ADDENDUM NO. 4

PROJECT: East Tennessee State University -
New Football Stadium:
Bid Package No. 02 – Rough Grading & Early Utilities
SBC No. 166 / 005-02-2013

MHM PROJECT NO. 15012

DATE: November 20, 2015

McCARTY HOLSAPLE McCARTY, INC.
550 WEST MAIN STREET
SUITE 300
KNOXVILLE, TENNESSEE  37902

TO: ALL BIDDERS OF RECORD

This Addendum forms a part of the Contract Documents for the East Tennessee State University –
New Football Stadium: Bid Package No. 02 – Rough Grading & Early Utilities, and modifies the original specifications and drawings issued for bidding August 31, 2015.

PROJECT MANUAL
A. Section 00.01.10 “TABLE OF CONTENTS”:
   1. This Section has been revised and is hereby re-issued in its entirety, footer dated 19-NOV-15.

B. Section 33.31.00 “SANITARY SEWER (GRAVITY)”:
   1. This Section has been revised and is hereby re-issued in its entirety, footer dated 19-NOV-15.

DRAWINGS
A. G000 - Coversheet:
   1. This drawing has been revised and is hereby re-issued, dated 19-NOV-15; revisions are in response to Pre-Bid RFI #6, Question 1.

B. Civil Drawings: The following Civil Drawings are hereby revised and re-issued, all Revision Number 1, and all dated 19-NOV-15:
   1. C111 – Demolition Plan;
   2. C112 – Demolition Plan;
   3. C121 – Layout and Paving Plan;
   4. C131 – Initial Erosion Control Plan;
   5. C141 – Grading and Erosion Control Plan;
   6. C142 – Grading and Erosion Control Plan;
   7. C151 – Storm Drainage Plan;
   8. C161 – Sanitary Sewer Plan;

D. Civil Drawings - As follows are responses to Pre-Bid RFI #6 Questions:


2. C111 – Demolition Notes: All demolition of above-grade structures and elements is a part of the previous Bid Package No. 1 scope; demolition and removal of below-grade structures and elements is a part of this Bid Package No. 2 scope.

3. C111, C113 – Gas Line/Sewer Line Conflict: Actual locations and relationships of gas and sewer line will need to be field verified, to confirm whether apparent conflict between the lines actually exists. If a conflict is subsequently determined to exist, the gas line will need to be relocated, in accordance with the terms and conditions of the Contract for Construction.

4. C151 – New Storm Line Conflict with Existing Utilities: The actual locations and relationships of the new storm line and existing utilities will need to be field verified, to confirm whether the apparent conflict between the two actually exists. If a conflict is subsequently determined to exist, additional utility relocation(s) may be required, in accordance with the terms and conditions of the Contract for Construction.

5. C151 – Box Culvert Details: The box culverts will be detailed and back-filled in accordance with TDOT STD-17-17 and STD-17-18.

6. C151 – Box Culvert Configuration: Either a single 2’x12’ or a pair of 2’x6’ box culverts will be acceptable. Either options must comply with TDOT requirements referenced above.

7. C171, C172 – Water Line Piping Type & Size(s): Refer to sheet C102 for water line types and installation requirements. Pipe sizes are either 6” or 8”, and field verification is required.

8. Rock Removal – Use of Explosives: The use of explosives is forbidden on ETSU Campus.

9. Demolished Asphalt Used As Fill Material: The use of demolished asphalt for fill material cannot be addressed prior to the bid date, as the existing material will need to be evaluated on the basis of size, content, consistency, etc. Accordingly, bids shall not be based on the use of demolished asphalt as fill material.

10. Stabilization of Disturbed Areas Upon Completion: Temporary and final stabilization must follow the requirements of the SWPPP and TDEC requirements, as regards duration of inactivity versus actual date of completion.

11. Unclassified vs Classified Excavation: All excavation is to be considered unclassified, down to design depth. Any removal and replacement of unacceptable fill materials below design depth will be handled accordance with the terms and conditions of the Contract for Construction.

ATTACHMENTS

A. Project Manual:
1. Specification Sections 00.01.10 and 33.31.00, dated as noted above.

B. Drawings:
2. Civil Drawings C111, C112; C121; C131; C141, C142; C151; C161; C171; C181; all Rev 1, all dated 19-NOV-15.

END ADDENDUM NO. 4
SECTION 00.01.10
TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS

00.01.07 - Seals Page
00.01.10 - Table of Contents (REVISED 19-NOV-15)
00.11.19 - Request for GMP Proposal (REVISED 27-OCT-15)
00.21.19 - Instructions to GMP Proposer
00.31.00 - Available Project Information (REVISED 27-OCT-15)
00.42.23 - Proposal Summary
00.42.71 - Proposal of Trade Subcontracts
00.42.75 - Proposal of General Conditions
00.42.79 - Proposal for Self-Performance
00.52.33 - ACH Credits Form
00.54.35 - W-9 Form
00.61.13 - Contract Bond
00.61.43 - Three Year Roof Bond
00.72.13 - General Conditions
00.73.16 - Supplementary Conditions

SPECIFICATIONS

DIVISION 01 -- GENERAL REQUIREMENTS

01.10.00 - Summary (REVISED 04-NOV-15)
01.25.13 - Product Substitution Procedures
01.25.33 - Product Substitution Request Form
01.26.00 - Contract Modification Procedures
01.26.20 - Weather Delays
01.26.25 - Weather Delay Report
01.26.40 - Amendment, Change Order, or Directive
01.26.54 - Form for Price Summary
01.26.55 - Form for Price of Work
01.26.56 - Form for Price of Time
01.29.16 - CM/GC-GMP Contingency and Reserve
01.29.17 - CM/GC-GMP Contingency Log
01.29.18 - CM/GC-GMP Reserve Log
01.29.54 - Retainage Escrow Initiation
01.29.73 - Schedule of Values
### TABLE OF CONTENTS

**01.29.76** - Payment Procedures  
**01.30.00** - Administrative Requirements  
**01.31.19** - Project Meetings  
**01.31.90** - Administrative Logs  
**01.31.93** - Visitor Log  
**01.32.15** - Progress Schedules and Reports  
**01.41.15** - Basic Regulatory Requirements  
**01.43.25** - Testing Laboratory Services  
**01.45.33** - Code-Required Special Inspections  
**01.50.00** - Temporary Facilities and Controls  
**01.57.23** - Temporary Storm Water Pollution Control (REVISED 04-NOV-15)  
**01.61.16** - Volatile Organic Compound (VOC) Content Restrictions (ISSUED 27-OCT-15)  
**01.62.25** - Product Options  
**01.74.19** - Construction Waste Management and Disposal  
**01.77.70** - Closeout Procedures  
**01.78.21** - Closeout Submittals  
**01.78.25** - Data Binder Receipt  
**01.78.88** - Report of Subcontractors and Suppliers  
**01.79.21** - Demonstration and Training  
**01.79.25** - Demonstration and Training Verification  
**01.91.13** - Commissioning  
**01.91.23** - Performance Testing Identification Form  
**01.91.26** - Performance Testing Procedures Form  
**01.91.29** - Functional Performance Test Certification

**DIVISION 02 -- EXISTING CONDITIONS**  
**02.41.00** - Demolition  
**02.82.13** - Asbestos Abatement  
**02.82.16** - Engineering Control of Asbestos-Containing Materials  
**02.82.33** - Removal and Disposal of Asbestos-Containing Materials  
**02.84.00** - Work With Other Hazardous Materials

**DIVISION 03 -- CONCRETE**  
**03.05.05** - Underslab Vapor Barrier  
**03.10.00** - Concrete Forming and Accessories  
**03.20.00** - Concrete Reinforcing  
**03.30.00** - Cast-in-Place Concrete

**DIVISION 04 -- MASONRY (NOT USED)**
DIVISION 05 -- METALS
05.12.00 - Structural Steel Framing
05.40.00 - Cold-Formed Metal Framing
05.50.00 - Metal Fabrications
05.52.13 - Pipe and Tube Railings

DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES
06.05.73 - Wood Treatment
06.10.00 - Rough Carpentry
06.41.00 - Architectural Wood Casework

DIVISION 07 -- THERMAL AND MOISTURE PROTECTION
07.13.00 - Sheet Waterproofing
07.21.00 - Thermal Insulation
07.61.00 - Sheet Metal Roofing
07.92.00 - Joint Sealants

DIVISION 08 -- OPENINGS
08.11.13 - Hollow Metal Doors and Frames
08.33.23 - Overhead Coiling Doors
08.51.13 - Aluminum Windows
08.71.00 - Door Hardware
08.71.10 - Basis of Design Door Hardware - Hager
08.80.00 - Glazing

DIVISION 09 -- FINISHES
09.05.61 - Common Work Results for Flooring Preparation
09.21.16 - Gypsum Board Assemblies
09.51.00 - Acoustical Ceilings
09.65.00 - Resilient Flooring
09.91.13 - Exterior Painting
09.91.23 - Interior Painting

DIVISION 10 -- SPECIALTIES
10.11.01 - Visual Display Boards (ISSUED 27-OCT-15)
10.28.00 - Toilet, Bath, and Laundry Accessories
10.44.00 - Fire Protection Specialties

DIVISION 11 -- EQUIPMENT
11.68.13 - Challenge Course (REVISED 27-OCT-15)

DIVISION 12 -- FURNISHINGS (NOT USED)
DIVISION 13 -- SPECIAL CONSTRUCTION
13.34.19 - Metal Building Systems

DIVISION 14 -- CONVEYING EQUIPMENT (NOT USED)

DIVISION 21 -- FIRE SUPPRESSION (NOT USED)

DIVISION 22 -- PLUMBING
22.05.53 - Mechanical Identification
22.07.19 - Piping Insulation
22.10.05 - Plumbing Piping

DIVISION 23 -- HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)
23.00.01 - Mechanical General Provisions
23.05.01 - Basic Materials and Methods
23.05.48 - Vibration and Seismic Controls for HVAC Piping and Equipment
23.05.93 - Testing, Adjusting, and Balancing for HVAC
23.07.13 - Duct Insulation
23.08.00 - Mechanical & Control Systems Commissioning
23.08.13 - Sensor Point Calibration Check Sheet
23.08.16 - Terminal Box Point Calibration Check Sheet
23.31.00 - HVAC Ducts and Casings
23.33.00 - Air Duct Accessories
23.76.55 - Small Split-System Heating and Cooling

DIVISION 26 -- ELECTRICAL
26.05.00 - Electrical General Provisions
26.05.01 - Basic Electrical Materials and Methods
26.05.16 - Conduit
26.05.19 - Wire and Cable
26.05.26 - Grounding and Bonding
26.05.29 - Supporting Devices
26.05.33 - Outlet and Junction Boxes
26.05.53 - Electrical Identification
26.05.73 - Overcurrent Protective Devices
26.08.00 - Electrical & Lighting Systems Commissioning
26.08.06 - Panelboard Check Sheet
26.08.13 - Power Circuit Check Sheet
26.08.50 - Lighting Check Sheet
26.22.00 - Dry Type Transformers
26.24.00 - Mechanical Equipment and Controls
26.24.16 - Panelboards
26.27.26 - Wiring Devices and Plates
26.28.18 - Disconnect Switches
26.51.00 - Interior Lighting
26.61.00 - General Lighting Provisions

DIVISION 27 -- COMMUNICATIONS
27.01.00 - Reference Standards
27.05.28 - Telecommunications Outside Plant (OSP)
27.05.29 - Hangers and Support
27.05.53 - Administration / Labeling
27.08.00 - Commissioning and Documentation
27.11.10 - Telecommunications Spaces
27.15.00 - Voice and Network Horizontal Cabling System
27.15.53 - Coax Horizontal Cabling

DIVISION 28 -- ELECTRONIC SAFETY AND SECURITY
28.03.00 - Fire Alarm System

DIVISION 31 -- EARTHWORK
31.10.00 - Site Clearing
31.20.00 - Earthwork
31.23.33 - Trenching and Backfilling
31.25.00 - Erosion and Sedimentation Controls

DIVISION 32 -- EXTERIOR IMPROVEMENTS
32.12.16 - Asphalt Paving
32.13.13 - Concrete Paving
32.16.00 - Curbs and Gutters
32.17.23 - Pavement Markings
32.31.13 - Chain Link Fences and Gates (REVISED 27-OCT-15)
32.31.19 - Decorative Metal Fences and Gates
32.92.19 - Seeding

DIVISION 33 -- UTILITIES
33.31.00 - Sanitary Utility Sewerage Piping (REVISED 19-NOV-15)
33.40.00 - Storm Drainage Utilities

END OF SECTION
SECTION 33.31.00
SANITARY SEWER (GRAVITY)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes installation of asphalt paving as follows:
   1. Installation of sanitary sewage gravity lines, lateral connections, and structures.

B. Related Sections:
   1. Section 015000 – Temporary Facilities and Controls
   2. Section 312000 – Earthwork
   3. Section 311100 – Site Clearing
   4. Section 312500 – Erosion and Sedimentation Controls

1.3 SUBMITTALS

A. Submittals shall be in electronic form (via email) and shall be stamped by the Contractor. Submit to the Owner or Owner’s Representative.

B. Unless noted otherwise, only submit items that vary from the construction plans. Describe in the submittal why the substitution is being requested.

1.4 QUALITY ASSURANCE

A. Provide and maintain a quality control system that will provide reasonable assurance that materials and construction conform to the specified requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery, storage, and handling shall be in accordance with the manufacturer’s specifications and recommendations and also that of the utility Owner or Owner’s Representative.

1.6 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.
PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials will be visually inspected by the Owner or Owner’s Representative at the site for conformance to the specifications. At the Owner or Owner’s Representative's discretion the Contractor may be required to supply certified mill tests, samples, or other suitable form of verification that the material meets the required specifications.

2.2 PIPE MATERIALS

A. Polyvinyl Chloride (PVC) pipe: Pipe and fittings shall meet or exceed the requirements of ASTM D3034, SDR 26 for pipe from 4" to 15" in diameter. For sizes from 18" to 27" in diameter, the pipe shall meet or exceed the requirements of ASTM F-679, wall thickness T-1. All PVC pipe shall meet the requirements of the Materials Specifications herein.

B. Ductile Iron Pipe (DIP): Pipe shall be made of good quality ductile iron in conformance with the latest revision of ANSI/AWWA C-151/A21.51 Standard. The pipe shall be push-on joint with a minimum pressure class of 350 psi, cement-lined (Protecto 401 or equivalent) according to ANSI 21.4/AWWA C-104, and coated inside and outside with an asphaltic coating. Ductile iron pipe and fittings shall conform to the requirements of the Materials Specifications herein.

C. Sewer laterals shall include 6-inch tees of the same material as the sewer main, which are able to withstand all test pressures without leakage.

2.3 FLEXIBLE COUPLINGS

A. Flexible couplings are designed to join sewer pipes of the same or different material or sizes. Flexible couplings shall fit over the end of plain end or spigot pipe to form a positive seal against infiltration and exfiltration in non-pressure applications. Flexible couplings shall flex with normal earth movement to maintain integrity of seal. Use of flexible couplings shall be at the Owner or Owner’s Representative's discretion.

B. Flexible couplings shall be manufactured from elastomeric Polyvinyl chloride (PVC) which is unaffected by soil conditions and resistant to chemical, ultraviolet rays, and normal sewer gases. The PVC material shall contain bactericide and fungicide to inhibit growth of bacteria and fungus. The PVC material shall be 55 minimum to 65 maximum Shore A durometer hardness. Couplings shall conform to the applicable parts of ASTM C-443, C-425, C-564, and D-1869.

C. Each flexible coupling shall be supplied with two corrosion resistant series 300 stainless steel clamps, which when tightened to 60 inch-pounds torque, seal the joint.

D. Flexible couplings shall be approved and listed by all of the following code agencies: SBCCI (southern Building Code Congress International, Inc.), BOCA (Building Officials & Code Administrators International, Inc.), IAPMO (International Association of Plumbing and Mechanical Officials), and CSA (Canadian Standards Association).
2.4 SADDLE TEES

A. Saddle tees shall consist of a gasketed skirt sized to fit the existing pipe and an integral 6-inch branch connection. The saddle shall include two stainless steel straps or a single 3-1/2" wide stainless steel strap to attach it to the existing pipe. Saddle tees shall meet the requirements of ASTM 3034 and F-477.

PART 3 - EXECUTION

3.1 GENERAL

A. Sewers shall be designed with a 10-foot horizontal separation from any existing or proposed water main. If this is not practical, the sewer may be placed closer than 10 feet to a water main, provided it is laid in a separate trench and the elevation of the top of the sewer is at least 18 inches below the bottom of the water main, or as directed by the Owner or Owner’s Representative or Owner or Owner’s Representative’s Representative.

B. Where a sewer crosses under a water main, the top of the sewer shall be at least 18 inches below the bottom of the water main. If the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation, or the water main shall be reconstructed with ductile iron pipe for a distance of 10 feet on each side of the sewer with a full pipe section of the water main centered over the sewer, or as directed by the Owner or Owner’s Representative.

1. Minimum slope for sanitary sewers shall be as follows:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Min. % Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
<td>0.62%</td>
</tr>
<tr>
<td>8&quot;</td>
<td>0.40%</td>
</tr>
<tr>
<td>10&quot;</td>
<td>0.28%</td>
</tr>
<tr>
<td>12&quot;</td>
<td>0.22%</td>
</tr>
<tr>
<td>15&quot;</td>
<td>0.15%</td>
</tr>
<tr>
<td>18&quot;</td>
<td>0.12%</td>
</tr>
<tr>
<td>21&quot;</td>
<td>0.10%</td>
</tr>
<tr>
<td>24&quot;</td>
<td>0.08%</td>
</tr>
</tbody>
</table>

Minimum slope for other diameters shall be such that a minimum velocity of 2 ft/sec is maintained while the pipe is flowing full.

C. Where the slope of a sewer line is in excess of 20%, the line shall be constructed of mechanical joint ductile iron pipe with concrete anchors at each joint or as specified by the Owner or Owner’s Representative or Owner or Owner’s Representative’s Representative.

D. Minimum cover in roadways and other traffic-bearing areas is 48 inches for PVC pipe and 30 inches for ductile iron pipe. In non-traffic-bearing areas, the minimum cover is 30 inches for either type of pipe.

E. Maximum depth for standard PVC pipe is 17 feet. Depths greater than 17 feet will generally require ductile iron pipe and shall be approved by the Owner or Owner’s Representative or Owner or Owner’s Representative’s Representative.
F. Ductile iron pipe shall be used beneath waterways which have a continuous flow of water. Concrete encasement shall be provided when joints on the ductile iron pipe are located beneath waterways, or as directed by the Owner or Owner’s Representative or Owner or Owner’s Representative’s Representative.

G. The maximum spacing for manholes shall be 400 feet for pipe diameters of 21 inches and smaller and 500 feet for larger pipes.

H. Where the difference in the invert elevations of two sewers intersecting in a manhole is 2 feet or more, a drop manhole shall be provided.

I. When ductile iron pipe must be used on a portion of a new sewer line segment due to minimum or maximum cover, water line proximity, or waterway crossing, the entire length of sewer must be installed with ductile iron pipe. No flexible couplings will be permitted on new construction to convert to PVC between manholes.

3.2 PIPE INSTALLATION

A. All pipe shall be installed in the presence of the Owner or Owner’s Representative. Do not begin the backfilling of trenches until the pipe in place has been visually inspected by the Owner or Owner’s Representative. Pipe installation shall begin at the lowest elevation, unless otherwise approved by the Owner or Owner’s Representative.

B. Trench bottoms that are found to be unsuitable for foundations after pipe laying operations have started shall be corrected by bringing them to exact line and grade with material approved by the Owner or Owner’s Representative.

C. Carefully inspect each piece of pipe and special fitting before it is placed, and lay no defective pipe in the trench. Pipelaying shall proceed upgrade, starting at the lower end of the grade and with the bells upgrade. When pipe laying is not in progress, keep the ends of the pipe tightly closed with an approved temporary plug.

D. Excavation for bell holes shall be large enough to allow ample room for the pipe joints to be properly made. Excavate out bell holes no more than 2 joints ahead of the pipe laying. Carefully grade the bottom of the trench between bell holes so that each pipe barrel rests on a solid foundation as specified in the Earthwork section. Install each pipe with a close concentric joint to avoid sudden offsets or inequalities in the flow line.

E. As the work progresses thoroughly clean the interior of the pipe in place. After each line of pipe has been laid, carefully inspect it, and remove and, in accordance with all laws and regulations, dispose of all earth, trash, rags, and other foreign matter from its interior.

F. Install tee branches in sewer lines to serve properly each lot adjoining the sewer and at such other locations as may be designated by the Owner or Owner’s Representative. If tee branches are not to be used immediately, close them with approved plugs that are held in place to prevent infiltration and withstand all test requirements.

G. For all tees that are plugged and laid in rock, blast a minimum of 6 linear feet of ditch line in the direction and to the approximate grade of the future lateral as directed by the Owner or Owner’s Representative, but do not excavate the material. Furnish the Owner or Owner’s Representative with a record of the exact location of each tee installed.
H. If the work consists of constructing a new sewer to replace an existing one, connect existing laterals to the new line. Laterals which have been disconnected, cut or abandoned shall be plugged and sealed with a backing block securing the plug.

I. Cleanouts will be required only for those laterals crossing a roadway. Cleanouts should be located on the property line in most cases. However, where a long lateral crosses another private property, the cleanout should be located at the road right-of-way. In that case, a 4-inch line may be installed upstream of the cleanout to the property line.

J. For new laterals to be installed on existing sewer lines larger than 6 inches in diameter, a sewer saddle as specified in Part 2 above may be used in lieu of a tee section. The saddle shall be installed on a clean-cut, properly sized hole on the existing sewer, such that a watertight connection results. The cut in the existing pipe shall be made with a hole saw which retains the coupon. Sewer saddles shall not be used on vitrified clay pipe, or any other pipe deemed unsuitable for this method by the Owner or Owner’s Representative, unless approved by the Owner or Owner’s Representative.

K. For new laterals to be installed on existing sewer lines 6 inches in diameter, or as required by the Owner or Owner’s Representative, the existing line shall be cut and a watertight tee section shall be installed, while pumping the existing wastewater flow around the work zone. The tee section shall consist of a new tee of the same diameter as the existing pipe, with short sections of pipe on either end. The tee section shall be installed with waterproof flexible couplings on each end as specified in Part 2 above to connect the pipe to the new tee section.

L. Install new connections to existing manholes as specified in Section 02530, Manholes-Sewer. Reshape the bottom at the manhole as necessary to fit the invert of the sewer pipe.

M. Carefully protect from damage all existing sewers, water lines, gas lines, sidewalks, curbs, gutters, pavements, electrical lines, and other utilities or structures in the vicinity of the work at all times. If it is necessary to repair, remove, and/or replace any such utility or structure in order to complete the work properly, do so in compliance with the provisions set forth in other sections of these Specifications. Any such work shall be considered incidental to the construction of sewer mains.

N. Water service connections will be repaired or replaced in accordance with the Water Service Assemblies section, by the Contractor at his expense as an incidental part of the work.

O. Service or house connections to existing sewers that are damaged or removed shall be repaired or replaced by the Contractor at his own expense as an incidental part of the work.

P. Wastewater flow must be maintained in the existing sewers. Whenever pipe-laying progresses to the point where this flow must be interrupted, the Contractor shall plug the sewer upstream of the construction and provide by-pass pumping to the downstream manhole. All downstream pipes, manholes and appurtenances must be tested and acceptable to the Owner or Owner’s Representative to receive wastewater flow. Discharging raw wastewater to natural waterways will not be permitted. The Contractor shall notify the Owner or Owner’s Representative prior to proceeding with by-pass pumping. When working in areas where interruption of wastewater flow may occur, the Contractor shall have lines and all other equipment in readiness at the site to provide by-pass pumping. A back-up pump and hose is required. Contractor will be liable for clean-ups, fines, and any other problems that may occur. All equipment will be checked by Owner or Owner’s Representative for proper working conditions.
3.3 TESTING OF GRAVITY SEWERS

A. Visual Tests

1. Prior to backfilling, the Owner or Owner’s Representative shall make a visual inspection of the sewer. The visual tests shall include a check for proper grade and alignment, sufficient pipe bedding, pipe condition, and general cleanliness. The Contractor shall immediately repair all defects found by such inspection.

2. Sewers shall be built so as to remain true to line and grade. The inclining grade of the bottom of the sewer after completion shall be such that, after flooding, the flood water drains off so that no remaining puddle of water is deeper than ½ inch on pipe 36 inches internal diameter or smaller and ¾ inch on pipe larger than 36 inches internal diameter. Any section of pipe that does not comply with the specifications at any time previous to final acceptance of the work shall be replaced or re-laid at the Contractor's expense.

3. The Contractor will be held strictly responsible that all parts of the work bear the load of the backfill. If cracks 1/100 inch develop in the pipe within one year from the date of final acceptance of the work, the Contractor will be required to replace, at his expense, all such cracked pipe. To this end, the Contractor is advised to purchase pipe under a guarantee from the manufacturer, ensuring proper service of sewer pipe under conditions established by the drawings, specifications, and local conditions at the site of the work.

B. Air Testing for Sewers 24 inches in Diameter and Smaller

1. The Contractor is responsible for providing all labor and equipment for air testing.

2. This recommended practice defines the proper procedures for acceptance testing of installed gravity sewer pipe using low-pressure air, to provide assurance that the pipe, as installed, is free from significant leaks. Included are requirements for equipment accuracy, safety precautions, line preparation, test method, and minimum holding times. Air test results shall be recorded on the work sheet, which is included below in paragraph E., Air Test Data Sheet.

3. Only lines tested after backfilling to final grade will be considered for acceptability. However, this test may also be used by the installer as a presumptive test to determine the condition of the line prior to backfilling. During sewer construction, all service laterals, stubs and fittings into the sewer test section shall be properly capped or plugged to prevent air loss that could cause an erroneous air test result. It may be necessary and is always advisable to restrain gasketed caps, plugs, or short pipe lengths with bracing stakes, clamps, and tie-rods or wire harnesses over the pipe bells.

4. Unless otherwise specified, the Contractor shall furnish all the necessary equipment and be responsible for conducting all low-pressure air tests. In addition, the Contractor is responsible for any necessary repair work on sections that do not pass the test. No sealant shall be used in any newly installed sewer without the prior approval of the Owner or Owner’s Representative. Using sealant in a sewer is not the equivalent of a sound sewer pipe. Proper structural repair work is much preferred and may be required by the Owner or Owner’s Representative.

5. The Owner or Owner’s Representative shall witness all low-pressure air tests and verify the accuracy and acceptability of the equipment utilized. The Owner or Owner’s Representative
should inform the Contractor regarding acceptable methods of repair in the event one or more sections fail to pass the low-pressure air test.

6. It is extremely important and essential that all plugs be installed and braced in such a way that blowouts are prevented. As an example of the hazard, a force of 250 pounds is exerted on an 8-inch plug by an internal pipe pressure of 5 psig, and a force of 2,250 pounds is exerted on a 24-inch plug by an internal pressure of 5 psig. It must be realized that sudden expulsion of a poorly installed plug, or of a plug that is partially deflated before the pipe pressure is released, can be very dangerous. For this reason, it is recommended that every plug be positively braced against the manhole walls, and that no one be allowed in the manhole adjoining a line being tested so long as pressure is maintained in the line.

It is further recommended that no internal pressure of more than 9 psig be permitted except for leak location equipment where the plugs are firmly tied together.

Either mechanical or pneumatic plugs may be used. All plugs shall be designed to resist internal testing pressures without the aid of external bracing or blocking. However, the Contractor should internally restrain or brace the plugs to the manhole wall as an added safety precaution throughout the test.

7. All pressurizing equipment used for low-pressure air testing shall include a regulator or relief valve set no higher than 9 psig to avoid over-pressurizing and displacing temporary or permanent plugs. As an added safety precaution, the pressure in the test section should be continuously monitored to make certain that it does not at any time exceed 9 psig. (It may be necessary to apply higher pressure at the control panel to overcome friction in the air supply hose during pressurization.)

8. To facilitate test verification by the Owner or Owner’s Representative, all air used shall pass through a single, above ground control panel. The above ground air control equipment shall include a shut-off valve, pressure relief valve, input pressure gauge, and a continuous monitoring pressure gauge having a pressure range from 0 to at least 10 psi. The continuous monitoring gauge shall be no less than 4 inches in diameter with minimum divisions of 0.10 psi and an accuracy of +/- 0.04 psi. Two separate hoses shall be used to: (1) connect the control panel to the sealed line for introducing low-pressure air, and (2) a separate hose connection for constant monitoring of air pressure build-up in the line. This requirement greatly diminishes any chance for over-pressurizing the line.

If pneumatic plugs are utilized, a separate hose shall also be required to inflate the pneumatic plugs from the above ground control panel.

9. After a manhole-to-manhole reach of pipe has been backfilled to final grade and compacted, prepared for testing, and a 24-hour waiting period has elapsed, the plugs shall be placed in the line at each manhole and secured.

It is advisable to seal test all plugs before use. Seal testing may be accomplished by laying one length of pipe on the ground and sealing it at both ends with the plugs to be checked. The sealed pipe should be pressurized to 9 psig. The plugs shall hold against this pressure without bracing and without any movement of the plugs out of the pipe. No persons shall be allowed in the alignment of the pipe during plug testing. It is advisable to plug the upstream end of the line first to prevent any upstream water from collecting in the test line. This is particularly important to high groundwater situations.
When plugs are being placed, the pipe adjacent to the manhole shall be visually inspected to detect any evidence of shear in the pipe due to differential settlement between the pipe and the manhole. A probable point of leakage is at the junction of the manhole and the pipe, and this fault may be covered by the pipe plug, and thus not revealed by the air test.

10. Low-pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig. If the groundwater table is above the sewer being tested, the air pressure shall be increased 0.43 psi for each foot that the water table is above the invert of the sewer, up to a maximum of 9.0 psig. After a constant pressure of 4.0 psig (greater than the average groundwater back pressure) is reached, the air supply shall be throttled to maintain that internal pressure for at least 2 minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall.

When temperatures have been equalized and the pressure stabilized at 4.0 psig (greater than the average groundwater backpressure), the air hose from the control panel to the air supply shall be shut off or disconnected. The continuous monitoring pressure gauge shall then be observed while the pressure is decreased to no less than 3.5 psig (greater than the average backpressure of any groundwater over the pipe). At a reading of 3.5 psig, timing shall commence with a stopwatch.

If the time shown for the designated pipe size and length (see paragraph D., Air Test Time Tables, below) elapses before the air pressure drops 0.5 psig, the section undergoing test shall have passed. The test may be discontinued once the prescribed time has elapsed even though the 0.5 psig drop has not occurred. If the pressure drops 0.5 psig before the appropriate time shown in Table I has elapsed, the air loss rate shall be considered excessive and the section of pipe has failed the test.

If the section fails to meet these requirements, the Contractor shall determine at his own expense the source, or sources, of leakage, and he shall repair or replace all defective materials and/or workmanship to the satisfaction of the Owner or Owner’s Representative. The extent and type of repair which may be allowed, as well as results, shall be subject to the approval of the Owner or Owner’s Representative. The completed pipe installation shall then be retested and required to meet the requirements of this test.

C. Testing for Sewers Larger than 24 Inches in Diameter

1. The Contractor is responsible for providing all labor and equipment for testing.

2. Where the natural groundwater is 24 inches or more above the top of a section of pipe, the Contractor shall measure the flow of water in the pipe and the rates of seepage and infiltration. Measure the flow rate by using a calibrated weir. Leave the weir in the line until the flow rate has stabilized. The Contractor is responsible for verifying the groundwater level by providing sight gauges in manholes or digging test holes at suitable locations.

The total seepage and infiltration of groundwater as determined by the test shall in no case exceed 50 gallons per 24 hours per inch-mile of pipe. Make infiltration tests on all sewer construction before placing the lines in service and before making any connections to other sewers. If the amount of infiltration into the sewer(s) is in excess of the maximum quantity specified above, then repair the joints, relay the sewer (if necessary), or perform other remedial construction, at the Contractor's expense, in order to reduce groundwater infiltration to within the specified limits.
In making infiltration tests, furnish the required equipment and labor and do the necessary pumping under the direction of the Owner or Owner’s Representative. Tests may be repeated until each sewer individually meets the specifications for infiltration amounts as set above.

3. Where the groundwater is not 24 inches or more above the top of the pipe section being tested, the Contractor shall perform an exfiltration test. Bulkhead the pipe below the lower manhole of the section being tested with a pneumatic plug or other device. Insert a vent pipe 48 inches long in the stopper of the upper end of that section. Then fill the lower manhole with water, or add water until there is a minimum of 4 feet over the upper end; make certain that all air is forced out through the vent tube. Measure the drop in the level of the water in the manhole due to exfiltration over a specific time, and calculate the water loss due to exfiltration. The total exfiltration shall not exceed that specified above for infiltration.

D. **Air Test Time Tables**

The following tables indicate the time that must elapse before the air pressure inside the pipe drops 0.5 psig. If the pressure inside the pipe drops 0.5 psig before the time has completely elapsed, the air loss rate shall be considered excessive and the section of pipe has failed the test.

**MINIMUM SPECIFIED TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015 ft.³/min.**

<table>
<thead>
<tr>
<th>Pipe Dia. (in.)</th>
<th>2 Min. Time (min.:sec.)</th>
<th>3 Length For Min. Time (ft.)</th>
<th>4 Time for Longer Length (sec.)</th>
<th>Specification Time for Length (L) Shown (min.:sec.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100 ft.</td>
</tr>
<tr>
<td>4</td>
<td>1:53</td>
<td>597</td>
<td>.190 L</td>
<td>1:53</td>
</tr>
<tr>
<td>6</td>
<td>2:50</td>
<td>398</td>
<td>.427 L</td>
<td>2:50</td>
</tr>
<tr>
<td>12</td>
<td>5:40</td>
<td>199</td>
<td>1.709 L</td>
<td>5:40</td>
</tr>
<tr>
<td>15</td>
<td>7:05</td>
<td>159</td>
<td>2.671 L</td>
<td>7:05</td>
</tr>
<tr>
<td>18</td>
<td>8:30</td>
<td>133</td>
<td>3.846 L</td>
<td>8:30</td>
</tr>
<tr>
<td>30</td>
<td>14:10</td>
<td>80</td>
<td>10.683 L</td>
<td>17:48</td>
</tr>
<tr>
<td>36</td>
<td>17:00</td>
<td>66</td>
<td>15.384 L</td>
<td>25:39</td>
</tr>
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</table>
### E. Air Test Data Sheet

Air test results shall be recorded on the following worksheet:

<table>
<thead>
<tr>
<th>Pipe Dia. (in.)</th>
<th>2 Min. Time (min.: sec.)</th>
<th>3 Length For Min. Time (ft.)</th>
<th>4 Time for Longer Length (sec.)</th>
<th>Specification Time for Length (L) Shown (min.:sec.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>1:53</td>
<td>597</td>
<td>.190 L</td>
<td>1:53</td>
</tr>
<tr>
<td>6</td>
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<td>398</td>
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<td>298</td>
<td>.760 L</td>
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<td>10</td>
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<td>1.187 L</td>
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<tr>
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<td>159</td>
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<td>13:21</td>
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<td>133</td>
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<td>19:14</td>
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<td>34:11</td>
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<td>88</td>
<td>8.653 L</td>
<td>43:16</td>
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<td>30</td>
<td>14:10</td>
<td>80</td>
<td>10.683 L</td>
<td>53:25</td>
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<tr>
<td>33</td>
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<td>12.926 L</td>
<td>64:38</td>
</tr>
<tr>
<td>36</td>
<td>17:00</td>
<td>66</td>
<td>15.384 L</td>
<td>76:55</td>
</tr>
</tbody>
</table>

**AIR TEST DATA SHEET**

**CONSTRUCTION DOCUMENTS PACKAGE**

Revised: 19-NOV-15
### Field Test Data: (To be filled in by the inspector)

| Date: | Specified Maximum Pressure Drop: psig |

#### Identification of Pipe Material Installed:

<table>
<thead>
<tr>
<th>Pipe Under Test</th>
<th>Specification Time</th>
<th>Field Test Operations Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream MH sta #</td>
<td>Downstream MH sta #</td>
<td>Dia. D (in.)</td>
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<tr>
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</table>

Inspector's Name and Title:  
Signature of Inspector:

If a section fails, the following items should be completed:

- Identify section(s) that failed:
- Leak (was) (was not) located. Method used:
- Description of leakage found:
- Description of corrective action taken:

For test results after repair refer to Test No.: Inspector:

### 3.4 DEFLECTION TESTING FOR PVC PIPE

A. The Contractor is responsible for providing all labor and equipment for deflection testing.
B. Test deflection of the pipe by manually pulling with twine a one-piece 9-arm go/no-go mandrel (sized in accordance with ASTM D3034) through the pipe. Within 24 hours after compaction of the backfill is complete, the line shall be tested using a 5% deflection mandrel. If the line is satisfactory, it shall be retested using a 7.5% deflection mandrel no less than 30 days following the completion of compaction.

3.5 CLEANUP

A. After completing each section of the sewer line, all debris and construction materials shall be removed from the work site and disposed of in compliance with all applicable laws and regulations and with Section 02321, paragraph 3.4. Then the surface shall be graded and smoothed on both sides of the line. The entire area shall be left clean and in a condition satisfactory to the Owner or Owner’s Representative. The Contractor shall keep cleanup operations as close to active pipe laying activities as practical, generally following by less than 300 feet, or as approved by the Owner or Owner’s Representative.

END OF SECTION