTION 017517

SECTION 017800 - FINAL COMPLIANCE AND SUBMITTALS

PART 1 - GENERAL

- 1.1 The following forms and related sign-offs shall be documented in accordance with provisions of the contract. These forms shall be completed by the Contractor and approved by the Owner before final retainer is approved for release. Forms for Items A to E will be attached to the Contractor's executed copy of the contract.
- A. Certificate of Substantial Completion (To be submitted at time of Substantial Completion).
 - B. Contractor's Certification of Completion.
 - C. Contractor's Affidavit of Prevailing Wage.
 - D. Consent of Surety Company for Final Payment.
 - E. Affidavit of Final Acceptance Date and Correction Period.
 - F. Before the OWNER will approve and accept the work and release the retainer, the CONTRACTOR will furnish the OWNER a written report indicating the resolution of any and all property damage claims filed with the CONTRACTOR by any party during the construction period. The information to be supplied shall include, but not be limited to, name of claimant, date filed with CONTRACTOR, name of insurance company and/or adjuster handling claim, how claim was resolved and if claim was not resolved for the full amount, a statement indicating the reason for such action.
 - G. DBE Subcontractor Participation Forms SR-EPA.7-8 (Applicable for WPCLF & WSRLA funded projects only).
 - H. CDBG Subcontractor List 017800 (Applicable for CDBG funded projects only).

END OF SECTION 017800

SECTION 017821 - CLEANING AND PROTECTION

PART 1 - GENERAL

1.1 GENERAL

- A. On or before the completion date for the work, the Contractor shall tear down and remove all temporary structures built by him, all construction plant used by him, and shall repair and replace all parts of existing embankments, fences or other structures which were removed or injured by his operations or by the employees of the Contractor. The Contractor shall thoroughly clean out all buildings, sewers, drains, pipes, manholes, inlets and miscellaneous and appurtenant structures, and shall remove all rubbish leaving the grounds in a neat and satisfactory condition.
- B. As circumstances require and when ordered by the Engineer, the Contractor shall clean the road, driveway, and/or sidewalk on which construction activity under this contract has resulted in dirt or any other foreign material being deposited with an automatic self-contained mechanical sweeper with integral water spray, vacuum and on-board or supplementary containment.
- C. Failure to comply with this requirement when ordered by the Engineer or his representative, may serve as cause for the Engineer to stop the work and to withhold any monies due the Contractor until such order has been complied with to the satisfaction of the Engineer.
- D. As the work progresses, and as may be directed, the Contractor shall remove from the site and dispose of debris and waste material resulting from his work. Particular attention shall be given to minimizing any fire and safety hazard from form materials or from other combustibles as may be used in connection with the work, which should be removed daily.
- E. The Contractor shall wash all windows and other glass surfaces, leaving all areas free from putty marks, paint, etc.
- F. During and after installation, the Contractor shall furnish and maintain satisfactory protection to all equipment against injury by weather, flooding or breakage thereby permitting all work to be left in a new condition at the completion of the contract.

END OF SECTION 017821

SECTION 017823 – MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance information shall be submitted for all manufactured items, i.e. equipment, hardware, pumps, valves, motors, etc.
- B. This manual will either contain or make reference to all information that has been issued during the construction and start-up periods, as well as information necessary for the proper operation and maintenance of equipment.
- C. It shall be the responsibility of the Contractor who supplies such equipment to obtain from his vendors the required information and submit to the Engineer. This information will be accepted only if properly identified and only after it has been revised, where necessary, to conform to previous transmittals of the same material that have been "approved as noted" by the Engineer. All submittals shall be on 8-1/2" X 11" size paper or folded to that size.
- D. In general and where applicable, the information shall consist of, but not be limited to, six (6) sets of the following:
 - 1. Descriptive literature, bulletins or other data covering equipment or system.
 - 2. Complete list of equipment and appurtenances included with system, complete with manufacturer and model number.
 - 3. Utility requirements.
 - 4. General arrangement drawing.
 - 5. Sectional assembly.
 - 6. Dimension print.
 - 7. Materials of construction.
 - 8. Certified performance curve.
 - 9. Performance guarantee.
 - 10. Parts list.
 - 11. Recommended spare parts list with part and catalog number.
 - 12. Lubrication recommendations and instructions.
 - 13. Schematic wiring diagrams.
 - 14. Schematic piping diagrams.
 - 15. Instrumentation data.
 - 16. Drive dimensions and data.
 - 17. Control data.
 - 18. Operating instructions.
 - 19. Maintenance instructions including troubleshooting guidelines and preventative maintenance instructions with task schedule.
 - 20. Required tools and equipment for operation and maintenance.
 - 21. Safety considerations for O & M procedures.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORDS, DRAWINGS

PART 1 - GENERAL

1.1 RECORD DRAWINGS

- A. The Contractor shall furnish an authentic set of marked-up drawings showing the installation insofar as the installation shall have differed from the Engineer's drawings. The drawings shall be delivered to the Engineer for making revisions to the original drawings immediately after final acceptance by the Owner.
- B. The Contractor shall furnish dimensioned drawings indicating locations of all underground mechanical and electrical facilities.

1.2 SERVICE CONNECTION RECORDS

- A. The Contractor shall record the location of all service and property connections, new or existing, made to utilities constructed under this contract. Such records shall be turned over to the Owner upon completion of the work. The cost of making such records shall be included in the various unit or lump sum prices stipulated for the various items of the work.
- B. The location of each sewer connection as measured along the sewer from the nearest downstream manhole and its description with respect to the sewer shall be recorded. The record shall include the depth of new stubs for future connections and the depth of existing connections as measured from the surface grade. Also, the use of any vertical riser pipe shall be noted.
- C. The location of each water connection as measured along the water line from the nearest fire hydrant.

END OF SECTION 017839

SECTION 017901 – OPERATIONAL DEMONSTRATION

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION

A. Work Included:

A demonstration of the operation of all systems is required. This Operational Demonstration shall be conducted, coordinated and recorded by the Contractor in accordance with the requirements specified herein.

1.2 SUMMARY

A. Section Includes:

1. Requirements for the conduct and reporting of the Operational Demonstration. This work is additional to any other installation, shop and factory testing, field testing, dry testing, wet testing, performance testing, balancing, or adjustments required elsewhere in the Contract Documents.

1.3 RELATED SECTIONS

- A. Section 110801, Starting of Systems / Commissioning

1.4 DEFINITIONS

- A. Operational Demonstration is defined in Section 110801, Starting of Systems/Commissioning.
- B. Operational Demonstration Log: A chronological record of the status of the system and equipment during the Operational Demonstration. All changes in status or system parameters, adjustments, and results of tests shall be included. Entries shall be made, noting the date and time, at the occurrence of each event. Operational Demonstration Logs shall be on a form acceptable to the Owner.

1.5 SUBMITTALS

A. Quality Control Submittals:

1. Test Reports:
 - a. Operational Demonstration log per subparagraph 3.4.A of this Section.
 - b. Report of Operational Demonstration per subparagraph 3.4.B.2 of this Section.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 EXAMINATION AND VERIFICATION OF CONDITION

- A. Before beginning the Operational Demonstration, the Contractor shall verify that:
1. All required construction activities are completed, including any activities by any entity that would interrupt the normal operations of the system. Coordinate with the Owner to resolve such conflicts.
 2. Adequate parts and supplies for routine maintenance and replacement are on hand to support system operation through the demonstration period.
 3. Start-up of equipment and systems per Section 110801, Starting of Systems/Commissioning has been completed.
 4. All Repair Parts and Maintenance Materials have been delivered to the Owner.
 5. Certain Instruction of Operating Personnel (training) has been scheduled to take place during the Operational Demonstration where specified. All other training will occur within 45 days prior to initiation of Operational Demonstration. The training of Operations Personnel shall be scheduled to take place during the first half of the demonstration period, and the remaining training of Electrical, Instrumentation and Maintenance Personnel shall be scheduled to be complete before the end of the Operational Demonstration.
 6. The field verification of the Initial Maintenance and Operating Inspections has been completed in accordance with the Specifications.

3.2 PREPARATION

- A. The Contractor shall provide two (2) representatives, a prime and an alternate, who will be responsible for the Operational Demonstration. These representatives will:
1. Demonstrate the operation of systems and equipment to the Owner's operating personnel.
 2. Direct maintenance and repair work, by either the Contractor or the approved representative of the manufacturer of the system components and equipment.
 3. Maintain a log of the Operational Demonstration, as described herein.
 4. Be available at all times during the Operational Demonstration to perform these duties.
- B. Submit start-up notification to the Owner per Section 110801, Starting of Systems/Commissioning.

3.3 OPERATIONAL DEMONSTRATION

- A. The Contractor shall perform an Operational Demonstration of the work. Unless otherwise specified, the Operational Demonstration shall be a continuous 30-day, (720 hours) period during which the work is operated and maintained in a continuously on-line, fully functional process status.
- B. The Operational Demonstration shall encompass the entire work, or the portion thereof designated for Substantial Completion.
- C. Filling, draining, heating or cooling to temperature, stabilizing, adjusting, or other start-up activity time shall not be counted as Operational Demonstration time.
- D. During the Operational Demonstration period, the Contractor shall provide 24-hour per day, 7 days per week on-site supervision, in addition to the requirements of supervision as stated in the General Conditions. The Contractor shall provide labor and sufficient material to fully operate and maintain the work 24 hours per day, 7 days per week.
- E. When systems are on-line, conform to the requirements of Section 110801, Starting of Systems/Commissioning, Paragraph 3.3(G) for alterations in the Wastewater Treatment Plant processes.
- F. During the first half of the Operational Demonstration of the system and equipment, Owner personnel will observe the Contractor's personnel operating systems and equipment. The Contractor shall cooperate with this familiarization process.
- G. After the first 15 days of Operational Demonstration of system and equipment, operation of equipment will be assumed by the Owner personnel, under the direction of the Contractor, as described in Section 110801, Starting of Systems/Commissioning.

The Owner remains in control of the plant processes per Section 110801, Starting of Systems/Commissioning. The Contractor shall provide technical direction in the operation of equipment and systems.

- H. Start-up and operation of the system and all associated equipment shall be in accordance with the Initial Maintenance and Operating Instructions which have received an acceptable disposition from the Owner. If deviations from these instructions are necessary, these shall be noted in the Operational Demonstration Log, and subsequently submitted as revisions to the Maintenance and Operating Instructions. During the period of time between the completion of the Operational Demonstration and the Date of substantial Completion, the system and equipment will be operated and maintained under the requirements of the second half of the Operational Demonstration. The Owner will not assume full responsibility for maintenance of the system and equipment until all conditions for Substantial Completion have been satisfied and both the Contractor and Owner and accepted the Certificate of Substantial Completion.
- I. All required maintenance and servicing prior to the Date of Substantial Completion shall be performed by the Contractor at the specified interval and as necessary. All maintenance and servicing shall be noted in the Operational Demonstration Log.
- J. All outages of equipment, system(s), or the plant should be noted in the Operational Demonstration Log. Plant outages are considered a part of normal plant operation and will

not invalidate the Operational Demonstration. The Contractor is responsible for the safe and orderly shutdown and restart of equipment as necessary in the event of an outage. Outage time is not to be included in the Operational Demonstration period.

- K. The Contractor shall attend operational coordination meetings as called by the Owner to review operating conditions of equipment and systems.
- L. If, during the Operational Demonstration, any part of the work fails to fully conform to the requirements of the Contract Documents, the Operational Demonstration shall be considered to have failed, and the work shall not be considered to be Substantially Complete as defined in the General Conditions and the Owner shall so notify the Contractor in writing. If, during the Operation Demonstration, the provisions of the General Conditions are evoked to stop the work, the Operational Demonstration will also be considered to have failed.
- M. Upon failure of the Operational Demonstration, the Contractor shall promptly remedy any defects in the work and shall promptly reschedule and re-start the complete 30 day, (720 hours) Operational Demonstration time period. No Operational Demonstration time will be considered to have accrued to any part of the work by reason of a failed Operational Demonstration.
- N. During the Operational Demonstration, the Owner may require or permit the Operational Demonstration to be suspended:
 - 1. As provided in the General Conditions.
 - 2. Upon the written request of the Contractor to correct or adjust the work when in the judgment of the Owner such required correction or adjustment is insufficient to deem the Operational Demonstration to have failed.
 - 3. If the Operational Demonstration is suspended for any reason except failure, Operational Demonstration time shall accrue to the work from the time of the beginning of the Operational Demonstration to the time of the suspension.

3.4 REPORTING

- A. Daily: Copy of the Operational demonstration Logs shall be submitted to the Owner by 9:00 a.m. the following day.
- B. Within two (2) weeks of the termination or completion of the Operational Demonstration, the Contractor shall submit for approval:
 - 1. Any changes to the Maintenance and Operating Instructions.
 - 2. A report of the Operational Demonstration, describing the equipment utilized and any repairs, modifications, adjustments, or other work performed during the demonstration period.

- C. In the event the conduct of the Operational Demonstration or the submittals are unacceptable to the Owner, the Contractor shall perform the additional work or demonstrations required per the General Conditions.

END OF SECTION 017901

SECTION 017902 - INSTRUCTION OF OWNER'S PERSONNEL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. General requirements for the conduct of training of permanent plant operating personnel on the care, maintenance and proper operation of the equipment. Specific requirements for training materials and for training are included in the individual Sections of the Contract Documents.

1.2 SUMMARY

- A. Work Included:

Except as otherwise specifically provided in individual Sections of the Project Manual, work under this Section includes the preparation of the detailed lesson plans and the conduct of detailed training for permanent plant operating personnel. Training shall be conducted on all components of equipment, as specified in individual Sections of the Project Manual.

- B. Training sessions and hours for all equipment specified as requiring training shall be per the manufacturer's recommendations. However, in no case shall the number of sessions be less than two (2) to accommodate multiple shifts. Sessions shall cover maintenance, operations and electrical.

1.3 RELATED SECTIONS

- A. Section 013323, Shop Drawings, Product Data and Samples
- B. Section 017901, Operational Demonstration

1.4 DEFINITIONS

- A. Lesson Plan:

A Lesson Plan is a submittal containing a statement of the instructional objectives of the training, a training outline, credentials of the instructor, audio/visual requirements, a listing of training materials to be used, and the desired schedule times and dates.

- B. Training Aid:

A mock-up, model, sample, or other device used during a training class to help demonstrate the maintenance, operation, or control of equipment.

1.5 SUBMITTALS

- A. Submittal of Instructor's credentials, Lesson Plans, instructional materials, training aids, and other training information shall be coordinated with the Training Schedule.
- B. Enough copies of instructional materials used for training for everyone present shall be provided at the time of the first training session.
- C. Provide two copies of all audio/visual aids utilized during training including films, slides, mock-ups, videotapes, DVDs or other training aids. All multimedia video shall be submitted in either Audio Video Interleave (AVI) format or Moving Pictures Expert Group (MPEG) format.
- D. Submit the following:
 - 1. Proposed training Schedule for the entire Contract showing tentative dates for each training session: include number, type and duration of each session. This schedule shall be submitted 120 days prior to the commencement of any individual training being performed.
 - 2. The detailed credentials of the representative of the equipment manufacturer who is to be the course Instructor for each category and type of training. Include Instructor's name, education, knowledge of equipment, experience as a trainer and employment history with the manufacturer. Include specific details of Instructor's experience pertaining to the operation and maintenance of, the training for, the equipment or system specified. These credentials shall be submitted 60 days prior to the commencement of any training.
 - 3. The Lesson Plan shall be submitted sixty (60) days prior to the commencement of any training and shall cover all components of equipment, regardless of source of supply or manufacturer, and shall include:
 - a. A title page containing: Title of the Lesson Plan, product name and model of equipment; name of manufacturer, manufacturer address and phone number; name and phone number of manufacturer's contact; job location (Name of Facility); contract no.; specification number; Contractor name, address and phone number; subcontractor name, address, phone (if applicable); submittal number assigned by Contractor; and submittal date.
 - b. A table of contents listing the headings: instructional objectives; training outline; credentials of Instructor(s); audio/visual requirements; training materials to be used.
 - c. A detailed instructional objective statement on the goal(s) intended to have been achieved by the end of the training session.

- d. The credentials of Instructors are to include name; education; knowledge of equipment; experience of trainer; and employment history with manufacturer.
- e. The audio/visual requirements listing specific equipment that is to be provided by the Contractor for training purposes.
- f. A list of all training materials to be used. An initial Operations and Maintenance (O&M) Instruction Manual, which has received an acceptable disposition, for the equipment shall be required to be utilized by the Instructor in the training and therefore shall be included on this list.
- g. A request of schedule dates and times for each training session.
- h. A training outline indicating the category of training (maintenance and operation, electrical and instrumentation or system); description of the session; length, and type (classroom or field). The training shall include as a minimum:
 - 1) Electrical and Instrumentation Training: System Equipment) Overview:
 - a) Describe system (equipment) fundamental operating principals and dynamics.
 - b) Identify system's (equipment's) mechanical, electrical and electronic components and features. Review system (equipment) wiring diagrams and process and instrumentation diagrams.
 - c) Identify support systems (equipment) associated with the operation (e.g., air intake filters, valve actuators, motors).
 - d) Identify and describe safety precautions and potential hazards related to maintenance.
 - e) Identify and describe in detail safety and control interlocks.
 - f) Identify and describe alarm conditions and response to alarms.
 - g) Cover the supply of power to process equipment and related appurtenances, lighting, etc.
 - h) Cover low voltage controls, monitoring devices, etc.
 - 2) Electrical and Instrumentation Training Equipment Preventive Maintenance (PM):
 - a) Describe PM inspection procedures required to perform an inspection of the equipment in operation, spot potential trouble symptoms and anticipate breakdowns and forecast maintenance requirements (predictive maintenance).
 - b) Define the recommended PM intervals for each component.
 - c) Provide lubricant and replacement part recommendations and limitations.
 - d) Describe appropriate cleaning practices and recommend intervals.
 - e) Identify and describe the use of special tools required for maintenance of the equipment.

- f) Describe component removal and installation, and disassembly and assembly procedures.
 - g) Perform at least 2 "field" demonstrations of preventive maintenance procedures.
 - h) Describe recommended measuring instruments and procedures, and provide instruction on interpreting alignment measurements, as appropriate.
 - i) Define recommended torque settings, mounting, calibration and alignment procedures and settings, as appropriate.
 - j) Describe recommended procedures to check or test equipment following a corrective repair.
- 3) Electrical and Instrumentation Training Equipment Troubleshooting:
- a) Define recommended systematic troubleshooting procedures.
 - b) Provide component specific troubleshooting checklists.
 - c) Describe applicable equipment testing and diagnostic procedures to facilitate troubleshooting.
- 4) Maintenance and Operation Training: System (Equipment) Overview:
- a) Describe system (equipment) operating (process) function and performance objectives.
 - b) Describe system (equipment) fundamental operating principals and dynamics.
 - c) Identify system's (equipment's) mechanical, electrical and electronic components and features.
 - d) Identify support systems (equipment) associated with the operation (e.g., air intake filters, valve actuators, motors).
 - e) Identify and describe safety precautions and potential hazards related to operation.
 - f) For systems (equipment) comprised of several components: Identify and describe in detail each component's function. Where applicable, group related components into subsystems. Describe subsystem functions and their interaction with other subsystems.
 - g) Identify and describe in detail safety and control interlocks.
- 5) Operation and Maintenance Training, Operation of Equipment:
- a) Describe operating principles and practices.
 - b) Describe routine operating, start-up and shutdown procedures.
 - c) Describe abnormal or emergency start- up, operating, and shutdown procedures that may apply.
 - d) Describe alarm conditions and responses to alarms.
 - e) Describe routine monitoring and record keeping procedures.
 - f) Describe recommended housekeeping procedures.
- 6) Operation and Maintenance Training, Troubleshooting:
- a) Describe how to determine if either corrective maintenance or an operating parameter adjustment is required.

4. Once the Lesson Plan submittal has received an acceptable disposition but at least 3 weeks prior to the actual commencement of the training, Contractor shall submit the detailed training material as a Power Point presentation in an electronic format (either DVD, CDR, or flash drive/micro storage) with appropriate labeling. In addition to the electronic format the Power Point material shall be provided in hardcopy for Owner review and approval. The number of copies shall be as defined in Section 013323, Shop Drawings, Product Data and Samples. The text and lettering on the presentation slides shall not be smaller than 12 font size and shall be black in color. Slides shall have an appropriate light colored background, resulting in a high contrast between the text and background.
5. Sample Evaluation Form: Submit with Lesson Plan a sample Evaluation Form. Form shall include area for comments and evaluation of Instructor, classroom training and field instruction. Form shall identify Contract name and number, Specification Section, Job location, date and time of training, title of training session, name of manufacturer, model number of equipment, Instructor name, and Contractor and Subcontractor's name.

PART 2 – PRODUCTS

2.1 QUALIFICATIONS OF INSTRUCTOR

- A. The course Instructor shall be knowledgeable and experienced in the details of operation and maintenance of the equipment.
- B. The Instructor must be knowledgeable of the equipment's application specific to this work.
- C. The Owner will reject Instructors who are deemed not in compliance with the above stated minimum qualifications. The Contractor will submit for approval alternate Instructors for consideration. No additional cost will be allowed for replacement of Instructors who are unacceptable to the Owner.

PART 3 – EXECUTION

3.1 EXAMINATION AND VERIFICATION OF CONDITION

- A. The training site for the classroom instruction will be provided by the Owner. The Owner will provide this location.
- B. The Contractor shall coordinate and verify to ensure that, prior to the scheduled training time(s):

1. The equipment is ready for Operational Demonstration in accordance with Section 017901, Operational Demonstration.
2. That all associated construction required to operate the equipment in all normal and anticipated operating modes is complete.
3. That the equipment area is well lit and unobstructed, so that all training class attendees may access, hear, and view the training.
4. That the equipment area is free of construction activities that could present a hazard to training class participants.
5. That adequate training materials, as required by paragraph 1.5 of this Section, are on hand for use during the training session.
6. Any representatives of interfacing Contractors or equipment suppliers needed to perform supporting operations allowing demonstration of equipment operation have been notified and will be available.

3.2 PREPARATION

- A. Training classes shall be approved by the state-regulating agency for continuing education. This is in the event of the facility choosing to apply for CH/CEU credits for their training program.
- B. Videotaping of all training will be conducted by the Contractor. Before the start of training the Contractor, and the Contractor will review the training site(s) to establish acceptable sight lines, lighting and locations for the participants.
- C. Training classes shall be scheduled through the Owner. Training shall begin within 45 days to the beginning of the Operational Demonstration period. Certain training sessions will occur only during the Operational Demonstration period as specifically noted in the Contract Documents.
- D. Training classes shall be conducted and separated for the following personnel:
 1. Maintenance and Operation
 2. Electrical and Instrumentation
 3. Systems Training
- E. Audio-visual equipment available at the Owner's training sites include:
 1. Blackboards and/ or Whiteboards
- F. Verify training materials are compatible with all equipment. The Contractor is responsible for providing other audio/visual equipment and training aids as needed.

- G. Classroom and field instruction where specified shall be provided for each group. Field instruction will include attention to applied familiarization with the actual equipment. Training hours as required in the Contract Documents do not include travel, set-up or cleanup time by the Instructor.
- H. Training may be either "field" or "classroom" as specified. If not specifically noted, provide field training. For field training, the Instructor will demonstrate all operations of the equipment and may be expected to show assembly and disassembly procedures, maintenance procedures, replacement procedures, and the like. Field training will generally occur at the installed location of the equipment or material unless mock-ups are approved in the Lesson Plan and provided by the Contractor. Such mock-ups will become property of the Owner after the training sessions unless previously requested in the Lesson Plan.
- I. Systems Training:

The Lesson will provide a detailed description of the system design, intended operation, and interactions of systems components. The Contractor's portion of Systems Training will provide additional detail descriptions of system's components and their interface with each other and other systems. Contractor's personnel for system training will be the same personnel who provided Operation and Maintenance training and Electrical and Instrumentation training.
- J. Training shall be conducted to accommodate the Owner's shift schedules. Contractor shall coordinate with Owner prior to scheduling the training sessions. Contractor shall anticipate multiple shifts.

3.3 CONDUCT OF TRAINING

- A. All topics of the approved Lesson Plan shall be discussed, in the classroom or the field, in complete and sufficient detail to allow plant operating personnel to knowledgeably operate and maintain the equipment in accordance with manufacturer's recommended procedures and safety considerations during all anticipated operational and maintenance situations.
- B. Safety concerns and features intended to enhance safety should be specifically addressed.
- C. Tasks required to maintain the warranty should be specifically addressed.
- D. Frequent reference shall be made to the Operation and Maintenance instructions.
- E. Address all questions and comments proposed by the training session participants as they are raised to the maximum extent practicable. If questions or comments cannot be addressed during the training session, additional materials and/or training may be required as determined by the Contractor.

- F. If any training session exceeds three (3) hours in duration, provide a 1/2- hour break.
- G. Ensure that all parts of the training session are legible or audible on the final tape. The Instructor must repeat all questions to insure that they are audible. Final acceptance of the training is contingent on the acceptability of the videotape.
- H. The Contractor will be backcharged for cancelled training classes if the Owner is not notified at least 72 hours prior to scheduled training.
- I. Training Sessions shall be attended not only by the Owner's Operating Personnel but also by members of the Contractor or any other entities designated by the Owner.

3.4 EVALUATION

- A. Immediately following training, the Instructor shall pass out an evaluation form to the Owner's personnel. This form shall provide a means for the Owner's personnel to comment on the Instructor and the quality, completeness, and value of the session.
- B. Evaluation Forms shall be collected, along with the Attendance Sheet at the end of each training session and the original documents shall be submitted to the Owner for use in determining if additional training is required by the Contractor. If additional training is required due to the material as outlined in the Lesson Plan not being covered correctly or in its entirety or the inability of the Instructor to answer questions pertaining to the operation and maintenance of the equipment, or if the training aids or equipment fail to operate as intended, the Contractor shall provide such additional training at no additional cost to the Owner.

END OF SECTION 017902

SECTION 024119 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. This section includes removal of pavement, piping, and equipment necessary to clear space for new construction and/or to rehabilitate existing construction.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

- A. State and local code requirements shall control the disposal of debris resulting from the removal operation.

1.4 PROTECTION

- A. Structures shall be removed in such a manner as not to damage portions of the existing structure which are to remain in place.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 PAVEMENTS, SIDEWALKS, CURBING, SIMILAR STRUCTURES

- A. Removal of existing pavements, sidewalks, curbing, and similar structures shall end at an existing joint or a sawed joint. Sawed joints shall be straight, neat and free from chipped or damaged edges.
- B. For removal of reinforced or non-reinforced concrete, the minimum depth of saw cut shall be 3 in.
- C. For removal of reinforced concrete, the depth of saw cut shall be sufficient to cut the steel.
- D. If the concrete is coated with a bituminous surface or other material, the depth shall be sufficient to cut into the concrete, not including the coating depth, as specified above.

3.2 EXCAVATION OF RIGID PAVEMENT

- A. The Contractor shall excavate rigid pavement, consisting of concrete or concrete base with a wearing surface of brick or bituminous concrete, wherever such excavation is required for the purpose of this Contract.
- B. Pavement shall be excavated to neat lines and, only to widths required for trenches, for pipe laying and for construction of structures. Adequate provision shall be made to prevent settlement and breakage of pavement beyond the approved limits of excavation.
- C. All pavement broken or damaged beyond the limits above stated, or the approved extension thereof, shall be replaced by the Contractor at his expense.

3.3 CATCH BASINS, INLETS AND SIMILAR STRUCTURES

- A. Existing drainage structure designated by the Engineer to be removed shall be completely removed.
- B. Abandoned sewers shall be sealed and made watertight with approved masonry bulkheads.
- C. All castings salvaged from abandoned or removed drainage structures shall remain the property of the Owner and shall be cleaned and transported by the Contractor to a site designated by the Engineer or incorporated in the work where called for on the Drawings, scheduled, or so directed.

3.4 FENCE

- A. Where so required by the Drawings, existing fence shall be carefully dismantled and stored for reuse or for salvage by the Owner.
- B. Wood posts and other materials not considered salvageable by the Engineer shall be disposed of by the Contractor.
- C. The Contractor will be required to replace, at no cost to the Owner, material lost or damaged by negligence or by the use of improper methods.

3.5 EQUIPMENT REMOVAL

- A. All equipment, valves, piping, fittings, and miscellaneous steel structures that are removed shall remain the property of the Owner and shall be stored at site selected by the Owner. The Owner reserves the right to require the Contractor to dispose of certain unwanted portions of removed equipment and materials. The Owner shall have the right to reject any or all materials removed during construction, and the Contractor shall haul away and dispose of these materials in a suitable manner at no additional cost to the Owner.

3.6 DISPOSAL OF DEBRIS

- A. All debris resulting from demolition operations; i.e., broken concrete, masonry, pipe, miscellaneous metal, trees and brush, equipment, etc., shall be disposed of offsite.
- B. The Contractor shall police the hauling of debris to insure that all spillage from haul trucks is promptly and completely removed.

3.7 BACKFILLING

- A. All trenches, holes, and pits resulting from the removal and abandonment of any structure or obstruction shall be backfilled and compacted.

END OF SECTION 024119

SECTION 269001 – REMOTE TELEMETRY SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish and install a Remote Telemetry System (RTS) with appurtenant equipment and accessories as indicated, specified and as necessary for a complete and proper operating system.
- B. The RTS shall be completely wired and configured to monitor and control all of the functions listed herein for a complete and proper operating system.
- C. The system supplier shall provide all engineering, installation and/or supervision of such, startup, testing and training as specified herein.
- D. The system supplier shall provide operation and maintenance manuals as specified herein.
- E. The contractor shall include an allowance in the base bid for the project, equal to the attached quotation amount.

1.2 EQUIPMENT COMPATIBILITY

- A. The Contractor shall be responsible for coordinating the instrumentation equipment, communication equipment and other related equipment so that all elements are compatible and form a complete working system. Shop drawing submittals shall include sufficient information regarding component compatibility to demonstrate compliance with this requirement.

1.3 SUBMITTALS

- A. Shop Drawings: Forward telemetry system information and auxiliary materials for engineer's review in accordance with General Requirements.
- B. As-Built Documentation: Review connection requirements with the telemetry system vendor and produce as built connection schedule for each site.
- C. O&M Manual: The manufacturer shall provide copies of an operation and maintenance manual, including storage, installation, start-up, operating and maintenance instructions, and a complete parts list. The O&M manual shall be in compliance with General Requirements.

PART 2 - PRODUCTS

2.1 MONITORING AND CONTROL SYSTEM (SYSTEM INTEGRATOR'S SCOPE)

- A. Provide a telemetry control panel (RTU) in NEMA 12 enclosure to interface to control and monitoring instrumentation on site.
- B. RTU shall feature a cellular modem for secure communication to the central monitoring site. The System Integrator shall transfer the cellular service name in Owner's name from the existing water tower site to this new modem.
- C. Provide instrumentation, per the drawings.

2.2 OTHER MATERIALS (BY CONTRACTOR OUTSIDE OF SYSTEM INTEGRATOR'S SCOPE)

- A. Contractor is responsible for all installation of all equipment provided by the System Integrator, including the RTU and instrumentation; provide all materials required to complete the installation.
- B. For each of the discrete I/O points, provide (2) #14 in conduit from the equipment being monitored, similarly, provide #18 twisted shielded pair cable in conduit for each analog signal. Confirm with the approved final I/O schedule to be produced by the System Integrator as part of the shop drawing process.
- C. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 INSTALLATION

- A. Install the work of this Section in strict accordance with the manufacturer's recommendations and shop drawings as approved by the Engineer.

- B. Upon completion of the installation, carefully inspect each component and verify that all items have been installed in their proper location, adequately anchored, and adjusted to achieve optimum operation.
- C. The System Integrator shall verify connections into the RTU and shall perform Start up services, including modifications to the SCADA programming at the central monitoring site.

3.4 TRAINING

- A. Demonstrate to the Owner's operation and maintenance personnel the proper methods for operating and maintaining the equipment, and the contents of the operation and maintenance manual.

3.5 SERVICE

- A. The Contractor shall furnish to the Owner, through the Engineer, a written certificate, signed by the System Integrator's field service technician confirming that:
 1. The equipment has been properly installed in accordance with manufacturer's recommendations;
 2. The equipment check out and initial start-up activities have been completed in accordance with manufacturer's recommendations and under the technician's supervision;
 3. The equipment is free from any undue stress imposed by connecting conduit or anchor bolts;
 4. The equipment operates satisfactorily and in compliance with the requirements of this Section.

END OF SECTION 269001

SECTION 310000 - EARTHWORK

1.1 SUMMARY

- A. The Work covered by this Section shall include all excavation, trenching and related work for the construction of the designated structures and pipelines, backfill and other incidental work.
- B. The Work covered by this Section consists of:
 - 1. making all necessary excavations for the construction of all Work;
 - 2. preparing subgrade for slabs, walks, and pavements;
 - 3. doing all pumping, fluming, and dewatering necessary to keep the trenches and other excavation free from water;
 - 4. providing for uninterrupted flow of existing drains and sewers, and the disposal of water from any sources during the progress of the Work;
 - 5. supporting and protecting all trench walls, structures, pipes, conduits, culverts, posts, poles, wires, fences, buildings and other public and private property adjacent to the Work;
 - 6. removing and replacing existing sewers, culverts, pipelines and bulkheads where necessary;
 - 7. removing after completion of the Work all sheeting and shoring or other soil support materials not necessary to support the sides of trenches;
 - 8. removing and disposing all surplus excavated material;
 - 9. doing all backfilling and grading, of compacting backfill to limits specified or ordered by the Engineer;
 - 10. restoring all property damaged as a result of the Work involved in this Contract.
- C. The Work includes transporting surplus excavated materials not needed for backfill at the location where the excavation is made, to other parts of the Work where filling is required, and disposal of all types of surplus material off the site.

1.2 RELATED DOCUMENTS AND SECTIONS

- A. Section 013319 – Field Test Reporting

1.3 DEFINITIONS

- A. Backfill: Soil or granular materials used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, not including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Bedding: Layer placed over the excavated subgrade in a trench before laying pipe.
- C. Borrow: Satisfactory soil imported for use as fill or backfill.

- D. Excavation: Removal and disposal of material encountered above subgrade or foundation elevations.
1. Additional Excavation: Excavation below subgrade or foundation elevations as directed by Engineer.
 2. Trench: Narrow linear excavation
 3. Unauthorized Excavation: Excavation below subgrade or foundation elevations or beyond indicated dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
 4. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface or subsurface conditions encountered, including rock, soil materials and obstructions.
- E. Embankment: A structure consisting of soil, granular material, shale, rock, or other approved material, constructed in layers to a predetermined elevation and cross-section.
- F. Granular materials: Natural aggregate, such as broken or crushed rock, gravel, or sand that can be readily incorporated into an 8-inch layer, and in which at least 65% by weight of the grains or particles are retained in a No. 200 sieve.
- G. Laboratory Dry Weight: The maximum laboratory dry weight shall be the weight provided by the laboratory when the sample is tested in accordance with ASTM D-698 Method A, C, or D.
- H. Optimum Moisture: The water content at which the maximum density is produced in a soil by a given compaction effort (ASTM D-698).
- I. Pavement Prism: Also referred to as the zone of influence. The area below a line drawn 45 degrees to the horizontal from the surface at the edge of pavement, sidewalk or curb.
- J. Pipe Embedment: The material placed in a trench surrounding a pipe or conduit consisting of the foundation, bedding, haunching, and initial backfill.
- K. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material one (1) cu. yd. or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2 inches.
- L. Shale: Laminated material, formed by the consolidation in nature of soil, having a finely stratified structure. For the purpose of these specifications, the following bedrock types shall also be considered shale: mudstone, claystone, siltstone and hard clay.
- M. Soil: All earth materials, organic or inorganic, which have resulted from natural processes such as weathering, decay, and chemical reaction.

- N. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, pavement, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- O. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage course, or topsoil materials.
- P. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

- A. Comply with all provisions of Section 013323, Shop Drawings and Submittals.
- B. Product Data: For the following:
 - 1. Source-locations of all materials shall be identified to the Engineer.
 - 2. Source quality laboratory test of all fill materials as required to show compliance with material specifications.
- C. Shop Drawings: Submit information for the following items:
 - 1. Sheeting and bracing (*prepared and stamped by a professional engineer, registered in the State of Ohio*).
 - 2. Dewatering system and standby equipment (*prepared and stamped by a professional engineer, registered in the State of Ohio*).
 - 3. Cofferdams (*prepared and stamped by a professional engineer, registered in the State of Ohio*).
 - 4. Protection methods anticipated (*prepared and stamped by a professional engineer, registered in the State of Ohio*).
 - 5. Underpinning (*prepared and stamped by a professional engineer, registered in the State of Ohio*).
 - 6. Excavation procedures (*prepared and stamped by a professional engineer, registered in the State of Ohio*).

1.5 REFERENCES

- A. AASHTO M 43 Standard Specification for Size of Aggregate for Road and Bridge Construction
- B. ASTM C-150 Standard Specification for Portland Cement
- C. ASTM C-618 Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
- D. ASTM D-698 Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop

- E. ASTM D-1586 Standard Method for Penetration Test and Split-Barrel Sampling of Soils
- F. ASTM D-2487 Standard Test Method for Classification of Soils for Engineering Purposes
- G. ASTM D-2940 Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports
- H. ASTM D-4253 Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
- I. ASTM D-4254 Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
- J. State of Ohio - Department of Transportation - Construction and Material Specifications, Item 304, Aggregate Base.
- K. State of Ohio - Department of Transportation - Construction and Material Specifications, Material Detail 703.16, Suitable Materials for Embankment Construction.
- L. State of Ohio - Department of Transportation - Construction and Material Specifications, Material Detail 703.02.A.2, Fine Aggregate for Portland Cement Concrete

1.6 QUALITY ASSURANCE

- A. Qualifications
- B. Regulatory Requirements
- C. Certifications
- D. Field Samples
- E. Mock-ups
- F. Pre-Construction Conference

1.7 PROJECT CONDITIONS

- A. Environmental Requirements

- B. Existing Conditions
 - 1. Existing ground elevations of the site are shown by figures and/or by contours on the Drawings. The contours and elevations of the present ground are believed to be reasonably correct, but do not purport to be absolutely so, and, together with any schedule of quantities, are presented only as an approximation. The Contractor shall satisfy himself, however, by actual examination on the site of the Work, as to the existing elevations and contours, and the amount of work required.

- C. Existing Utilities
 - 1. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
 - 2. Notify Engineer not less than two days in advance of proposed utility interruptions.
 - 3. Do not proceed with utility interruptions without Engineer's written permission.
 - 4. Contact utility-locator service for area where Project is located before excavating.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to the site, store and protect under provisions of Section 016600, Product Handling and Protection.

- B. Comply with all provisions of Section 013543, Environmental Protection.

1.9 SEQUENCING AND SCHEDULING

- A. Refer to 013319 - Field Test Reporting for testing laboratory service scheduling.

1.10 PROHIBITION OF EXPLOSIVES

- A. The use of explosives is not permitted.

1.11 FIELD MEASUREMENTS

- A. The Contract Drawings may indicate locations where certain utilities, structures or facilities might possibly interfere with the installation of new improvements. The Contractor shall dig such exploratory test pits as may be necessary to determine the

exact location and elevation of the indicated subsurface structure and shall make acceptable provision for their protection, support and maintenance in operation. The Engineer shall be provided advance notification when and where excavation for test pits will take place. The Contractor shall provide the Engineer a record of field

locations of all listed utilities, structures or facilities a minimum of five (5) days prior to initiating construction of the project. Locations and elevations are to be provided by a Surveyor registered in the State of Ohio.

PART 2 - PRODUCTS

2.1 GRANULAR PIPE EMBEDMENT

- A. Crushed gravel or crushed limestone meeting AASHTO M 43 gradation shall be used for bedding, haunching, and initial backfill as shown on the Drawings.

2.2 ONSITE BACKFILL

- A. Excavated soil material, capable of meeting specified compaction, and approved by the Engineer for use as backfill in designated locations.
- B. Based on the subsurface investigation, the Owner does not guarantee the onsite soils in its present state consists of the proper moisture content to achieve the specified compaction without drying or adding water.
- C. Unsuitable Backfill Material
 - 1. Onsite materials that are unsuitable for backfill, unless otherwise specifically shown in the Drawings, include rock or other materials greater than six (6) inches in their largest dimension, pavement, rubbish, debris, wood, metal, plastic, frozen earth, and the following soils classified per ASTM D-2487:

Symbol	Description
OL	Organic silts and organic silty clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity
PT	Peat, muck, and other highly organic soils

2.4 SPECIAL BACKFILL MATERIAL (ODOT Item 304)

- A. Special backfill material shall meet the gradation requirements of ODOT Item 304 and shall consist of crushed gravel or crushed limestone in combination with natural sand or stone. The aggregate shall meet the following gradation requirements:

Sieve	Total Percent Passing
2 inch	100
1 inch	70-100
¾ inch	50-90
No. 4	30-60

No. 30
No. 200

9-33
0-15

2.5 LOW STRENGTH MORTAR BACKFILL

- A. Low Strength Mortar shall comply with ODOT Item 613.
- B. Submit test data that demonstrates that the proposed mix has a strength of 50 to 100 PSI at 28 days.
- C. Each load shall be tested with 3 cylinders for strength test broken at 3, 7, and 28 days until the Engineer is assured that the mix will be between 50 to 100 PSI at 28 days. Thereafter, one set of strength tests shall be taken every 50 CY.

It is intended that the sand be fine enough to stay in suspension in the mixture to the extent required for proper flow. The Engineer reserves the right to reject the sand if a flowable mixture cannot be produced.

- D. Mortar Mix Proportioning
 - 1. The initial trial mixture shall be as follows:

Quantity of Dry Materials per Cubic Yard

Cement	100 lbs.
Fly Ash	250 lbs.
Sand (SSD)*	2700 lbs.
Water	500 lbs.

* saturated-surface dry

- 2. These quantities of materials are expected to yield approximately 1 cubic yard of mortar of the proper consistency. Adjustments of the proportions may be made providing the total absolute volume of the materials is maintained.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Excavation; Temporary Sheeting, Shoring, and Bracing
 - 1. All excavation shall be in accordance with the Occupation Safety and Health Administration (OSHA) regulations.
 - 2. The Contractor shall furnish and install adequate sheeting, shoring, and bracing to maintain safe working conditions, and to protect newly built work and all adjacent neighboring structures from damage by settlement.
 - 3. Bracing shall be arranged so as not to place a strain on portions of completed work until construction has proceeded enough to provide ample strength. Sheeting and bracing may be withdrawn and removed at the time of

backfilling, but the Contractor shall be responsible for all damage to newly built work and adjacent and neighboring structures.

4. All sheeting shall be removed unless specifically authorized in writing by the Engineer to be left in place.

B. Construction Sheeting Left in Place

1. The Contractor shall furnish, install, and leave in place construction sheeting and bracing when specified or when indicated or shown on the Drawings.
2. Any construction sheeting and bracing which the Contractor has placed to facilitate his work may be ordered in writing by the Engineer to be left in place. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating an obligation on his part to issue such orders. Failure of the Engineer to order sheeting and bracing left in place shall not relieve the Contractor of his responsibility under this Contract.

3.2 REPLACING, MOVING AND REPAIRING OF EXISTING UTILITIES

A. The Contractor shall:

1. replace, move, repair and maintain all utilities and all other structures encountered in the work
2. coordinate and communicate with applicable utility companies
3. repair all damage done to any of the said structures and appurtenances through his acts or neglect and shall keep them in repair during the life of this contract. The Contractor shall in all cases leave them in as good condition as they were previous to the commencement of the work and to the satisfaction of the Engineer.

3.3 DEWATERING

A. Drainage and Removal of Water

1. The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent property or structures.
2. The Contractor shall, when ordered by the Engineer, construct tight bulkheads across trench and provide pumps suitable for the removal of any water which may be encountered or which may accumulate in the trenches. Unless otherwise provided for in the Contract Documents, drainage water will not be permitted to flow through the conduit.
3. The trench shall be kept free from sewage and storm, surface, and subsurface water to at least 2 feet below the bottom of the excavation.
4. Where open water courses, ditches, or drain pipes are encountered during the progress of the Work, the Contractor shall provide protection and securing of the continuous flow in such courses or drains and shall repair any damage that may be done to them.

3.4 EXCAVATION CLASSIFICATION

A. All excavated materials are unclassified as defined in Article 1.3.

3.5 GENERAL EXCAVATION

- A. All necessary excavation for buildings, structures, pavements, and site improvements shall be performed to accommodate the completion of all related Contract Work.
- B. The Drawings show the horizontal and the lower limits of structures. The methods and equipment used by the Contractor when approaching the bottom limits of excavation shall be selected to provide a smooth surface and to prevent disturbing the soil below the bottom limits of excavation. All soil loosened during excavation shall be removed from the bottom of the excavation.
- C. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
- D. Excavation which is carried below the bottom limits of structures shall be classified as Unauthorized Excavation, unless said excavation below bottom limits of structures has been authorized by the Engineer prior to each occurrence.
- E. Unauthorized Excavation shall be filled with Class B concrete to the bottom limits of structures. Under circumstances where structural integrity is not a factor, the Engineer may authorize the filling of Unauthorized Excavation with Low Strength Mortar Backfill or Special Backfill material compacted to 100% density as specified under the compaction requirements in this Section. Such work shall be at the cost of the Contractor.

3.6 TRENCH EXCAVATION

- A. Excavation for trenches in which pipelines, sewers, and conduits are to be installed shall provide adequate space for workmen to space and joint pipe properly, but in every case the trench shall be kept to a minimum width. The width of trench shall not exceed the limits shown on the Drawings.
- B. Excavation shall be to the depth necessary for placing of granular bedding material under the pipe as shown on the Drawings. If over-excavation occurs, the trench bottom shall be filled to grade with compacted granular bedding material.
- C. Trenching operations shall not be performed beyond the distance that will be backfilled and compacted the same day.
- D. In general, backfilling shall begin as soon as the conduit is in approved condition to receive it and shall be carried to completion as rapidly as possible. New trenching shall not be started when earlier trenches need backfilling or the surfaces of streets or other areas need to be restored to a safe and proper condition.

3.7 EXCAVATION OF UNSUITABLE MATERIALS

- A. Unsuitable materials existing below the Contract bottom limits for excavation shall be removed as directed by the Engineer. Such excavation shall not exceed the vertical and lateral limits as prescribed by the Engineer.
- B. In utility trenches, the voids left by removal of unsuitable excavated material shall be filled with AASHTO M 43 No. 1 and No. 2 aggregate conforming to the material requirements of Article 2.1 of this Section.
- C. In excavations other than utility trenches, the voids left by removal of unsuitable excavated material shall be filled with material consisting or either: (1) Special Backfill Material; (2) Class B concrete; or (3) Low Strength Mortar Backfill, whichever is ordered by the Engineer.
- D. Removal of unsuitable excavated material and its replacement as directed will be paid on basis of Contract Conditions relative to Changes in Work unless specific unit prices have been established for excavation of unsuitable material.

3.8 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

- A. It shall be the responsibility of the Contractor to dispose of all surplus material that cannot be used in backfill or embankments at his expense outside the limits of the project. Unsuitable excavated material, including rock or large boulders, shall be disposed of outside the limits of the project.
- B. Surplus material may be wasted adjacent to or incorporated in the regular construction only when ordered in writing by the Engineer.

3.9 BACKFILL

- A. Pipelines, Sewers and Conduits
 1. All pipe shall have bedding extending the width of the trench with depth in conformance with the Drawings. The bedding material shall be thoroughly compacted by tamping until no further densification is possible.
 2. Pipe cover material shall be used for filling above the pipe bedding along the sides of the pipe and to a height of twelve (12) inches over the top of the pipe. The pipe cover material shall be brought up evenly on both sides of the pipe to eliminate the possibility of lateral displacement of the pipe and shall be thoroughly compacted by tamping until no further densification is possible. Care shall be taken to spade the aggregate under the pipe haunch below the spring line.
 3. All trenches and excavations shall be backfilled immediately after pipe is laid therein, unless otherwise directed by the Engineer.
 4. After the pipe cover has been placed and compacted around the pipe as specified above, the remainder of the trench may be backfilled by machine.

The backfill material shall be deposited in eight (8) inch horizontal layers, and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case will backfilling material from a bucket be allowed to fall directly on a pipe and in all cases the bucket must be lowered so that the shock of the falling earth will not cause damage.

B. Structures

1. Backfilling shall not commence before concrete has attained specified strength. Do not use equipment for backfilling and compaction operations against structures that will overload the structure.
2. Backfilling around and over structures shall be carefully placed and tamped with tools of suitable weight to a point one (1) foot above the top of same. Additional backfill may be required to protect the structure from damage from heavy equipment. Backfill shall be placed in uniform layers not exceeding eight (8) inches in depth. Each layer shall be placed, then carefully and uniformly compacted to the specified density so as to eliminate the possibility of displacement of the structure.
3. After the backfill has been placed and compacted around the structure to the height specified above, the remainder may be backfilled by machine. The backfill material shall be deposited in eight (8) inch horizontal layers, and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case will backfilling material from a bucket be allowed to fall directly on a structure, and in all cases the bucket must be lowered so that the shock of the falling earth will not cause damage.

C. Where any new, proposed, or future pavement, driveway, parking lot, curb, curb and gutter, or walk is to be placed over a backfilled area, Special Backfill material shall be used for any portion of the trench falling within the pavement prism.

D. Where it is necessary to undercut or replace existing utility conduits and/or service lines, the excavation beneath such lines shall be backfilled the entire length with approved Granular Pipe Embedment Material compacted in place in eight (8) inch layers to the required density. The approved Granular Pipe Embedment Material shall extend outward from the spring line of the conduit a distance of two (2) feet on either side and thence downward at its natural slope.

3.10 LOW STRENGTH MORTAR BACKFILL

- A. Low strength mortar backfill shall be discharged from the mixer as recommended by the supplier and approved by the Engineer.
- B. Low strength mortar backfill may be placed in the trench in as few lifts as may be practical.
- C. Secure conduit or pipelines before placing low strength mortar backfill to prevent conduits and pipelines from floating during backfilling.

- D. For low strength mortar backfill placed against existing structures of unknown strength, backfill material shall be brought up uniformly in maximum 12 inch lifts and allowed to cure for a minimum of 24 hours or until it can carry a person's weight without leaving imprints before the next lift is placed.
- E. Low strength mortar backfill shall be brought up to subgrade elevation or the pavement prism, whichever may be applicable.

3.11 SUBGRADE

- A. All soil subgrade shall be prepared in accordance with this subsection.
- B. Drainage
 - 1. The surface of the subgrade shall be maintained in a smooth condition to prevent ponding of water after rains to insure the thorough drainage of the subgrade surface at all times.
- C. Unsuitable Subgrade
 - 1. Where unsuitable subgrade or subgrade not meeting the required bearing capacity is encountered in cuts, due to no fault or neglect of the Contractor, in which satisfactory stability cannot be obtained by moisture control and compaction, the unstable material shall be excavated to the depth required by the Engineer.
 - 2. Suitable material required for the embankment to replace the undercut will be paid on basis of Contract Conditions relative to changes in Work.
 - 3. Where soft subgrade in cuts is due to the failure of the Contractor to maintain adequate surface drainage as required in this article, or is due to any other fault or neglect of the Contractor, the unstable condition shall be corrected as outlined above at no expense to the Owner.

3.14 CONSTRUCTION WITH MOISTURE AND DENSITY CONTROL

- A. All backfill shall be constructed using moisture and density control. All subgrade, except rock and shale in cut sections, shall be constructed using moisture and density control.
- B. Backfill and subgrade material which does not contain sufficient moisture to be compacted in accordance with the requirements of Article 3.17 of this Section shall be sprinkled with water as directed by the Engineer to bring the moisture content to within the range of optimum plus or minus three (3) percent. Water shall be thoroughly incorporated into the material by means of discs or other approved equipment.
- C. Backfill and subgrade material containing excess moisture shall be dried, prior to installation, to a moisture content not greater than three (3) percentage points above optimum, except that for material within the moisture content range specified herein that displays pronounced elasticity or deformation under the action of loaded

construction equipment, the moisture content shall be reduced to optimum or below if necessary to secure stability. For subgrade material, these requirements for maximum moisture shall apply at the time of compaction of the subgrade and also at the time of placing pavement or subbase. Drying of wet soil shall be expedited by the use of plows, discs, or by other approved methods when so ordered by the Engineer.

3.17 COMPACTION REQUIREMENTS

- A. The bottom of excavations upon which concrete foundations or structures are to be placed shall be compacted so as to obtain 100% of maximum dry density per ASTM D-698 in the top twelve (12) inches.
- B. The top twelve (12) inches of stripped original subgrade and final subgrade shall be compacted to not less than 100% of maximum dry density per ASTM D-698.
 - 1. Subgrade under new, proposed, or future pavement shall be compacted 18 inches beyond the edge of pavement, paved shoulders or paved medians.
- C. Compaction of subgrade for sidewalks (regardless of paving material) shall be 100% of maximum dry density per ASTM D-698 in the top six (6) inches.
- D. Compaction of non-paved areas shall be 90% of maximum dry density per ASTM D-698.
- E. Aggregate pipe embedment and aggregate backfill around structures shall be compacted to not less than 100% of maximum dry density per ASTM D-4253 and ASTM D-4254.
- F. Final backfill shall be compacted to not less than 100% of maximum dry density per ASTM D-698.
- G. Fill placed within the interior of structures shall be compacted to not less than 100% of maximum dry density per ASTM D-698.
- H. Embankment shall be placed and compacted in layers until the density is not less than the percentage of maximum dry density indicated in the following table determined by ASTM D-698.

EMBANKMENT SOIL COMPACTION REQUIREMENTS

Maximum Laboratory Dry Weight <u>Pounds/Cubic Foot</u>	Minimum Compaction Requirements Percent Laboratory <u>Maximum</u>
90-104.9	102
105-119.9	100
120 and more	98

I. Test Sections

1. If it is determined by the Engineer that the composition of the material is such that it cannot be tested for density using a nuclear densometer or other methods; or where, in the opinion of the Engineer, in-place compaction testing is not feasible; and if approved by the Engineer, the Contractor may construct a test section to demonstrate acceptable compactive effort in lieu of in-place compaction testing. Test sections shall be constructed at no additional cost to the Owner.
2. The test section shall be completed by repeatedly compacting the material until no further density is achieved. This value shall be the Minimum Test Section Density (MTSD). The compaction equipment used to complete the test section shall be of suitable size to compact the material and shall be the same equipment used to compact the in-place material.
3. The test section shall be constructed with moisture density control as specified in this Section.
4. The material shall be compacted to at least 98% of the MTSD.
5. Each lift of in-place fill or backfill shall be densified using a compactive effort equal to or greater than the effort applied to achieve the MTSD; i.e., if six passes were required to achieve MTSD, then each lift of material shall be compacted using six or more passes.
6. Construct a new test section when, in the opinion of the Engineer, the fill or backfill material has changed character or when the supporting material has changed character.

3.18 GRADING

- A. Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading
1. Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - a. Lawn or unpaved areas shall be graded to plus or minus 1-inch.
 - b. Walks shall be graded to plus or minus 1-inch.
- C. Grading inside Building Lines
1. Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

END OF SECTION 310000

SECTION 329200.19 – SEEDING AND MULCHING

PART 1 - GENERAL

1.1 SUMMARY

- . Installation of seeded areas shall be to the extent shown on Contract Drawings and shall include supplying all seed, topsoil, soil conditioning materials, mulching materials and watering, and the incorporation of these materials into the work as specified.
- A. The Contractor shall place topsoil at the depths specified in those areas requiring seeding. Topsoil shall be furnished by the Contractor.

1.2 SUBMITTALS

- A. Product Data: For the following:
 1. Provide copies of soils tests for both new topsoil (provided) and onsite topsoil for review and approval. This applies to all areas that require seeding, including reconditioned areas.
 2. Provide location of properties from which topsoil is to be obtained, names and addresses of owners, depth to be stripped, and crops grown in the past 2 years.
 3. Provide the name of the seed supplier, name and phone number, list of the seed, including varieties of seed, labels, and an analysis of the seed for review, 4 weeks prior to the start of seeding.
 4. Provide soil amendments information based on soils test requirements.
 5. Hydroseed mixture, mulch and application rates prior to performing the work.

1.1 QUALITY ASSURANCE

- A. Any subcontracted restoration work shall be performed by a qualified firm specializing in landscape work.
- B. The Contractor shall have a soils test done at his expense and analyzed by a state approved testing agency. Soil tests shall be done on both the topsoil stockpiled from the site and new topsoil brought to the site. A minimum of two (2) tests shall be done. The tests shall include percent organic matter, pH, Buffer pH, Phosphorus, Exchangeable Potassium, Calcium, Magnesium, Cation Exchange Capacity and Percent Base Saturation with recommendations for nitrogen, phosphate, potash, magnesium and lime based on plant type and use.
- B. Seed: All seed specified shall meet O.D.O.T. specifications as to the percentage purity,

weed seed, and germination. All seed shall be approved by the State of Ohio, Department of Agriculture, Division of Plant Industry, and shall meet the requirements of these specifications.

- D. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.

1.4 PROJECT CONDITIONS

- B. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
- C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, such conditions shall be rectified by the Contractor before planting, with approval from the Owner's Representative.
- D. Soil Stabilization: The Contractor shall provide permanent or temporary soil stabilization to denuded areas within fifteen (15) days after final grade is reached on any portion of the site. Any such area which will not be regraded for longer than fifteen (15) days shall also be stabilized. Soil stabilization includes any measures which protect the soil from the erosive forces of raindrop impact and flowing water. Applications include seeding and/or mulching, or the use of other erosion control measures as directed by the Owner's Representative. If necessary, the Contractor shall coordinate soil stabilization practices with the local Soil and Water Conservation District.
- D. Spring-sown work shall be installed between April 1st and May 30th and Fall-sown work shall be installed between September 1st and October 15th. No permanent seeding shall take place between May 30th and September 1st and between October 15th and April 1st. The dates for seeding may be changed at the discretion of the Owner's Representative.

PART 2 - PRODUCTS

2.1 TOPSOIL

- A. Topsoil shall be furnished by the Contractor. Stockpiled material, if any, shall be utilized prior to obtaining additional topsoil.
- B. All topsoil shall conform to the U.S. Department of Agriculture soil texturing triangle and shall contain between 3% to 8% organic matter. Topsoil shall be loamy and not consist of more than 38% clay. New topsoil shall be screened to remove clay lumps, brush, weeds, litter, roots, stumps, stones larger than ½" in any dimension and any other extraneous or toxic matter harmful to plant growth.

New topsoil shall be obtained only from naturally well drained sites where topsoil occurs in

a depth of not less than 4". Do not obtain from bogs or marshes.

- C. Soil amendments shall be added according to the soils test requirements. Amendments can include, but are not limited to fertilizer, lime, compost, sand, and organic matter. Organic matter shall consist of composted leaves or other approved material.

2.2 SEED

- A. Seed shall be vendor mixed, delivered in original bags and shall be proportioned as follows:

<u>Common Name</u>	<u>Proportion by Weight</u>
Kentucky Blue Grass	50%
Perennial Rye	50%

2.3 MULCH

- A. Mulch shall be clean straw free of seed and weed seed.
 - 1. Anchoring for mulch shall be an ODOT specified SS-1 at 60 gal./ton non-toxic tackifier such as Hydro-stik, or equal, or by securing with a photo degradable netting.
- B. If hydroseeding is used, wood fiber mulching material shall be used and shall consist of virgin wood fibers manufactured expressly from whole wood chips and shall conform to the following specifications.

- Moisture content	10.0% \pm 3.0%
- Organic content	99.2% \pm 0.8% O.D. Basis
- pH	4.8 \pm 0.5
- Water holding capacity, minimum (grams of water per 100 grams of fiber)	1,000

Wood fiber mulching material shall be processed in such a manner as to contain no growth or germination inhibiting factors, and must contain a biodegradable green dye to aid in visual metering during application.

PART 3 - EXECUTION

3.1 PREPARATION - GENERAL

- A. Rough grading to a depth necessary to accept the specified thickness of topsoil must be approved prior to placing topsoil.
- B. Loosen subgrade, remove any stones greater than 1/2" in any dimension. Remove sticks, roots, rubbish, and other extraneous matter.
- C. Spread topsoil to a minimum depth of 4 inches, to meet lines, grades, and elevations shown

on plan, after light rolling and natural settlement. Remove sticks, roots, rubbish, stones greater than 1/2" in any dimension, and other extraneous matter. Topsoil shall be tilled thoroughly by plowing, disking, harrowing, or other approved methods. Add specified soil amendments and mix thoroughly into the topsoil.

- D. Preparation of Unchanged Grades: Where seed is to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil for planting as follows: Till to a depth of not less than 6 inches. Apply soil amendments and initial fertilizers as specified. Remove high areas and fill in depressions. Till soil to a homogenous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter. Soils test requirements apply here as well.
1. Prior to preparation of unchanged areas, remove existing grass, vegetation and turf. Dispose of such material outside of project limits. Do not turn existing vegetation over into soil being prepared for seed.

If necessary, supply and install topsoil in areas where there is no topsoil left after vegetation has been removed.
 2. Apply specified soil amendments at rates specified in the soils test and thoroughly mix into upper 2 inches of topsoil. Add topsoil if existing grade has less than 4" of topsoil. Delay application of amendments if planting will not follow within two (2) days.
- E. Fine grade areas to smooth, even surface with loose, uniformly fine texture. Roll, rake, and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Remove sticks, roots, rubbish, stones greater than 1/2" in any dimension, and other extraneous matter. Limit fine grading to areas which can be planted immediately after grading.
- F. Moisten prepared areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.
- G. Restore areas to specified condition, if eroded or otherwise disturbed, after fine grading and prior to planting.

3.2 SEEDING

- A. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage. Seed shall not be sown when the ground is frozen, muddy, or when weather conditions prevent proper soil preparation, interference with sowing and/or proper incorporation of seed into the soil.
- B. Sow seed using a spreader or hydroseeder. Do not seed when wind velocity exceeds 5 miles per hour. Distribute seed evenly over entire area by sowing 3 lbs. per 1000 S.F. at right angles to each other. Total amount to equal a minimum of 6 lbs. per 1000 S.F.
- C. For seed sown with a spreader, mulch shall be spread uniformly to form a continuous

blanket at a rate of 100 lbs. per 1,000 S.F. Mulch shall be 1 1/2" loose measurement over seeded areas and shall be anchored.

- D. Contractor has the option to hydroseed large lawn areas, using equipment specifically designed for such application. The rate of application of wood fiber mulching materials is 40 lbs./1,000 S.F. Contractor shall not hydroseed within close proximity to buildings and structures, or when unfavorable wind conditions may blow the hydroseed material onto the structure. Contractor shall clean all areas not to be seeded of overspray.
- E. The seeded area shall be watered, as soon as the seed is applied, at the rate of 120 gallons per 1000 square feet. The water shall be applied by means of a hydroseeder or a water tank under pressure with a nozzle that will produce a spray that will not dislodge the mulching material. Cost of this watering shall be included in the cost of seeding and mulching.

3.3 DORMANT SEEDING METHOD

- A. Seeding shall not take place from October 15 through November 20. During this period prepare the seed bed, add the required amounts of lime and fertilizer, and other amendments, then mulch and anchor.
- B. From November 20 through April 1, when soil conditions permit, prepare the seed bed, lime and fertilize, apply the selected seed mixture, mulch, and anchor. Increase the seeding rate by 50 percent.

3.4 RECONDITIONING EXISTING LAWNS

- A. A soils test shall be required for existing lawns prior to any reconditioning.
- B. Recondition all existing lawn areas damaged by Contractor's operations including storage of materials and equipment and movement of vehicles. Also recondition existing lawn areas where minor regrading is required.
- C. Provide soil amendments as called for in the soils test.
- D. Provide new topsoil, as required, to fill low spots and meet new finish grades.
- E. Cultivate bare and compacted areas according to the topsoil specifications.
- F. Remove diseased and unsatisfactory lawn areas; do not bury into soil. Remove topsoil containing foreign materials resulting from the Contractor's operations, including oil drippings, stone, gravel, and other loose building materials.
- G. All work shall be the same as for new seeding.
- H. Water newly planted seed areas. Maintenance of reconditioned lawns shall be the same as maintenance of new lawns.

3.5 ESTABLISHMENT

- A. Maintain work areas as long as necessary to establish a uniformly close stand of grass over the entire lawn area. A uniformly close stand of grass is defined as the seeded areas having 90%+ coverage of grass at 60 days after seeding. 90%+ coverage is defined as very little or no dirt showing when seeded area is viewed from directly overhead.
- B. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading and replanting as required to establish a smooth acceptable lawn.
 - 1. Mowing
 - a. Mow lawn areas during the period of maintenance to a height of 2 inches whenever the height of the grass becomes 3 inches. A minimum of 3 mowings is required during the period of maintenance.
 - 2. Refertilizing
 - a. Distribute fertilizer on the seeded area between August 15 and October 15, during the period when grass is dry, and in accordance with the manufacturer's recommendations. The fertilizer shall be as specified in the soils test.
 - 3. Reseeding
 - a. Reseed with the seed specified for the original seeding, at the rate of 4 lbs. per 1,000 S.F. in a manner which will cause minimum disturbance to the existing stand of grass and at an angle of not less than 15 degrees from the direction of rows of prior seeding.
 - 4. Watering
 - a. The Contractor shall keep all work areas watered daily to achieve satisfactory growth. Water shall be applied at a rate of 120 gallons per 1,000 square feet. If water is listed as a pay item, it shall be separately paid for based on the actual amount of water used, measured in thousands of gallons.
 - 5. Any mulching which has been displaced shall be repaired immediately. Any seed work which has been disturbed or damaged from the displacement of mulch shall be repaired prior to remulching.

3.6 INSPECTION AND ACCEPTANCE

- A. When seeding work is complete and an acceptable stand of growth is attained, the Contractor shall request the Owner's Representative to make an inspection to determine final acceptance.
- B. Acceptance shall be based upon achieving a vigorous uniformly stand of the specified grasses. If some areas are satisfactory and some are not, acceptance may be made in blocks, provided they are definable or bounded by readily identified permanent surfaces, structures, or other reference means. Partial acceptance decisions may be made by the Owner's Representative. Excessive fragmentation into accepted and unaccepted areas shall not be allowed. Unaccepted areas shall be maintained by the Contractor until acceptable.
- C. No payment shall be made until areas are accepted.

- D. All seeded areas shall be guaranteed for one full growing season to commence upon final acceptance of the areas.

END OF SECTION 329200.19

SECTION 331113.01 – WATER UTILITY DISTRIBUTION SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

- A. Furnishing all labor, materials, tools, equipment, and services for all waterlines as shown on the Drawings.
- B. Although such is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a functional and complete installation.

1.2 RELATED DOCUMENTS AND SECTIONS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions (if included), and Division 1 Specifications Sections, apply to this Section.
- B. Section 013543 – Environmental Protection
- C. Section 013319 – Field Testing Requirements
- D. Section 016600 – Product Handling and Protection
- E. Section 031000 – Earthwork

1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Granular pipe bedding and cover material specified in Section 310000 – Earthwork.
- B. Special backfill material specified in Section 310000 – Earthwork.

1.4 DEFINITIONS

- A. Bedding: Material placed under, beside and directly over pipe for the full width of the trench up to a distance of 6 inches over the top of the pipe barrel prior to subsequent backfill operations.

1.5 SUBMITTALS

- A. Manufacturer's Affidavit: The manufacturer shall furnish an affidavit indicating that all pipe, fittings, valves, fire hydrants, and appurtenances have been manufactured and tested in accordance with the requirements of the applicable referenced Standards. A copy of the affidavit indicating the Project on which the material is to be used, shall be forwarded to ENGINEER prior to construction.

- B. For butt fusion joints, submit a printout giving all the parameters of each joint as required under paragraph 3.4.
- C. For polyethylene encasement, submit sample.
- D. Method of construction with detailed drawings and written descriptions of the entire construction procedure to insert the pipe, and connections to water services, fire hydrants, and intersecting water mains. Drawings shall show, but are not limited to, excavation locations, access pits, dimensions, shoring, method of dewatering, adjacent utilities, and traffic control.

1.6 REFERENCES

- A. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
- B. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems
- C. AWWA C110 - Ductile-Iron and Gray-Iron Fittings
- D. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- E. AWWA C116 - Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
- F. AWWA C150 - Thickness Design of Ductile-Iron Pipe
- G. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast
- H. AWWA C153 - Ductile-Iron Compact Fittings
- I. AWWA C213 - Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
- J. AWWA C301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type
- K. AWWA C400 - C400-03: AWWA Standard for Asbestos-Cement Pressure Pipe, 4 In. through 16 In. (100 mm through 400 mm), for Water Distribution Systems
- L. AWWA C502 - Dry-Barrel Fire Hydrants
- M. AWWA C504 - Rubber-Seated Butterfly Valves
- N. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service
- O. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
- P. AWWA C550 - Protective Interior Coatings for Valves and Hydrants
- Q. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances

- R. AWWA C651 - Disinfecting Water Mains
- S. AWWA C800 - Underground Service Line Valves & Fittings
- T. AWWA C900 - Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. through 24 In. (100 mm through 600 mm) for Water, Wastewater, and Reclaimed Water Service
- U. ASTM A36 - Standard Specification for Carbon Structural Steel
- V. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings
- W. ASTM A48 - Standard Specification for Gray Iron Castings
- X. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
- Y. ASTM A181 - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping
- Z. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts
- AA. ASTM A307 -Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
- BB. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings
- CC. ASTM B88 - Standard Specification for Seamless Copper Water Tube
- DD. ASTM B124 - Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes
- EE. ANSI B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings
- FF. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³))

1.7 QUALITY ASSURANCE

- A. Comply with all provisions of Section 014323 – Qualifications of Tradesmen.
- B. Comply with all provisions of Section 014126 – General Regulations and Permits.
- C. Field samples shall comply with Section 013319 – Field Test Reporting and Section 013326 – Product Testing and Certifying.
- D. Before and during installation, the Contractor shall comply with provisions under Section 013119 – Project Meetings.

- E. All pipes, fittings, valves, fire hydrants and appurtenances shall be appropriately marked for identification purposes. The materials and methods of manufacture, and completed pipes, fittings, valves, and appurtenances shall be subject to inspection and rejection at all times. OWNER and ENGINEER have the right to make inspections.

1.8 PROJECT CONDITIONS

- A. Environmental Requirements
- B. Existing Conditions
 - 1. Verify locations of underground utilities.
 - 2. Protect existing structures and utilities from damage. Repair if damaged by this work.
 - 3. Do not change pipe sizes without securing written approval of Engineer.
- C. Field Measurements
 - 1. If it becomes necessary to change location of waterlines due to underground utility interference, secure approval of Engineer.
 - 2. If Contractor initiated, make changes approved by the Engineer without added cost to Owner.

1.9 DELIVERY STORAGE AND HANDLING

- A. Deliver products to the site, store and protect under provisions of Section 016600 – Product Handling and Protection.
- B. Comply with all provisions of Section 013543 – Environmental Protection

1.10 SEQUENCING AND SCHEDULING

- A. Perform no pipe work in fill areas until embankment or fill has been completed to at least two (2) feet above proposed top of pipe and fill has been properly compacted.

PART 2 – PRODUCTS

2.1 WATER MAIN PIPE AND FITTINGS

- A. Ductile Iron Pipe and Fittings
 - 1. Pipe shall be designed in accordance with AWWA C150, minimum Thickness Class 52 with polyethylene encasement when buried; except Thickness Class 56 for river crossing pipe; manufactured in accordance with AWWA C151; furnish in minimum nominal 18 foot laying lengths, except river crossing pipe to be in full length joints with shorter lengths required to facilitate installation supplied by pipe manufacturer (no field cutting permitted).
 - 2. Fittings: AWWA C110 or C153, with fittings to be polyethylene encased when buried.

3. Exterior Coating: Asphaltic material. Fittings may be coated with a fusion-bonded epoxy coating in accordance with AWWA C116.
4. Interior Lining: AWWA C104 cement mortar with seal coat, or AWWA C116 fusion-bonded epoxy coating.
5. Joints: AWWA C111, rubber gasket, push-on or mechanical type, with restrained type joints and river crossing pipe joints to be provided within the lengths noted on Drawings.
 - a. For all bolted joints, bolt length shall be such that all threads of the nut will be engaged.
 - b. Restrained push-on joints shall be provided within the lengths noted on the drawings; shall be completely boltless; McWane Super-Lock, American Flex-Ring, U.S. Pipe TR Flex, or as approved. Restrained mechanical joints shall be MEGALUG with Mega-Bond Coating System as manufactured by EBAA Iron, Inc., or as approved, of ductile iron and with a working pressure of at least 250 psi and a minimum safety factor of 2:1.
 - c. River crossing pipe joints shall be boltless, self-restraining, push-on type, gasketed ball and socket joints; Clow Ball and Socket Pipe, American Flex-Lok Boltless Ball Joint Pipe, U.S. Pipe USIFLEX, or as approved.

2.2 VALVES

A. Materials

1. Valves bodies shall be of either gray or ductile cast iron and shall have the name, monogram, or initials of the manufacturer cast thereon.
2. Valves shall have nonrising stems, open by turning left or counter-clockwise and be provided with either a 2-inch square nut for buried valves or handwheel for exposed valves unless otherwise noted. The direction of opening shall be indicated by an arrow cast on the body and/or the actuator.
3. All body bolts and nuts shall be bronze or stainless steel for buried, submerged or nonprotected applications and Type 304 stainless steel for exposed or interior applications that will receive protective finish coatings.

B. Tapping sleeves

1. Type: Mechanical joint made in two halves for assembly around main.
2. Branch Flange: Accommodate tapping valve.
3. Materials: Cast iron with gaskets extending entire length of sleeve to form water-tight joints.

C. Gate or Tapping Valves

1. AWWA C509 cast iron, bronze-mounted, or AWWA C515 ductile iron, bronze-mounted, polyethylene encased when buried installation; designed for 200 psi working water pressure; mechanical joint ends, AWWA C111, except for tapping valves; non-rising stem type with standard AWWA nut; stem seal consisting of at least two Buna-N rubber O-rings; open by turning left (counterclockwise); bolts, nuts, and washers used by manufacturer to assemble valves to be Type 304 stainless steel.

2. The valve shall have a smooth, unobstructed waterway free from any sedimentation pockets. Valve shall provide a 100% port of nominal pipe size when fully open. Tapping valve port shall be sized to permit a full pipe port tap.
3. Verify direction of valve with OWNER.
4. Body style shall be mechanical joint type for buried service, flange joint type for exposed service and when required, to include special end connections for tapping requirements or otherwise if indicated on the contract drawings.
5. Stuffing boxes shall be O-ring seal type with two (2) rings located in stem above thrust collar.
6. Thrust bearings shall be of the low friction torque reduction type, located both above and below the stem collar.
7. Valves shall be as manufactured by; Mueller Co., American-Darling, Clow, M & H, Stockham, U.S. Pipe or an approved equivalent.

D. Protective Coatings

1. All iron parts of valve assemblies shall be painted before leaving the shop.
2. All exterior and internal waterway ferrous surfaces of each valve, except finished or bearing surfaces shall be shop painted with a liquid or powder epoxy coating of approximately 10 mils dry film thickness conforming to AWWA C550.

E. Extension Stems and Stem Guides

1. When required by drawings, schedule or project details, provide an extension stem made of cold-rolled steel material and the same size as the stem of the valve it operates. If the extension is more than 8 ft. long, intermediate stem guides shall be installed and supported from the wall by suitable brackets at a maximum spacing of 8 ft.
2. Brackets and stem guides shall be made of cast iron and fully adjustable. The guide block shall be bronze bushed where it contacts the extension stem. Stem guides shall be as manufactured by the Eddy Valve Co., Rodney Hunt, or equal. Secure stem guides to walls with stainless steel bolts. In the event of off-set of misalignment, provide off-set extension rod with universal end fittings at valve actuator and stem drop connection.
3. Extension stem shall have connecting socket for 2-inch square nut and pin socket to lock on valve operating nut.

F. Valve Boxes

1. Valve boxes shall be cast iron, 5-1/4" shaft, three-piece screw type, adjustable boxes. The top section to have a drop lid of which to be marked for service which it is used cast thereon. Cover and boxes shall be round pattern.
2. Provide proper base size and shape to straddle the valve bonnet without touching or being supported by the valve mechanism. Use No. 6 base size for 6-inch and 8-inch gate valves or typical butterfly valve operators, No. 160 oval base size for 12-inch and larger gate valves or other size necessary to suit a particular valve manufacturer's requirements.
3. Extension sections shall be provided where the depth of trench is such that they are needed to bring the top of the box to finished grade. The valve box shall be installed so that it is perfectly vertical and centered on the valve operating nut.

2.3 SERVICE CONNECTION AND BACTERIA SAMPLING AND FLUSHING ASSEMBLY PIPE

- A. Copper Pipe and Fittings:
 - 1. Pipe: ASTM B88, Type K, annealed, seamless copper water tube; 2 inch.
 - 2. Fittings: ASME B16.18 cast copper, ASME B16.22 wrought copper, or AWWA C800 service line fittings.
 - 3. Joints: Compression connections.

2.4 SERVICE CONNECTION ASSEMBLIES

- A. Assemblies include a service saddle, corporation stop, and curb stop and box. All service connections shall be rated to 150 psi working water pressure.
- B. Service saddle shall be designed for type of pipe to be installed on, and to accept the corporation stop; Ford Meter Box Co. 202BS, A.Y. McDonald Mfg. Co., Mueller Co. M-16000, or an approved equivalent.
- C. Corporation stop shall be in accordance with AWWA C800, complete with required coupling and accessories for connection to service pipe; subject to an air test at the factory; Ford Meter Box Co. FB600, A.Y. McDonald Mfg. Co., Mueller Co. 15000, or as approved.
- D. Curb stop shall be in accordance AWWA C800, complete with required fittings for the type of connection to service pipe; Ford Meter Box Co. B22, A.Y. McDonald Mfg. Co., Mueller Co. Oriseal, or as approved.
- E. Curb box shall be made of steel and cast iron; shut-off rod matching type in the system; Ford Meter Box Co. Arch Base, Tyler Pipe 6500 Series, or as approved.
- F. Provide the Vadle Curb Box Lock as supplied by the JRC Supplies LLC to support each service curb box.

2.5 FIRE HYDRANT ASSEMBLIES

- A. Includes fire hydrant, watch valve and valve box, piping, and appurtenances.
- B. Fire Hydrant:
 - 1. Manufacturers: American Flow Control, Kennedy, Mueller, or as approved, to match rest of water system
 - 2. AWWA C502, compression type, 5-1/4-inch valve opening, open by turning left (counterclockwise); traffic model with frangible barrel section and stem coupling; positive operating drain valve installed in open position; 6-inch mechanical joint base, designed so water hammer will be prevented when properly operated. If drain valve, install with drain valve plugged.
 - 3. Two 2-1/2 inch hose nozzles, and one 4-1/2 inch pumper nozzle.
 - 4. Suitable for setting in trenches of depths and in locations shown; CONTRACTOR responsible for determining hydrant depth of bury based on locations shown.

5. Verify that the direction of opening, hydrant pumper nozzle, operating nut, outlet nozzle cap nuts and hose threads conform to those in the system before the new hydrants are shipped.
- C. Watch Valves and Valve Boxes: Watch valves and valve boxes shall be gate valves and valve boxes as specified in Article 2.2, with valves to have ends suitable for receiving the spigot end of 6 inch anchoring pipe.
- D. Piping:
1. Ductile Iron Pipe: AWWA C150, AWWA C151; asphaltic material, or AWWA C116 fusion-bonded epoxy exterior coating, AWWA C104 cement mortar with seal coat, or AWWA C116 fusion-bonded epoxy interior lining.
 2. AWWA C110 or C153 mainline tees with standard mechanical joint branch for connecting to anchoring pipe and fittings, and mechanical joint anchoring type branch when connecting to a watch valve; coated and lined as specified for pipe. C153 fittings to be polyethylene encased when buried.
 3. Anchoring pipe, plain end mechanical joint type incorporating an integral cast shoulder and follower gland.
 4. Anchoring Pipe Manufacturers: American Cast Iron Pipe Company, Clow Corporation, United States Pipe and Foundry Company, or as approved.

2.6 POLYETHYLENE ENCASEMENT

- A. AWWA C105, 8 mil linear low-density polyethylene tube or 4 mil high density, cross-linked polyethylene tube; 2 inch wide plastic-backed, adhesive tape, bond to both metal surfaces and polyethylene film.

2.7 TRACE WIRE

- A. Inert bonded layer plastic with metallized foil core, 6 inches wide, resistant to alkalis, acids and other destructive chemical components encountered in soils; APWA Uniform Color Code, brightly colored; imprinted indicating pipe type; Griffolyn Company Terra Tape "D", Seton Name Plate Corporation, or an approved equivalent.
- B. Use with non-metallic water main pipe materials.

2.8 PIPE INSULATION

- A. Cellular glass insulation with an aluminum jacket; thickness as required to prevent freezing at 0 degrees F, but in no case less than 1 inch; suitable for burial; Pittsburgh Corning Corporation FOAMGLAS, or as approved.

2.9 JOINT BOLTS AND NUTS

- A. Unless otherwise specified or noted, bolts and nuts on buried piping shall be low alloy steel cathodic to pipe with a minimum yield strength of 45,000 psi, and all other bolts and nuts shall be low carbon steel, ASTM A307, Grade B, zinc-plated.

2.10 SPARE PARTS

- A. Hydrant Wrenches: Provide 2 spare hydrant wrenches with pentagon hydrant nut operator on handle, constructed of stainless steel, and a minimum length of 36-inches
- B. Valve Keys: Provide 2 spare valve keys with standard AWWA valve nut operator. Valve keys shall be 8 feet long and have a 4 ft long turn handle centered at top.

PART 3 – EXECUTION

3.1 ALIGNMENT AND GRADE

- A. Horizontal and Vertical Control
 - 1. All horizontal and vertical control required for the complete layout and performance of the Work under this contract shall be done by a registered surveyor at the Contractor's expense, and any observations by the Engineer of the Contractor's methods will not relieve the Contractor of his responsibility.
 - 2. The Contractor shall be solely responsible for the accuracy of all horizontal and vertical control.
- B. Alignment and grade shall be established by means of a laser beam.

3.2 PREPARATION

- A. String pipe sections along the route of the mains so as to interfere least with pedestrian and vehicular traffic and to protect the pipe.
- B. Excavate trench for Work of this Section; follow Section 310000.
- C. Location of service connections and insertion valves indicated are approximate. Final locations will be established during construction by OWNER.
- D. Do not install service connections until new mains have been successfully tested, disinfected, and placed in service.
- E. Prior to ordering tapping sleeve assembly, expose existing main and verify circumference of existing pipe.
- F. Prior to ordering insertion valve and sleeve assembly, expose existing main at point of installation and verify circumference, actual caliper diameter and roundness of existing pipe. In addition, identify the exterior condition of the pipe with respect to pitting, scaling, electrolysis, or other defects which would affect manufacturing dimensions or exact location of the insertion.
- G. Verify that polyethylene encasement is in place, where required, before placing bedding.

- H. For river crossing pipe, inspect trench just prior to laying pipe to ensure that it is in suitable condition.

3.3 BEDDING

- A. Place bedding material at trench bottom and shape for accurate placement and proper support of pipe.
- B. Place in 6 inch layers, loose measurement, and compact by hand or mechanical tamping to not less than 95 percent of maximum density as determined in accordance with ASTM D698 (Standard Proctor).
- C. Carefully place and tamp so as not to damage or displace joints or pipe. Do not drop material directly on pipe.
- D. Maintain optimum moisture content of bedding material to attain required compaction density.
- E. Construct thrust blocks at fittings, dead ends, and valves as shown. Place against firm, undisturbed soil. Provide straps and anchors as indicated; repair cuts and other damage to galvanized surfaces by applying two coats of cold galvanizing compound. Securely strap or block plugs and caps. Thrust blocks shall meet all applicable requirements of ODOT Item 638
 1. Concrete: Class C conforming to ODOT 499.
 2. Straps and Anchors for Thrust Blocks: Galvanized steel.
 3. Cold Galvanizing Compound: ZRC Products Company, or as approved.

3.4 PIPE INSTALLATION

- A. The Contractor shall furnish all of the proper tools and equipment required for the safe, proper handling and laying of all pipe, fittings, and specials that are to be installed in this work. All storage, handling, laying, and backfill methods shall be performed so as to avoid damaging either the interior or the exterior surfaces of all pipe fittings, specials, joint materials, or other appurtenances, and any such damage shall be remedied at the Contractor's expense.
- B. Before any pipe is lowered into the trench, it shall be inspected for damage, and any unsatisfactory lengths shall be rejected. Cast metal pipe and fittings shall be inspected for cracks by ringing with a light hammer while suspended. The interior and exterior of each pipe length used shall be cleaned as necessary to remove all dirt or other foreign material before it is inspected. The interior of the pipe shall be kept clean until the work is accepted.
- C. No pipe shall be laid in water, mud or when trench conditions or weather is unsuitable for such work.
- D. If mud, surface water, leaves and/or other debris have been permitted to enter the strung-out pipe, the inside shall be cleaned with a strong hypochlorite solution after all such foreign materials are completely cleaned from the pipe and before the pipe is lowered into the trench.

- E. Pipe shall not be pushed off the bank nor shall it be permitted to fall into the trench. Each type of pipe, fitting, special or other appurtenances shall be handled in strict accordance with recommendations of its respective manufacturer.
- F. No rocks, stones, metal, concrete, bricks, pavement pieces, wood, soil lumps or other hard materials too big to pass through a six (6") inch screen shall be permitted within six (6") inches of the pipe after it is laid in the trench. Any pipe endangered by such debris shall be subject to removal and disposal at the Contractor's expense.
- G. When pipe laying is not in progress, the open ends of installed pipe shall be closed by appropriate means to prevent the entrance of dirt and water. In the event ground water, sewage water or other potential contaminants enter any portion of the pipeline, after it is laid, cleaning and preliminary disinfection with a strong hypochlorite solution shall be done.
- H. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- I. Use suitable fittings, usually 1/8 bends, when abrupt grade changes of the pipe are necessary to avoid existing utilities or other obstructions, so as to secure and easy flow of liquid and to provide sufficient cover below same unless noted otherwise.
- J. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- K. Deflect pipe joints in strict accordance with the pipe manufacturer's instructions. For river crossing pipe, in no case shall joint deflection exceed 15 degrees during installation and 12 degrees after installation unless otherwise approved by manufacturer.
- L. With push-on joints, wipe surfaces that contact rubber gasket clean and dry just prior to making joint. Use lubricant in accordance with the manufacturer's instructions when making joint.
- M. With mechanical joints, brush surfaces that contact rubber gasket with soapy water to remove all sand and grit just prior to making joint.
- N. Make butt fusion joints in accordance with pipe manufacturer's and fusion machine manufacturer's instructions. The wall thickness of the adjoining pipes shall have the same DR at the point of fusion.
- O. For butt fusion joints, the fusion unit shall include a battery-operated data logger designed for field use and for providing complete fusion data documentation from the beginning to the end of the fusion process, ensuring joint integrity and reliability. Data logger shall:
 - 1. Record actual joint data, retrieve stored data recorded, print out joint data, and download data stored to a PC.
 - 2. Display total elapsed time, a resettable stopwatch, actual machine pressure, recommended machine pressure, and actual number of data points being recorded.
 - 3. Provide a summary plot indicating pressure used to seat the heater, if correct shift sequence was used, duration of the melt cycle, magnitude of the fusion pressure, and duration of the cool cycle.
 - 4. Provide a computer download printout giving all the parameters of each joint on one page.

- P. Install trace wire continuous over top of PVC or polyethylene pipe; locate 18 inches below finished grade.

3.5 VALVES

A. Installation

1. Valves shall be carefully handled and placed so as not to permit any damage to the interior coatings, disc or seat. Internal type lifting devices shall not be permitted. Do not use handwheels or stems as lifting or rigging points.
2. All valves shall be carefully installed in their respective positions free from distortion and stress. Connecting joints shall conform to applicable requirements of the specifications.
3. Stem guides shall be accurately aligned.
4. If the valve box is tipped or otherwise not centered on the valve operating nut or not installed at the proper elevation, the Contractor shall, at his own expense, make whatever correction is required to remedy the defect promptly, upon notice to do so by the Engineer.

B. Testing

1. All valves shall be tested in place by the Contractor as far as practicable under conditions for the pipelines, in which they are placed, and defects revealed in valves or connections under test shall be corrected at the expense of the Contractor to the satisfaction of the Engineer.

C. Operation and Maintenance Manuals

1. Prior to or with the delivery of equipment, the manufacturer shall provide copies of an operation and maintenance manual including storage, installation, start-up, operating and maintaining instructions, and a complete parts and recommended spare parts list. The O & M Manuals shall be in compliance with the General Requirements of these specifications.

3.6 SERVICE CONNECTION ASSEMBLIES; BACTERIA SAMPLING AND FLUSHING ASSEMBLIES; BLOW-OFF ASSEMBLIES

- A. Install assemblies as shown or noted; comply with component manufacturer's instructions.
- B. Set valves plumb and on solid bearing; center and plumb valve box over valve; set box cover flush with finished grade; provide expansion joint material around portion of box in concrete pavement or sidewalks.
- C. For 1" and 3/4" curb stops and curb box installations simply place the Vadle curb box lock on a properly prepared sub base under the curb stop. Follow manufacturer's installation instructions.
- D. Place stone fill under blow-off assemblies.
- E. Provide drain hole where indicated for blow-off assembly.

- F. Remove bacteria sampling and flushing assemblies after notice from OWNER that mains have passed all tests and have been placed in service.
- G. For existing service connections to be abandoned on existing water mains to remain in service, dig up (expose) and turn off the existing corporation stop at the connection to the existing main.

3.7 SERVICE CONNECTION PIPE

- A. Installation pipe under street and highway pavements by pushing or boring, with no excavation closer than 5 feet to edge of pavement. No joints permitted within these limits.
- B. When boring, if opening exceeds by 2 inches the outside diameter of the pipe installed, the opening around the pipe shall be filled with grout.
- C. For existing service connections, intercept or extend as shown or noted to connect to new water mains.

3.8 JOINTING

- A. The particular method of making up pipe joints shall be governed by the type of pipe material and type of joint in accordance with the drawings and/or specifications.

3.9 CONNECTION TO AND INSERTIONS INTO EXISTING MAINS

- A. Existing mains into which valves are to be inserted cannot be shut down or taken out of service. The entire operation of installing the valves shall be accomplished below 100 psig at the point of installation.
- B. Connect new mains to existing mains using proper fittings and in a manner acceptable to OWNER and ENGINEER.
- C. Expose existing mains at connection points 10 days prior to making connections to determine elevation, verify type of pipe, confirm outside diameter of pipe, and identify type of restraints existing.
- D. No cut-ins or connections to existing mains shall be made unless at least 48 hours' notice is given to OWNER and ENGINEER.
- E. Plan all connecting work to reduce number of shutoffs.
- F. Two days prior to shutting valves on existing lines, notify all affected property owners, local official in charge of the water works system, and ENGINEER of such shutoff.
- G. Keep shutoff time to a minimum and do at off-peak hours.
- H. A representative of OWNER shall operate existing valves. CONTRACTOR shall not operate existing valves.

- I. OWNER and ENGINEER assume no responsibility for any delay occasioned by special requirements or conditions which must be met in making connections.
- J. Take extreme care in making connections to prevent contamination of existing mains.
- K. Before making cut-ins or connections to existing mains, wash all fittings, valves, and pipe with clean water, and then disinfect by washing with a chlorine solution having a residual chlorine strength of not less than 50 ppm.
- L. Plugs removed from existing mains that are not damaged may be reused within the Project, and those remaining after completion of construction shall remain the property of OWNER.
- M. Connections to AC pipe shall be made with appropriate fittings specifically designed for AC pipe connections, and shall be acceptable to OWNER. All connections to AC pipe shall be via pad adapters. AC pipe must not be cut with a saw. All cuts shall be accomplished by snap cut.

3.10 ANCHORAGE

- A. All hydrants, plugs, caps, tees and bends shall be provided with a reaction backing or shall be restrained by attaching suitable metal rods, clamps, anchored fittings or harnessed joints, as shown on the plans or as specified so as to prevent movement.
- B. Reaction backing shall be of concrete, with steel reinforcement as required, unless otherwise shown on the drawings. Backing shall be placed between solid ground and the fitting or other part of the pipeline to be anchored; the area of bearing on the pipe and on the ground in each instance shall be that as indicated on the plans. The backing shall be so placed unless otherwise directed, that the pipe and fitting joints will be accessible for repair.
- C. Steel tie rods or clamps of adequate strength to prevent movement may be used instead of concrete backing. Steel tie rods or clamps shall be used to connect the hydrant watch valves to the main and to connect the hydrant to the water valves when shown on the drawings. Steel rods or clamps shall be painted with three coats of an approved bituminous paint or coat tar enamel.

3.11 BACKFILLING

- A. Backfilling shall be accomplished in a two-step procedure as follows: 1) partial backfill before leakage tests, and 2) completion of backfill after tests. Departure from this procedure due to traffic or other conditions shall be approved by the Engineer.

3.12 MAINTENANCE OF EXISTING DITCHES

- A. The Contractor shall use the utmost care in maintaining ditches and other waterways, and, if either bottoms or banks of such ditches are disturbed, they shall be promptly restored and maintained for the life of the guaranty period. Similar care shall be used in preventing damage to existing pavement by caving of trench walls and undermining such pavement. If pavement is damaged, the Contractor shall repair same at his own expense.

3.13 CLEARING SITE AND RESTORING DAMAGED SURFACES

- A. Upon completion of the backfill work, the Contractor shall immediately remove and dispose of all surplus materials including dirt and rubbish.
- B. Unless otherwise called for on the plans, the Contractor shall replace all pavement, sidewalks, sod, or other surfaces disturbed to a condition equal to that existing before the work was started, furnishing all materials, labor, equipment, etc., at no additional cost to the Owner.

3.14 LEAKAGE TESTS

- A. All pipeline construction shall be subjected to hydrostatic leakage testing of each valve section, as it is completed, unless otherwise directed by the Engineer. All pipes, valves, fittings, etc. shall be laid in such a manner as to leave all joints watertight.
- B. Each section of pipe being tested shall be filled slowly with water, and, before applying the specified test pressure, all air shall be expelled from the pipe. The method of obtaining and placing test water(s) into the pipeline shall be approved by the Engineer.
- C. The test shall be observed by the Engineer or his designate. The Owner will furnish a pressure gauge for measuring the pressure on the water main. The Contractor shall furnish a suitable pump, pipes, bulkheads and all appliances, labor, fuel, and other appurtenances necessary to make these tests.
- D. The test pressure shall be maintained for sufficient length of time to allow for a thorough examination of joints and elimination of leakage where necessary. The pipeline shall be made absolutely tight under the test pressure.
- E. The Contractor shall drain each section of the waterline piping after it has been tested. If the drains are connected to valve or drain vaults, then, within a reasonable period of time after the test has been completed, the Contractor shall pump all water out of the vaults.
- F. In cold weather, immediately after testing a section of the waterline piping, the Contractor shall open all valves, air cocks, by-passes, and drains; shall drain that section of the pipeline, including the bonnets of all valves contained therein, and shall take all other precautions necessary to prevent injury due to freezing to the water main, piping and appurtenances.
- G. Every precaution must be taken to remove, valve-off, or otherwise protect delicate control equipment in or attached to pipelines to prevent damage or injury thereto.
- H. Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, as required to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled as herein required.
- I. In calculating leakage, the Engineer will not make allowance for any leakage at the valves, the removable bulkheads, etc.

- J. The evaluation of actual leakage to standard pressure leakage is calculated by the application of the ratio determined from the square root of respective pressures, other factors being equal.
- K. The test pressure shall be 250 psi unless otherwise specified elsewhere in these specifications. Testing procedure shall be as specified herein for the particular pipe material contained in the section tested and shall be subject to modification as required by a particular pipeline material specification or part thereof, as contained elsewhere in these specifications.
- L. For cast iron pipe (CIP) or ductile iron pipe (DIP), AWWA C600 shall govern the test, except that the allowable leakage rate shall be 12 gpd per mile of pipe per inch of diameter.
- M. All defective materials and construction found in the pipeline as a result of leakage tests shall be corrected by removal of the defective materials and reconstruction with sound materials and construction. The entire section shall then be retested in accordance with the foregoing.
- N. Any testing performed without the knowledge of the Engineer shall not be considered a test for the purpose of this specification.
- O. The lack of hydrants, branch shutoff valves, or any other attachments to the line being tested shall not preclude the testing of each valved section as it is completed. In the event that hydrants, branch shutoff valves or any other attached appurtenances are not available for installation prior to testing of each valved section, then plugs or other approved means of containing line pressure must be utilized so as to test each valved section of main line as it is completed. A retest of each valved section will then be necessary after all appurtenances are installed. There will be no additional payment for any such retests.
- P. The Contractor shall provide all pressure test equipment. The Owner shall provide all test water required and shall provide test gauges.

3.15 DISINFECTION

- A. Prior to disinfection, all pipeline construction shall be flushed to remove any foreign material. Flushing shall be performed after completion and approval of the leakage tests. The minimum requirements for flushing are as follows:

<u>Pipe Size</u>	<u>Minimum GPM Required</u>
6"	220
8"	390
10"	610
12"	880
14"	1,200
16"	1,565
18"	1,980
20"	2,450
24"	3,500

- B. Flushing at these rates shall be continued for at least five (5) minutes. In the event the foregoing requirements cannot be met due to the Owner's facilities being inadequate, alternate rate(s) and duration(s) of flushing shall be used.
- C. Disinfecting water mains shall be in accordance with AWWA C651 and as specified herein.
- D. The following disinfectants may be used: Chlorine or chlorine water; calcium hypochlorite; sodium hypochlorite solution, or chlorinated lime-water mixture. Chlorine shall be applied at one extremity of a pipe section via a corporation stop (installed in the top of the pipe by the Contractor) and bled at the opposite extremity of a properly segregated section. Precautions shall be taken to prevent dosed water from flowing into the potable water supply. All high points on the section treated shall be properly vented for air escape.
- E. The rate of applying the disinfectant shall provide at least 25 ppm (mg per liter) chlorine dose at the outlet end of the line section being treated. The disinfecting period shall be twenty-four (24) hours, and, at the end of this period, a chlorine residual of at least 10 mg per liter shall exist at the outlet end of the line.

In the event of unfavorable or unsanitary conditions of installation, poor packing, or high pH, the period of disinfection may be extended. For shorter periods of disinfection, higher dosages shall be required.

- F. Sterilizing water shall be disposed of in a satisfactory manner by the Contractor. If the foregoing disinfection procedure fails to provide thorough disinfection of the line, it shall be repeated as necessary in the pipeline for a period of 20 - 30 days after it is placed into operation.
- G. Tests for efficacy of sterilization shall be made by the Owner, and repeated sterilization shall be carried out by the Contractor when required.
- H. Contractor shall provide all disinfectants and disinfection equipment. Owner shall provide all test waters needed.

END OF SECTION 331113.01