SMALL DIAMETER FORCE MAIN SPECIFICATIONS

SECTION 0 – GENERAL REQUIREMENTS

PART 1 – GENERAL OVERVIEW

1.01 Definitions – For the purposes of these Small Diameter Force Main Specifications ("SPECIFICATIONS"), the following definitions shall apply:
A. "HSE" shall mean Hamilton Southeastern Utilities, Inc., the public utility which provides sanitary sewer service in the PROJECT (as hereafter defined) area. HSE's address is 11901 Lakeside Drive, Fishers, Indiana 46038, and HSE's phone number is (317) 577-2300.
B. "ENGINEER" shall mean the engineer for HSE, which is Sanitary Management & Engineering Company, Inc. ("SAMCO") or SAMCO's engineers. SAMCO's inspector shall be the ENGINEER's representative during construction of the PROJECT. SAMCO's address is 11901 Lakeside Drive, Fishers, Indiana 46038, and SAMCO's phone number is (317) 577-1150.
C. "SUBSCRIBER" shall mean those signatories identified as SUBSCRIBERS under a Special Contract for Extension of Sewer Mains and Facilities with HSE through which the PROJECT is being undertaken. SUBSCRIBER is generally the Owner under a construction contract. This definition is intended to include all employees and/or agents acting in the interest of the SUBSCRIBER.
D. "CONTRACTOR" shall mean any construction contractor approved by HSE to construct, install, maintain, repair and remove public or PRIVATE (as hereafter defined) SANITARY SEWER FACILITIES (as hereafter defined) within the HSE service area. This definition is intended to include all employees, sub-contractors and/or agents acting for or on behalf of the CONTRACTOR or the CONTRACTOR's company.
E. "DESIGN ENGINEER" shall mean the engineer sealing the CONSTRUCTION PLANS (as hereafter defined), as opposed to the ENGINEER for HSE and the RECORD DRAWING ENGINEER, both of whom are also defined under these SPECIFICATIONS. This definition is intended to include all employees, sub-contractors and/or agents acting for or on behalf of the DESIGN ENGINEER or the DESIGN ENGINEER's company.
F. "RECORD DRAWING ENGINEER" shall mean the professional who will certify the record drawings, as opposed to the ENGINEER for HSE and the DESIGN ENGINEER, both of whom are also defined under these SPECIFICATIONS. The RECORD DRAWING ENGINEER and DESIGN ENGINEER may be the same person or represent the same company. This definition is intended to include all employees and/or agents acting for or on behalf of the RECORD DRAWING ENGINEER or the RECORD DRAWING ENGINEER's company.
G. "PROJECT" shall mean any SANITARY SEWER FACILITIES constructed under a distinct set of contract documents and shall include all work necessary for the COMPLETE (as hereafter defined) and operable installation of all SANITARY SEWER FACILITIES and appurtenances in conformity with the HSE approved CONSTRUCTION PLANS and the standards, specifications and details of HSE.
H. "SANITARY SEWER FACILITIES" shall mean any lift station wet wells and valve vaults, I & A septic tanks, station piping, force mains, pipes, air/vacuum release manholes, clean-out manholes, manholes, flow monitoring/metering manholes, clean-outs, grease traps, grit traps, oil/water separators, neutralization tanks, wyes, laterals, valves and valve boxes, submersible pumps and controls, control panel, alarm devices, float system, electrical wire in conduit from wet well to control panel, vents, slide rails and hoist system, wet well and valve vault access doors, fittings, thrust blocks, odor control, asphalt access drives, fencing and any other appurtenances which convey or process sanitary sewage.
I. "CONVEYED" with regards to SANITARY SEWER FACILITIES shall mean PROJECTS for which HSE has received title.
J. "PRIVATE" with regards to PROJECTS shall mean PROJECTS from which sewage flows into HSE's SANITARY SEWER FACILITIES, but for which title for the SANITARY SEWER FACILITIES is not to be CONVEYED to HSE.
K. "COMPLETED" with regards to PROJECTS shall mean any PROJECTS which are acceptably constructed, tested and through which customer service has been authorized by HSE, but for which HSE has not received title. All applicable fees must be paid to HSE and all requirements specified in HSE's "Sanitary Sewer Completion Specifications" must be addressed prior to a PROJECT being deemed COMPLETED.
L. "CONSTRUCTION PLANS" shall mean primary plats, secondary plats, sets of construction drawings, architectural plans, shop drawings, landscaping plans, record drawings, easements, deeds, covenants and restrictions, contract documents and any other documentation to be submitted for the PROJECT under these SPECIFICATIONS and HSE's "Design Specifications for Sanitary Sewer Facilities". CONSTRUCTION PLANS must meet the applicable standards in effect at the time the documents are submitted.
M. "COMPLETION DOCUMENTATION" shall mean record drawings and other documentation to be submitted under HSE's "Sanitary Sewer Completion Specifications". COMPLETION DOCUMENTATION must meet the applicable standards in effect at the time the documents are submitted.

1.02 Purpose
The purpose of these SPECIFICATIONS is to define the standards for engineering design, construction specifications and construction practices related to the PROJECT which will allow for the orderly and proper installation of SANITARY SEWER FACILITIES constructed within HSE's service area.

1.03 Applicability
These SPECIFICATIONS are applicable for all public and PRIVATE SANITARY SEWER FACILITIES which will be connected to HSE's sanitary sewer system. This includes PRIVATE PROJECTS which will not initially be connected to HSE's sanitary sewer system but at some future date may be connected to the system.

1.04 Liability and Costs for PROJECT
No direction, field directive or other instruction contemplated by these SPECIFICATIONS and/or conducted by others shall accrue any liability, charge or cost to HSE, ENGINEER or ENGINEER's inspectors.

1.05 Standards, Specification and Details
A. HSE's Gravity Sanitary Sewer Details sheet, Gravity Sanitary Sewer Specifications sheet, Common Force Main Details sheet, Grinder Pump Details sheet, Standards for Design and Construction of Building Sewers, Rules and Regulations, Master Plan, Design Specifications for Sanitary Sewer Facilities and Sanitary Sewer Completion Specifications are integral parts of these SPECIFICATIONS. The CONTRACTOR should become familiar with these documents prior to construction of any SANITARY SEWER FACILITIES within HSE's service area.
B. These SPECIFICATIONS, HSE's Common Force Main Details sheet, Grinder Pump Details sheet and Design Specifications for Sanitary Sewer Facilities are complementary in nature and should not be interpreted individually.
C. These SPECIFICATIONS and HSE's Common Force Main Details sheet, Grinder Pump Details sheet, Master Plan and other standards, specifications and details are subject to revision at any time prior to the start of construction of the PROJECT. These documents are also subject to revision at any time during construction when, in ENGINEER's opinion, those revisions materially affect the maintenance, operation or life of the PROJECT. All such revised documents must replace the corresponding documents in the CONSTRUCTION PLANS at the time when provided to the CONTRACTOR.
D. HSE reserves the right to modify or waive any of these SPECIFICATIONS and/or its Master Plan and other standards, specifications and details in its best interest.
E. These SPECIFICATIONS are intended to define the construction requirements of SANITARY SEWER FACILITIES which are constructed and operated under typical conditions in HSE's service area. Depending on field conditions and the composition and characteristics of the sanitary sewer flow, different or unusual conditions may occur which cannot be anticipated in a document of this nature. ENGINEER may impose additional or special construction requirements under these circumstances.

1.06 Drawing Discrepancies and Omissions
A. Prior to the start of construction, the CONTRACTOR must notify ENGINEER of any conflicts between the CONSTRUCTION PLANS, any supplemental information supplied by HSE and/or these SPECIFICATIONS. Resolution of any such conflict will be at the ENGINEER's sole discretion.
B. Any items which are not covered in these SPECIFICATIONS, the CONSTRUCTION PLANS or HSE's other standards, specifications and details, but are required for construction of this PROJECT, must be approved by ENGINEER prior to installation and must be made a part of this contract.
C. If construction practices are not described, but in the ENGINEER's opinion, will affect the quality of construction or long term maintainability of the SANITARY SEWER FACILITIES, then the ENGINEER must approve any construction practices proposed by the CONTRACTOR.

1.07 Governing Laws, Codes and Regulations
A. Construction practices must meet all applicable laws, codes or regulations and be in accordance with the requirements of all governmental agencies and public entities having jurisdiction.
B. These SPECIFICATIONS shall not be considered as a substitute, nor shall supersede any state or federal law, code or regulation related to the PROJECT. In the event of a conflict between any state or federal law, code or regulation governing the PROJECT and these SPECIFICATIONS, the more stringent requirement will apply.
C. All persons on site must abide by all Indiana Occupational Safety and Health Administration ("IOSHA") standards including but not limited to "General Construction Practices" and "Trench Safety Standards".

1.08 Notices
All notices required by these SPECIFICATIONS must be given to both HSE and ENGINEER at their respective business offices.

PART 2 – GENERAL CONSTRUCTION REQUIREMENTS

2.01 General
A. These SPECIFICATIONS cover all work necessary for the installation of SANITARY SEWER FACILITIES and other appurtenances to convey sewage from the pumps to the receiving sewer in an acceptable and operable manner.
B. CONTRACTOR must provide all necessary work to install the SANITARY SEWER FACILITIES in a COMPLETE manner in accordance with the CONSTRUCTION PLANS.
C. All pumps, pipe, fittings, valves and appurtenances must be the size, type, classification and grade shown on the CONSTRUCTION PLANS and must meet all requirements of these SPECIFICATIONS.
D. CONTRACTOR must not substitute materials which differ from the approved CONSTRUCTION PLANS unless approved by ENGINEER.
E. All pipe, fittings and valve sizes and all references to pipe diameter on the CONSTRUCTION PLANS or in these SPECIFICATIONS are intended to be nominal size or diameter and must be interpreted as such.
F. If a material type is shown on the CONSTRUCTION PLANS, the material type must describe a general category of materials meeting these SPECIFICATIONS.

2.02 Submittals
A. CONTRACTOR must submit only one model number or type per item for approval. Multiple submittals of model number or type for a single item will be cause for rejection of the shop drawing.
B. Before delivery of products to the site (for standard yard stocked items) or before fabrication (for items which are not standard yard stocked items), CONTRACTOR must provide submittals to, and obtain acceptance from, ENGINEER. Submittals must be thoroughly reviewed by CONTRACTOR and certified to meet these SPECIFICATIONS (with all exceptions explicitly indicated) prior to submission to ENGINEER.
C. Shop drawings with performance data, field measurements, details of fabrication, details of installation and physical characteristics for mechanical products, including valves, controls, pumps, etc.
D. Shop drawings for control and other electrical wiring.
E. System head curve plotted with the proposed pump curve.
1. The plot must also indicate the pump efficiency, solids handling capacity and reflect the motor service factor.
2. Efficiency and other performance data must be based on performance with an un-coated impeller. Attempts to improve reported efficiency by coating impeller will not be accepted.
F. Catalog cuts with product data, including details of manufacture, for all manufactured items.
G. Manufacturer's recommendations on all materials and methods of installation.
H. Forms of warranty.
1. Warrant equipment free from manufacturing and installation defects for a period of three (3) years and pumps for a period of one (1) year from date of successful operation. Successful operation date will be the first day of the initial thirty (30) day period where pump station and system functioned without failure due to defects in workmanship or materials.
2. I & A septic tank manufacturers must warrant their tanks to remain water tight and structurally sound for a period of three (3) years from date of manufacture and for at least two (2) years after delivery to the site. The warranty must include any joints and fittings installed by the manufacturer and others installed according to the manufacturer's recommendations.
I. Operation and maintenance instructions for all mechanical and electrical equipment.
J. If the SANITARY SEWER FACILITIES are to be CONVEYED, then CONTRACTOR must provide HSE with copies of all contracts, invoices, statements, material lists, payment requests and all other related documents pertaining to the construction cost of the PROJECT. The above documents must be provided monthly, unless otherwise determined by HSE.
K. Submit any other items required by the ENGINEER.

2.03 Initiation of Construction
A. CONSTRUCTION PLAN approval will be an authorization to proceed with construction of the PROJECT, however, it shall not be construed as authority to violate, cancel or set aside any of HSE's requirements or the laws, codes, regulations and permit processes of governmental agencies or public entities. Approval will be evidenced by an "Approved Hamilton Southeastern Utilities, Inc." stamp on the CONSTRUCTION PLANS.
B. CONSTRUCTION PLAN approval will be valid for a period of six (6) months from the date of the approval stamp. Extensions of this time limit may be requested from ENGINEER if extenuating circumstances exist. ENGINEER's decision regarding time extensions will be final.
C. Prior to the start of construction, DESIGN ENGINEER must receive formal written approval from ENGINEER. At this time, DESIGN ENGINEER must supply ENGINEER with five (5) complete sets of CONSTRUCTION PLANS for distribution to the ENGINEER's inspectors and CONTRACTOR.
D. CONTRACTOR will not be permitted to initiate construction until the CONSTRUCTION PLANS are formally approved and the SUBSCRIBER has entered into all necessary agreements and authorizations with, and all required fees have been paid to, HSE.
E. CONTRACTOR will not be permitted to initiate construction until all applicable permits have been obtained from and approved by all affected government agencies and public entities. Copies of the permits must be submitted to ENGINEER for review.
F. CONTRACTOR will not be permitted to initiate construction until all off-site easements have been reviewed, approved and recorded by ENGINEER.
G. The pipe layers and foreman (superintendent) assigned to the PROJECT must be approved by HSE prior to the start of construction.
H. Notice must be provided to ENGINEER twenty-one (21) days prior to the initiation of construction.
I. A pre-construction meeting is required between the ENGINEER and CONTRACTOR prior to the initiation of construction. The pre-construction meeting must be completed no more than fourteen (14) days prior to the start of construction.

2.04 Continuity of Construction
A. Once construction has commenced, the PROJECT must be COMPLETED promptly and in a timely manner as directed by the ENGINEER.
B. CONTRACTOR can not discontinue work on the PROJECT, except for weather delays, without written approval from the ENGINEER and in this case no sanitary sewer structures including wet wells, I & A septic tanks, air/vacuum release manholes, clean-out manholes, flow monitoring/metering manholes, grease traps, grit traps, oil/water separators, neutralization tanks, etc. ("MANHOLES") can be left open and incomplete.

2.05 Confined Space Entry
All persons, including but not limited to SUBSCRIBERS, CONTRACTORS, sub-contractors, DESIGN ENGINEERS, RECORD DRAWING ENGINEERS and surveyors must abide by HSE's "General Procedures for Manhole Opening and Entry" or the most recent IOSHA confined space entry standards, which ever is more stringent.

2.06 Cleanliness
A. The PROJECT site must, at all times, be kept free of trash, rubbish, unsightly materials and other nuisances.
B. All streets, alleys, pavement, parkways and private property must be thoroughly cleaned each day of all surplus materials, earth and rubbish.
C. PROJECT site must be cleaned at the end of each work day. Trash receptacles must be provided as necessary to dispose of waste items.

2.07 Product Delivery, Handling and Storage
A. The CONTRACTOR is responsible for the delivery, storage and handling of products.
B. Deliver products with manufacturer's tags and labels intact.
C. Handle products in accordance with manufacturer's recommendations and with extreme care so as not to damage or shock. Load and unload all products by hoists or skidding. Do not drop products. Do not skid or roll products on or against other products. Slings, hooks and pipe tongs must be padded.
D. Keep stored products safe from damage or deterioration in accordance with manufacturer's recommendations. Keep the interior of products free from dirt or foreign matter. Drain and store products in a manner that will protect them from damage by freezing. Store electronic and electrical products in a manner that will protect them from freezing and weather. Do not stack products unless allowed by the manufacturer's requirements. Store gaskets and other products affected by sunlight in a cool location out of direct sunlight. Gaskets must not come in contact with petroleum products. Use gaskets on a first-in, first-out basis. Pipe must be stored on clean, level ground to prevent undue scratching or gouging.
E. Promptly remove damaged or defective products from the PROJECT site. Replace damaged or defective products with acceptable products.
F. The CONTRACTOR is responsible for verifying that the materials are free of defects and are the proper type, classification, grade, etc. complying with the CONSTRUCTION PLANS and/or HSE's standards, specifications and details.

2.08 Quality Assurance
A. The CONTRACTOR must test and perform quality assurance requirements on all SANITARY SEWER FACILITIES in accordance with these SPECIFICATIONS.
B. Execute work in conformance with applicable sections of the latest published editions of American National Standards Institute ("ANSI"), American Society of Mechanical Engineers ("ASME"), American Society for Testing and Materials ("ASTM"), American Water Works Association ("AWWA"), American Welding Society ("AWS") and National Electrical Manufacturers Association ("NEMA") standards or as indicated in these SPECIFICATIONS and/or the CONSTRUCTION PLANS, whichever is more stringent.
C. All materials and products installed by CONTRACTOR must be of the type approved by the National Electric Code ("NEC"), Uniform Building Code and Underwriters Laboratories Inc. ("UL"). All components of control panels must conform to the above, however, the assembled control panel does not require a UL label.
D. All SANITARY SEWER FACILITIES must be new and unused.
E. The CONTRACTOR must provide assurance to the ENGINEER that the force main is laid accurately to the required line and grade as shown on the CONSTRUCTION PLANS. The CONTRACTOR must constantly check horizontal alignment of the force main. The CONTRACTOR must coordinate verification of the SANITARY SEWER FACILITIES with the RECORD DRAWING ENGINEER so as to provide an as-built record set as described later in these SPECIFICATIONS. Verification is defined as certification by an appropriately registered Indiana professional as to actual elevation and horizontal location of the force main. Variations from a uniform line and grade as shown on the CONSTRUCTION PLANS are cause for the force main to be rejected and re-laid in compliance with the CONSTRUCTION PLANS.

2.09 Inspection and Rejection of Materials
A. The quality of all materials, the process of manufacture and the finished product are subject to inspection and acceptance by the ENGINEER. Such inspection may be made at the place of manufacture and/or on the work site after delivery. The products are subject to rejection at any time for failure to meet any of the manufacturer's specifications even though samples may have otherwise been accepted as satisfactory.
B. Immediately prior to being incorporated into the PROJECT, each product must be carefully inspected, and those not meeting these SPECIFICATIONS and the applicable (Common Force Main Details or Grinder Pump Details) HSE detail sheet must be rejected, immediately removed from the site and replaced at CONTRACTOR's sole expense.
C. CONTRACTOR must not repair, or permit manufacturer to repair, any pre-cast concrete structures with exposed steel or welded wire fabric reinforcement.
D. Pre-cast reinforced concrete structures, risers and tops are subject to rejection for failure to conform with, but not limited to, any of the following requirements:
1. Fractures or cracks passing through the shell with a depth greater than or equal to one (1) inch.
2. Defects that indicate imperfect proportioning, mixing and molding.
3. Surface defects indicating honeycombed or open texture.
4. Damaged ends where such damage would prevent making a satisfactory joint.
5. Infiltration into the structure.
6. The internal diameter of the structure must not vary more than one (1) percent from the nominal diameter.
7. Not clearly marked with date of manufacturer, trade name, size designation, ASTM number, etc.8. Having any visible steel bars or wire mesh along inside or outside surfaces of the structure.
9. Evidence of patching.

2.10 Relation to Wells and Water Supplies
A. Force mains must be laid at least ten (10) feet horizontally from any existing or proposed water main. The distance is to be measured edge to edge. Should specific conditions prevent this separation, the CONTRACTOR must notify the ENGINEER for specific instructions.
B. Whenever the force main crosses a water main, it should be laid at least eighteen (18) inches below the main.
C. Sewer/water supply separations and pipe classifications must conform with the latest edition of the Indiana State Board of Health's ("ISBH") "On-Site Water Supply and Wastewater Disposal for Public and Commercial Establishments – Bulletin S.E. 13."

2.11 Utilities
A. All existing utility systems that conflict with the construction of the PROJECT, which can be temporarily removed and replaced, must be accomplished at the expense of the CONTRACTOR. Work must be done by the respective utility unless the utility approved in writing that the CONTRACTOR can do the work.
B. Permanent Relocation of Utilities
1. Except as otherwise noted on the CONSTRUCTION PLANS, it is the responsibility of the CONTRACTOR to move or pay for moving all utility appurtenances, including but not limited to, water mains, storm sewer inlets, gas lines, wire lines, service connections, water and gas meter boxes, water and gas valve boxes, light and traffic standards, cable ways, signals, etc. located in the public right-of-way or private easement which would permanently interfere with the PROJECT.
2. It is understood and agreed that the CONTRACTOR has considered in his bid all of the permanent and temporary utility appurtenances shown or otherwise indicated on the CONSTRUCTION PLANS. It is also understood and agreed that no additional compensation will be allowed for any delays, inconvenience or damage sustained by the CONTRACTOR due to any interference from said utility appurtenances or the operation of moving them either by the respective utility company or the CONTRACTOR.
C. The CONTRACTOR must provide, at CONTRACTOR's expense, all electrical and gas energy, water service (including water for flushing and testing) and telephone service required for the PROJECT until the PROJECT is COMPLETED.

2.12 Installation Service
The manufacturer of any SANITARY SEWER FACILITIES may be required to provide installation advice on bedding, haunching and backfill to the CONTRACTOR's work force. ENGINEER will determine the need for these services based on the experience of the CONTRACTOR's work force or field conditions encountered during construction.

2.13 Product Installation
A. Install all products in strict accordance with manufacturer's recommendations and these SPECIFICATIONS in a neat and workmanlike manner.
B. Bring all conflicts between the manufacturer's recommendations and these SPECIFICATIONS to the attention of ENGINEER and obtain direction from ENGINEER as to the resolution of any conflict in installation directives.

2.14 As-Built Record Set
A. CONTRACTOR must maintain, during the course of the PROJECT, an up-to-date plan set which accurately reflects the actual, as-built dimensions, materials of construction, horizontal location, vertical elevation and other relevant information necessary to develop a set of as-built record drawings in accordance with HSE's "Sanitary Sewer Completion Specifications".
B. As-built horizontal locations and vertical elevations are required on all fittings (including ells, tees, valves and adapters), the force main (at a maximum separation of 500 feet) and MANHOLES (including initially installed I & A septic tanks and grinder pump stations).
C. Failure to provide as-built information as specified in HSE's "Sanitary Sewer Completion Specifications" may require excavation by the CONTRACTOR to obtain this information.

2.15 COMPLETION DOCUMENTATION
A. HSE's "Sanitary Sewer Completion Specifications" specify the requirements which must be met prior to the time the PROJECT is placed into service.
B. CONTRACTOR and RECORD DRAWING ENGINEER must provide to HSE and ENGINEER in SUBSCRIBER's name the necessary COMPLETION DOCUMENTATION for the PROJECT, including record drawings and a digital file. At the end of construction, ENGINEER will provide a Record Drawing Notification to the SUBSCRIBER and RECORD DRAWING ENGINEER. COMPLETION DOCUMENTATION, including record drawings in a digital file format, must be delivered by CONTRACTOR and RECORD DRAWING ENGINEER in the name of SUBSCRIBER to ENGINEER within thirty (30) days of the date of this notification. If the COMPLETION DOCUMENTATION has not been provided within sixty (60) days of the date of this notification, HSE will procure the services necessary to generate or otherwise acquire the record drawings and other COMPLETION DOCUMENTATION at SUBSCRIBER's expense.
C. RECORD DRAWING ENGINEER must also submit Sanitary Sewer Record Drawing Information sheets or field notes for all MANHOLES that have not been previously as-built. These sheets must be submitted to ENGINEER within fourteen (14) days of the Record Drawing Notification.
D. CONTRACTOR must complete all outstanding items detailed in ENGINEER's correspondence and supply all necessary information (including, construction cost documentation, with all applicable change orders, Sanitary Sewer Inventory form, etc.) to ENGINEER within thirty (30) days. CONTRACTOR must also provide timely responses to RECORD DRAWING ENGINEER for questions associated with constructed conditions including, pipe sizes, pipe types, horizontal location of concrete encasement/capping and bores, water tight castings, fittings, manufacturer and model number, valve description (ball, plug, etc.) and operator type (key or nut), etc.
E. If a Manhole top of casting is adjusted after as-building, then the CONTRACTOR must supply ENGINEER with a new measure down from the flow line to the top of casting. If the new measure down is not provided to ENGINEER, then the CONTRACTOR must pay ENGINEER, at their current rate, for all time required obtaining this information.

2.16 Inspection and Reimbursement
A. Full time inspection by ENGINEER is required for all repairs, maintenance or construction to SANITARY SEWER FACILITIES. ENGINEER must approve, in writing, all methods of repair to SANITARY SEWER FACILITIES as recommended by the CONTRACTOR and manufacturer. Failure to comply will be grounds for removal from the HSE approved contractor list.
B. If, for any reason, construction work is delayed or cancelled, CONTRACTOR must notify ENGINEER's inspector assigned to the PROJECT and ENGINEER's chief inspector at least one (1) hour prior to the normal scheduled starting time on the day the work is delayed or cancelled. CONTRACTOR will be charged $56.00 for failure to notify ENGINEER's inspector and ENGINEER's chief inspector per occurrence.
C. CONTRACTOR must pay ENGINEER for all inspector's overtime cost. CONTRACTORS will be charged overtime costs at the rate of $28.00 per hour prior to 7:00 a.m. and after 3:30 p.m. on weekdays and all day on Saturdays. The hourly rate for Sundays and holidays will be $56.00 per hour. The above rates are subject to change without notice. Contact ENGINEER prior to starting construction for current rates.
D. If, at the sole discretion of ENGINEER, construction volume is less than what is deemed acceptable, then the CONTRACTOR may be required to pay $200 per day for additional inspection services.
E. The ENGINEER's decision on field changes or construction practices is final. Failure to comply is grounds for removal from the HSE approved contractor list.

PART 3 – TESTING, PUNCH LISTS AND CLEANING

3.01 General Testing Requirements
A. All testing must be conducted at the CONTRACTOR's expense in the presence of the ENGINEER.
B. Notification must be provided at least five (5) days prior to any testing.
C. At HSE's option, HSE or their agent may perform all testing of SANITARY SEWER FACILITIES within the HSE service area. CONTRACTOR must reimburse HSE or its agent at HSE's current rate for all testing.
D. All testing (except manhole vacuum testing) must be conducted after the final backfill has been in place and is undisturbed for at least thirty (30) days and after all other utilities have been installed. All concrete thrust blocks must have been in place for a period of at least ten (10) days prior to testing.
E. At the ENGINEER's discretion, testing may be delayed or additional testing may be required, based upon weather conditions (inadequate precipitation to allow for adequate settlement, etc.) Also, testing may be delayed or additional testing may be required due to the installation of site improvements (including but not limited to fencing, signage, landscaping, site lighting and other sub surface improvements).
F. If the SUBSCRIBER requires sanitary sewer service prior to final testing, a preliminary test may be performed, however, SUBSCRIBER must provide, in writing, a guarantee that all cleaning and testing will be performed per the CONSTRUCTION PLANS and HSE's then current standards, specifications and details.

3.02 Force Main Testing
A. Perform hydrostatic pressure tests on all force mains.
B. The hydrostatic pressure test must conform to ANSI/AWWA C600 and C605 procedures except as modified by these SPECIFICATIONS.
C. Conduct test at pressure of at least one hundred (100) psi or one and an half (1.5) times the operating pressure, whichever is greater.
D. Maintain pressure for a minimum of eight (8) consecutive hours.
E. Test pressure must not vary by more than five (5) +/- psi.
F. During filling of the pipe and before the application of the specified test pressure, all air must be expelled from the force main by means of the air/vacuum release valves and, if necessary by additional taps at points of highest elevation. After the test is finished, the taps must be tightly plugged, unless otherwise specified.
G. Limit fill rate of force main to available venting capacity. Fill rate must be regulated to limit velocity in force main when flowing full to not more than one (1) foot per second.
H. Test separately in segments between isolation valves, between an isolation valve and a test plug, or between test plugs.
I. CONTRACTOR must furnish and install test plugs, including all anchors, braces and other temporary or permanent devices to withstand hydrostatic pressure on plugs.
J. CONTRACTOR is responsible for any damages caused by failure of the SANITARY SEWER FACILITIES during testing of the PROJECT.
K. Refit and replace all pipe not meeting the leakage or pressure requirements.
L. Repair all visible leaks regardless of the amount of leakage.
M. Repeat hydrostatic pressure test as necessary
1. After location of leaks and repair or replacements of defective joints, pipe or fittings.
2. Until satisfactory test results are obtained.
3. Open all air/vacuum release valves and verify proper operation.
N. The system will not be considered COMPLETE until all leaks have been repaired and all tests have been passed to the satisfaction of the ENGINEER.

3.03 Manhole Testing
A. All closed bottom air/vacuum release, clean-out and flow monitoring/metering manholes must be vacuum tested after installation, repair or modification.
B. ENGINEER reserves the right to vacuum test any I & A septic tank. Tests may be performed at the manufacturer's production site, at time of delivery, upon installation prior to final backfilling or upon installation after final backfilling. The intent of the test is to ensure water tight septic tanks under high groundwater conditions.
C. ENGINEER also reserves the right to vacuum test any I & A septic tank for structural integrity. This vacuum test will be performed prior to installation of the riser. The test will consist of placing airtight plugs in the inlet, outlet and manhole openings, and then subjecting the tank to a vacuum equal to four (4) inches of mercury. Measurements must be taken of the height, width and length of the tank. Changes in either the height, width or length of the tank by more than two (2) inches at the end of five (5) minutes and while the tank is still under vacuum constitutes structural failure and is cause for rejection.
D. ENGINEER may require additional vacuum tests if the manhole casting is not bolted to the structure prior to the test.
E. Manhole boots must be secured to prevent movement while the vacuum is drawn.
F. Installation and operation of vacuum equipment and indicating devices must be in accordance with manufacturer's recommendations and performance specifications that have been provided by the manufacturer and accepted by ENGINEER.
G. With the vacuum tester set in place:
1. Inflate the compression band to forty (40) psi to effect a seal between the vacuum base and the structure.
2. Connect the vacuum pump to the outlet port with the valve open.
3. Draw a vacuum of ten (10) inches of mercury and close the valve.
H. Acceptance standards for leakage will be established from the elapsed time for a negative pressure change from ten (10) inches to nine (9) inches of mercury. The maximum allowable leakage rate for a four (4) foot diameter manhole must be in accordance with the following:

Minimum Elapsed time for a Manhole Depth	Pressure Change of 1 Inch Mercury
10 ft or less	60 seconds
>10 feet but <15 feet	75 seconds
>15 feet but <25 feet	90 seconds

For manholes five (5) feet in diameter, add an additional fifteen (15) seconds and for manholes six (6) feet in diameter, add an additional thirty (30) seconds to the time requirements for four (4) foot diameter manholes. For all manholes deeper than twenty-five (25) feet, ENGINEER will determine the applicable minimum elapsed time.
I. If the manhole fails the test, necessary repairs must be made and the vacuum test and repairs must be repeated until the manhole passes the test.
J. If the manhole joints are pulled out during the vacuum test, the manhole must be disassembled and the joints replaced.
K. Manholes will be subject to visual inspection with all visual leaks being repaired.

3.04 Punch Lists
A. After all testing has been successfully completed, ENGINEER will perform an inspection of the SANITARY SEWER FACILITIES and provide CONTRACTOR a written summary of items, or punch list, which require corrective action.
B. CONTRACTOR must complete all punch list items within twenty-one (21) days of issuance. If, in the opinion of the ENGINEER, the punch list has not been completed, then the CONTRACTOR must pay HSE $100 per day damages until the ENGINEER deems the punch list is complete.

3.05 Cleaning
A. Flush internals of SANITARY SEWER FACILITIES with water of sufficient velocity and quantity that will dislodge sediment or dirt that has accidentally entered the system.
B. Remove surplus/waste materials, including but not limited to, earth, trash, rubbish, unsightly materials and other such nuisances from the PROJECT site.

PART 4 – OPERATION AND FINAL INSPECTION PRIOR TO CONVEYANCE

4.01 Operation
No person, including but not limited to SUBSCRIBERS, maintenance workers, CONTRACTORS, sub-contractors and engineers shall, directly or indirectly, allow flow to occur from any PROJECT which is not COMPLETE to a COMPLETED PROJECT.

4.02 Final Inspection
A. If the SANITARY SEWER FACILITIES are to be CONVEYED, then within six (6) months prior to CONVEYANCE, ENGINEER will conduct an inspection ("Final Inspection") at SUBSCRIBER's expense. The Final Inspection will consist of a walk-through of the PROJECT to identify any defects. The Final Inspection may also consist of pumping tests and force main hydrostatic pressure tests as determined by ENGINEER.
B. After the Final Inspection has been performed, ENGINEER will provide a written summary, or punch list, of items which require corrective action. SUBSCRIBER must complete all punch list items within forty-five (45) days from the date of issuance of the punch list. If, after the above forty-five (45) day period has expired, and in sole opinion of ENGINEER, the punch list items have not been corrected, then the CONTRACTOR and/or SUBSCRIBER may be required to pay HSE $100 per day damages until the items are corrected.
C. SUBSCRIBER must rectify all defects identified during the Final Inspection in a manner acceptable to ENGINEER prior to SANITARY SEWER FACILITIES being CONVEYED to HSE.

SECTION 1 – MANHOLES, PIPING, VALVES & FITTINGS

PART 1 – PRODUCTS

1.01 General Requirements
A. Under general laying conditions, force mains can be any one of the pipe materials specified in these SPECIFICATIONS provided, the material is that pipe type and standard indicated on the CONSTRUCTION PLANS.
B. Markings
1. All pipe, fittings and valves must be clearly marked in accordance with the various standards under which they are manufactured. All pipe must be marked with durable printing according to ASTM/AWWA requirements.
2. A marking must be provided on the spigot of each pipe utilizing bell joints to indicate when the pipe is driven home.

1.02 Polyvinyl Chloride ("PVC") Pipe
A. PVC pipe must meet ANSI/AWWA C900 for four (4) inch pipe or ASTM D 2241. The design and manufacture of pipe must meet minimum requirements of a working pressure of one hundred fifty (150) psi plus one hundred (100) psi surge and a safety factor of two (2) at the depth of cover indicated on the CONSTRUCTION PLANS. Wall thickness of pipe and integral bell must have a minimum dimension ratio of 21 (SDR or DR).
B. PVC compounds shall equal or exceed ASTM D 1784 class 12454-B.
C. Provide push-on joints with bell integrally cast into pipe. The joint must comply with ASTM D 3139 and the physical requirements of Uni-Bell PVC Pipe Association' UNI-B-1 "Recommended Specifications for Thermoplastic Pipe Joints, Pressure and Non-Pressure Applications."
D. Use elastomeric gaskets, as provided in ASTM F 477. Gaskets must meet all applicable requirements of ANSI A-21.11.
E. PVC fittings for pipe smaller than four (4) inches, must be fabricated in such a manner as will provide strength and water tightness at least equal to the class and material of the adjacent main line pipe to which they are joined. Pipe four (4) inches and larger must utilize ductile iron fittings. Contact ENGINEER for specifications on ductile iron fittings.

1.03 Polyethylene ("PE") Pipe
A. Materials
1. Materials used for the manufacture of PE pipe and fittings must be extra high molecular weight, high density PE 3408 polyethylene resin. The pipe must be extruded from virgin resin meeting the specifications of ASTM D 3350 with a minimum cell classification of PE 345434C. Fittings must be manufactured from the same resin type and cell classification as the pipe itself.
2. The pipe and fittings must contain no recycled compound except that generated in the manufacturer's own plant from resin of the same raw material.
3. The material must be listed by PPI ("Plastics Pipe Institute", a division of the Society of the Plastics Industry) in its pipe grade registry technical report (TR 4) with a seventy-three (73) degree Fahrenheit hydrostatic design basis of one thousand six hundred (1,600) psi and a one hundred forty (140) degree Fahrenheit hydrostatic design basis of eight hundred (800) psi.
4. The manufacturer must conform to ISO 9001.
B. Pipe and Fittings
1. Pipe supplied must have a nominal iron pipe size outside diameter.
2. Pipe having a diameter of three (3) inches and larger must be made to the dimensions and tolerances specified in ASTM F 714 with a cell class of PE 345434C. Pipe with diameters less than three (3) inches must be made to the dimensions and tolerances set forth in ASTM D 3035 with a cell class of PE 3408
3. Fittings must be manufactured in accordance with ASTM D 3261. Fittings must be manufactured by injection molding, a combination of extrusion and machining, or fabricated from PE pipe conforming to this specification.
4. Fittings must be fully pressure rated and provide a working pressure equal to that of the adjacent pipe with an included two (2) to one (1) safety factor.
5. The pipe and fittings must be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.
6. The pipe and fittings for horizontal directional drilling must be a minimum DR of 9. Pipe and fittings used in open cut installations must be a minimum of DR 11.
C. Joints
1. No person may join PE pipe unless ENGINEER has approved that person.
2. The butt fusion process should be used to join sections of PE pipe into continuous lengths above ground at the job site. The joining method must be by the heat fusion method and must be performed in strict accordance with the pipe manufacturer's recommendations. The heat fusion equipment used in the joining procedures must be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment and interfacial fusion pressure.
3. Properly executed electrofusion fittings may be used.
4. Socket fusion, extrusion welding, hot gas welding or threading and gluing of PE pipe will not be accepted.
5. MJ adapters are required to mechanically connect PE pipe to main line valves three (3) inches or larger. Two (2) inch valves and smaller must be connected by compression fittings.
6. Refer to the manufacturer's recommendations for proper installation procedures.
7. Fused segments of pipe must be handled so as to avoid damage to the pipe. Chains or cable type chokers must be avoided when lifting fused sections of pipe. Nylon slings are preferred. Spreader bars are recommended when lifting long fused sections.
D. Precautions
1. During the heat fusion process the equipment and pipe product may reach temperatures in excess of four hundred (400) degrees Fahrenheit. Caution should be taken to prevent burns.
2. Static electricity charges are generated on PE pipe by friction, particularly during the handling of pipe in storage, shipping and installation. The flow of air or gas containing dust or scale will also build up significant static charges, as will the flow of dry materials through the pipe. These charges are a safety hazard, particularly in areas where there is leaking gas or a flammable/explosive atmosphere.
3. Coiled PE pipe may contain energy as in a spring. Uncontrolled release by cutting straps, etc. can result in dangerous uncontrolled forces. Exercise appropriate safety precautions and use proper equipment.
4. Hitting PE pipe with an instrument, such as a hammer, may result in uncontrolled rebound.
E. All final connections to MANHOLES must not be completed until all PE materials have reached equilibrium conditions (average ground temperature, etc.).

1.04 Valves and Valve Boxes
A. Eccentric Plug Valves (Two and a Half (2.5) inch and larger)
1. Plug valves must be of the tight closing resilient faced, non-lubricating variety and must be of eccentric design such that the valve's pressure member (plug) rises off the body seat contact area immediately upon shaft rotation during the opening movement. Valves must be drop-tight at rated pressures up to one hundred seventy-five (175) psig. The valve closing member must rotate approximately ninety (90) degrees from the full-open to full-closed position.
2. Plug valves must be Tyler plug valves model number 5825RN.
3. Operators for buried service must be two (2) inch square AWWA operating nut, opening counterclockwise. Operator must be designed for submersion in water for pressures up to ten (10) psi. and must not require additional lubrication after installation.
B. Ball Valves
1. Ball valves must be of the tight closing resilient faced, non-lubricating variety and must be of the quarter turn design. Valves must be drop-tight at rated pressures up to one hundred seventy-five (175) psig. The valve closing member must rotate approximately ninety (90) degrees from the full-open to full-closed position.
2. Ball valves must be Ford ball valves model number B11-777 with key slot actuator.
C. Main Line Check Valves
1. Check valves must be full-body flanged type with an access cover. The valve body must have full flow equal to the nominal pipe diameter at any point throughout the valve. The seating surface must be on a forty-five (45) degree angle, and the top access port must be full-sized, allowing the removal of the disc without removing the valve from the force main.
2. The valve body and cover must be rated at an operating pressure of one hundred seventy-five (175) psi. All exposed surfaces must be painted with three (3) coats of Tnemec Company, Inc. two (2) part epoxy paint Hi-Build Epoxoline Series 66 (66-IN01).
3. The disc must be of one piece construction, precision molded with an integral O-ring type sealing surface and containing steel reinforcement.
4. A screw-type back flow device must be provided to allow back flow capabilities.
5. CONTRACTOR must submit shop drawings identifying durometer hardness appropriate for operating pressure of the system.
6. ENGINEER must approve the check valve.
D. Air/Vacuum Release Valves
1. Air release valves and air/vacuum release valves must be sized for initial and ultimate flow range as directed by ENGINEER.
2. Valves must be provided with all hoses, shutoff valves, fittings and appurtenances necessary for back flushing.
3. CONTRACTOR must submit shop drawings identifying durometer hardness appropriate for operating pressure of the system.
4. Air/vacuum valves must be Model D-025, reinforced nylon, combination air valve as manufactured by A.R.I. The use of this valve as an Air only valve shall include the installation of a check valve prior to the polypropylene flushing connection.
E. Valve Boxes
1. Valve boxes for buried valves must be cast iron.
2. Valve boxes must be two piece or three piece type. Each two piece box must include the bottom section, top section, and cover. Each three piece box must include the base, center section, top section and cover.
3. Valve boxes must be extension type with slide or screw type adjustment. Each base and bottom section must be the proper size for the valve served. Each valve box assembly must be the proper length for the valve served.
4. The minimum thickness of metal must be 3/16 inch.
5. Valve box cover must be lettered "Sewer".
6. Valve boxes for service valves must not be installed until the building is connected into the force main. CONTRACTOR must supply ENGINEER with valve box for future installation.
7. Valve boxes for isolation valves must be installed at the time of initial construction.

1.05 Manholes
A. Manholes must be constructed of monolithic concrete or pre-cast manhole sections. Pre-cast manhole sections must conform to the requirements of ASTM C 478. Manhole joints must conform to the requirements of ASTM C 443, except that the joint design of the pre-cast sections must consist of a bell or groove on one end of the unit of pipe and a spigot or tongue on the adjacent end of the joining section.
B. Materials for manholes and miscellaneous concrete structures must comply with the following:
1. Concrete for pre-cast manhole sections and monolithic manholes must use four thousand (4000) psi concrete. Ready-mix concrete must conform to ASTM C 94, Alternate 2. Maximum size of aggregate must be one and a half (1.5) inches. Slump must be between two (2) and four (4) inches.
2. Reinforcing steel must conform to ASTM A 615, Grade 40 deformed bars or ASTM A 616, Grade 40 deformed bars.
3. Mortar Materials:
a. Sand – ASTM C 144, passing a #8 sieve.
b. Cement – ASTM C 150, Type 1.
c. Water – Must be potable.
4. Joints on pre-cast manhole sections must utilize rubber gaskets meeting the requirements of ASTM C 443 and these SPECIFICATIONS, the more stringent will apply. O-ring gaskets must be confined in a groove in the spigot end of the pre-cast manhole section. Profile gaskets must bear on a lateral face of the tongue so as to provide positive positioning. The joint must be further sealed as noted on the Open Bottom Air/Vacuum Release Manhole Detail of the applicable (Common Force Main Details or Grinder Pump Details) HSE detail sheet.
5. The manufacturer of the pre-cast manholes must provide factory cut openings to produce a smooth, uniform, cylindrical hole of the proper size to accommodate the resilient connector. Resilient connectors can be pre-cast-in-place by the manufacturer. All pipes entering and leaving MANHOLES must have a resilient connector meeting the requirements of ASTM C 923 firmly clamped around the pipe. The resilient connectors must be PSX gasket or Press Wedge II as manufactured by Press-Seal Gasket Corp. or similar flexible manhole sleeves as manufactured by Kor-N-Seal or equal.
6. Without prior written consent of ENGINEER, pre-cast manhole sections must be steam cured and can not be shipped from the point of manufacture for at least five (5) days after having been cast. Upon written consent of ENGINEER, pre-cast manhole sections can be shipped prior to five (5) days if they were manufactured of early high strength concrete and are verified through testing to have achieved a strength acceptable to ENGINEER.
7. Manhole castings must be of good quality cast iron conforming to ASTM A 48 or ductile iron conforming to ASTM A 536, Grade 65-45-12 with concealed pick hole. Refer to HSE's Gravity Sanitary Sewer Details sheet for detailed information. Unless specifically designated otherwise, Manhole castings must be the non-locking type.
8. Manhole steps must be made from a steel reinforcing rod encapsulated in a copolymer polypropylene resin. The manhole steps must equal or exceed IOSHA requirements. Manhole steps manufactured by M.A. Industries, Inc., American Step Company, Inc., or equal, are acceptable.
9. Any other special manholes and miscellaneous concrete structures must be constructed as detailed on the CONSTRUCTION PLANS.
10. Manhole bases must be cast-in-place concrete, reinforced as shown of the applicable (Common Force Main Details or Grinder Pump Details) HSE detail sheet, or combination pre-cast concrete base and first section. Detailed drawings must be submitted to the ENGINEER prior to casting or manufacture.
11. No interior surface applied materials can be used.

1.06 Odor Control
A. Generally, odor control systems will be required in manholes receiving discharge from a force main with a substantial length, low velocity or substantial pump cycle time. ENGINEER will make the determination as to the need for odor control.
B. Earth Filters
1. Required for small (four (4) inch or smaller) force main connections.
2. Refer to the Odor Control Earth Filter Detail of the applicable (Common Force Main Details or Grinder Pump Details) HSE detail sheet.
C. Sodium Hypochlorite Injection System
1. A building will need to be constructed for the sodium hypochlorite injection system within ten (10) feet of the valve vault.
2. Refer to the Sodium Hypochlorite Odor Control Facilities Detail on HSE's Lift Station and Force Main Details sheet.
D. Power ventilated scrubber using Iron Sponge media as manufactured by Marcab, Inc.
1. Media bed sizing must be as determined by ENGINEER.
2. Air flow rate must be as determined by ENGINEER.

PART 2 – EXECUTION

2.01 Handling and Cutting Pipe
A. Each product to be incorporated into the PROJECT must be handled into its position, placed and supported only in such manner and by such means as the ENGINEER accepts as satisfactory.
B. Pipe and fittings must be handled carefully to avoid cracking or abrasion of the coating. Handle in a manner to insure installation in sound and undamaged condition. Do not drop or bump. Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements and coatings. Ship, move and store with provisions to prevent movement or shock contact with adjacent units. Handle with equipment capable of performing the work with an adequate factor of safety against overturning or other unsafe procedures.
C. Any fitting showing a crack and any fitting or pipe which has received a severe blow which could have caused an incipient fracture, even though no such fracture can be seen, must be marked as rejected and removed at once from the site. To visually examine ductile iron pipe for incipient fractures, paint the bell, spigot, or other suspected portions with turpentine and dust with cement to check for cracks invisible to the eye. Remove turpentine and cement by washing when test is satisfactorily finished.
D. In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved, may be cut off by the CONTRACTOR before the pipe is laid so that the pipe used is perfectly sound. The cut must be made in the barrel at a point at least twelve (12) inches from the visible limits of the crack.
E. All field cutting of pipe must be done in a neat, trim manner. Field cut pipe will only be allowed at MANHOLES and fittings. The cut end must be beveled using a file or a wheel to produce a smooth bevel of approximately fifteen (15) degrees and a minimum depth of one-third (1/3) of the pipe wall thickness.
F. PVC and PE Pipe
1. PVC and PE pipe must be cut with either a hand saw or power saw.
2. Smooth cut by power grinding to remove burrs and sharp edges.

2.02 Laying Pipe
A. Unless approved by the ENGINEER, CONTRACTOR must not install different sizes, types, classifications and grades of pipe between MANHOLES or isolation valves.
B. No construction work will be permitted after dusk or in poor light conditions as determined by ENGINEER.
C. All rough grading (on-site and off-site) must be finished to final grade prior to the start of construction of the SANITARY SEWER FACILITIES. CONTRACTOR must provide and protect survey grade stakes that enable ENGINEER to verify compliance with the rough grading requirement. No fill will be permitted over the force main.
D. The sewer segment downstream from any connection made to an existing sewer must be cleaned by a jet-rodder with vactor truck immediately after the connection to the existing sewer and plugging of the connection is finished.
E. If, for any reason, live or in-service SANIATARY SEWER FACILITIES must be plugged for more than four (4) hours, the accumulated wastewater must be pumped out at the location of the plug and transported to a proper disposal site. Additionally, the upstream lines and manholes must be cleaned and flushed to the location of the plug.
F. All pipe must be bedded as described in these SPECIFICATIONS under Pipe Bedding and Haunching and according to the Force Main Trench Detail of the applicable (Common Force Main Details or Grinder Pump Details) HSE detail sheet. Bell holes must be excavated in advance of pipe laying so the entire pipe barrel will bear uniformly on the prepared sub-grade.
G. All pipe must be supported, guided or anchored as shown on the CONSTRUCTION PLANS, as specified or as required to insure accurate line and grade. Accomplish horizontal and vertical curve alignments of pipe with fittings and deflected joints.
H. All pipe must be laid accurately to the required line and grade in the manner prescribed by the pipe manufacturer and appropriate ASTM/AWWA specifications. Each section of pipe must be laid to form a close, concentric joint with the adjoining pipe at an elevation conforming to the required grade.
I. Obtain approval of ENGINEER of method proposed for transfer of line and grade from control to the work.
J. Survey instruments capable of third order accuracy must be used for checking alignment and grade throughout the PROJECT. It is the CONTRACTOR's responsibility to regularly test all equipment to assure compliance with manufacturer's specifications.
K. Clean interior of all pipe and fittings prior to installation.
L. When bell and spigot pipe is laid, the bell of the pipe must be cleaned of mud, sand and other obstructions and wiped out before the clean spigot of the next pipe is inserted. The joint must be made in a satisfactorily manner in accordance with the recommendations of the manufacturer of that particular type of joint and the direction of the ENGINEER. The new pipe must then be shoved "home" firmly against the back of the bell and securely held until the joint has sealed. Experienced personnel must perform all joint work.
M. Each length of pipe must be pushed "home" against the section previously laid by means of block and push-bar, and held in place until the trench and bedding are prepared for the next pipe section. Care must be taken in laying the pipe so as not to damage the bell end of the pipe. Mechanical means consisting of a cable placed inside the pipe with a winch, jack or come-along shall be considered to pull the pipe "home" where pushing the pipe will not result in a joint going "home" and staying in place. Use of hydraulic excavating equipment as the means of pushing or moving the pipe to grade will not be permitted.
N. Locate pipe joint to provide for differential movement at changes in type of pipe embedment or at changes in trench bottom material. Do not locate joint within eighteen (18) inches of Manhole walls. Clean and lubricate all joint and gasket surfaces with lubricant recommended by manufacturer. Check joint deflection for specified limits.
O. Maximum total deflection in all directions at each joint must be the lesser of the manufacturer's recommended maximum deflection or four (4) degrees. Use short specials preceding fittings as required.
P. No fittings of greater than forty-five (45) degree bend can be used outside the pump station and receiving manhole.
Q. Thrust Blocks and Restrained Joints
1. Provide concrete thrust blocks at:
a. All horizontal turns utilizing fittings.
b. All tee, end plug and plugged cross fittings.
c. All upward vertical bends.
d. All buried in-line valves three (3) inches and larger must be anchored as approved by ENGINEER against the thrust created when the valve is closed. Area of undisturbed soil that braces the thrust block must be large enough to withstand the thrust in whatever direction it is exerted.
2. Construct to undisturbed edge of trench for bearing.
3. Provide minimum bearing area and configuration as specified on the Force Main Thrust Blocking Detail of the applicable (Common Force Main Details or Grinder Pump Details) HSE detail sheet.
4. For force mains three (3) inches and larger, restrained joints must be installed on all vertical turns or where adequate bearing surfaces are not available. Joints can be restrained by flanged or restrained joint type fittings or by rodding as approved by ENGINEER.
5. If proper compaction, as described by the manufacturer, is provided around all fittings and all joints are joined by the heat fusion method, then thrust blocks will not be required for PE pipe.
R. CONTRACTOR must install insulated #10 copper tracer wire immediately adjacent to the top of the force main. Tracer wire must extend to the top step of all MANHOLES and to finished grade at all valves.
All lateral tracer wire connections shall be soldered and a 3M™ Scotchcast™ Electrical Insulating Resin 4 Size A epoxy sealer packet to be used at ALL spliced locations.
S. Fiberglass field markers must be placed at all locations where a force main crosses a street, at all MANHOLES, valves and fittings, and at distances not to exceed one thousand two hundred (1,200) feet along straight runs. Markers must be equal to Carlon, and must indicate ("Sewage Force Main").
T. Do not let water fill trench. Do not lay pipe in water. Include provisions to prevent flotation should water control measures prove to be inadequate.
U. Perform pipe installation only when weather and trench conditions are suitable. Allow pipe to reach trench air temperature prior to installation. The CONTRACTOR must discontinue pipe installation whenever there is a danger of the quality of work being impaired because of cold weather. The CONTRACTOR is responsible for heating the pipe and jointing material to prevent freezing of joints. Pipe must not be laid on frozen ground. Pipe must not be installed unless the outside temperature is greater than thirty-two (32) degrees Fahrenheit and rising unless proper precautions, per the manufacturer's recommendations, are taken.
V. Open excavation must be satisfactorily protected at all times. At the end of each work day, open ends of all pipe must be protected against the entrance of animals, children, earth, debris, etc. by bulkheads or stoppers. Provide adequate backfill to prevent flotation of the pipe. Any earth or other material that enters the SANITARY SEWER FACILITIES through any such open end or unplugged branch must be removed.
W. Install a temporary water tight plug at the end of the force main whenever installed pipe is left unattended. CONTRACTOR must prevent all water, earth or other material from entering the SANITARY SEWER FACILITIES. In the event any water, earth or other material enters the downstream sewer, the CONTRACTOR is responsible to HSE for the costs of sewage treatment, electrical power, equipment repairs, incidental damages, cleaning and any other costs or expenses related to such entry. CONTRACTOR shall pay HSE damages of $1000 per occurrence.
X. Pipe must be installed to cross storm sewers and other utilities at approximately ninety (90) degrees and must maintain a minimum horizontal separation (measured from the outer spring line of each pipe) of ten (10) feet from all storm and utility structures.

2.03 Bores
A. Casing wall thickness as per Section 716 – Jacked Pipe of the "Indiana Department of Transportation 1999 Standard Specifications" or latest edition.
B. All work within right-of-ways must be in accordance with the requirements of the governmental agency having jurisdiction. Where no procedures for a particular portion of the work are given, the recommendations of the "Indiana Department of Transportation Standard Specifications," latest edition, must be followed.
C. At the ENGINEER's discretion CONTRACTOR must fill carrier pipe with water to prevent flotation and misalignment during grouting.
D. ENGINEER recommends preliminary hydrostatic pressure and leakage testing of the carrier pipe prior to grouting.
E. Upon completion of the bore, CONTRACTOR must coordinate with the RECORD DRAWING ENGINEER to verify that carrier pipe is on line and grade. CONTRACTOR must submit invert elevations to ENGINEER.
F. For further information refer to the Typical Boring Detail of HSE's Gravity Sanitary Sewer Details sheet.
G. CONTRACTOR may request alternate methods or materials such as the use of directional boring and/or PE pipe. In this case, ENGINEER must approve, in writing, the use of alternate methods or materials and the contractor performing the bore.

2.04 Pipe Bedding and Haunching
A. Each pipe section must be laid in a firm foundation of bedding material and haunched and backfilled with care. These materials must be placed and compacted in accordance with ASTM D 2321.
B. The "clean" backfill indicated on the Force Main Trench detail of the applicable (Common Force Main Details or Grinder Pump Details) HSE detail sheet must be shovel sliced or otherwise carefully placed and "walked" or hand tamped in to ensure compaction of the haunch area and complete filling of all voids. Material must be added in six (6) inch lifts "walked" in for compaction.
C. Prior to pipe installation, carefully bring bedding material to grade along the entire length of pipe to be installed in accordance with the Force Main Trench Detail of the applicable (Common Force Main Details or Grinder Pump Details) HSE detail sheet. If in the opinion of the ENGINEER soil conditions are unstable, then the trench must be undercut until stable soil is encountered and #2 stone must be placed below bedding approved by ENGINEER.
D. When the bedding material is placed in a "fill" area, all such "fill" must be compacted to ninety-five (95) percent standard proctor density prior to installing the force main, from undisturbed earth to the crown of the pipe.
E. For flexible pipe such as PVC, the placement of embedment material or haunching around the pipe must be done with care. The ability of the pipe to withstand loading in a trench depends upon the method employed in its installation.
1. For PE pipe, the maximum particle size of materials used for bedding, haunching and initial backfill must be kept to an half (0.5) inch for pipe diameters of eight (8) inches and smaller.
2. Objects that may cause point loading on the pipe must be removed.
3. Care should be taken to not compact directly over the top of the pipe.
F. Where excavation occurs in rock or hard shale, the trench bottom must be undercut and a minimum of six (6) inches of #2 crushed stone must be placed below the bedding zone prior to pipe installation.
G. All stone bedding above and below the SANITARY SEWER FACILITIES must be free of dirt, organic matter and frozen material.

2.05 Concrete and Concrete Caps and Cradles
A. All concrete caps must be installed in accordance with the Concrete Cap Detail of HSE's Gravity Sanitary Sewer Details sheet.
B. The strength of concrete indicated on all drawings, details and specifications is twenty-eight (28) day compressive strength.
C. Concrete caps and cradles must be provided at all locations indicated on the CONSTRUCTION PLANS. When so ordered by the ENGINEER, concrete caps and cradles not shown on the CONSTRUCTION PLANS must be installed.
D. At the ENGINEER's discretion, CONTRACTOR must take four (4) cylinders per five (5) cubic yards of concrete and provide certified test results to ENGINEER.
E. All ductile iron pipe and fittings must have a minimum of eight (8) millimeter polyethylene wrap prior to installation of concrete.
F. If the outside temperature is between twenty (20) and thirty-two (32) degrees Fahrenheit and rising, then CONTRACTOR must use a fifty (50) percent ethylene-glycol/water mixture. If the outside temperature is forecasted to be below thirty-two (32) degrees Fahrenheit during the curing of any concrete or grout application, then the concrete must be protected from freezing with insulation blankets acceptable to the ENGINEER. All concrete work must be performed at an outside temperature of over twenty (20) degrees Fahrenheit and rising.

2.06 Manholes and Other Structures
A. All MANHOLES must be constructed in accordance with the applicable (Common Force Main Details or Grinder Pump Details) HSE detail sheet.
B. Unless otherwise approved in writing by ENGINEER, all flow monitoring/metering manholes must be five (5) feet in diameter.
C. Where applicable, manhole channels or inverts must be formed and poured with concrete to the crown of the connecting pipe in accordance with HSE's Gravity Sanitary Sewer Details sheet. The finished invert must be a semi-circular shaped smooth channel directing the flow to the downstream sewer. Changes in direction in base channels must be accomplished by smooth, constant radius turns in the channel joining the downstream channel tangentially. Concrete must be RE-CRETE twenty (20) minute set or approved equal incorporating Dayton Superior's J-40 or R-40 or approved equal liquid bonding agent. Patches over one (1) inch thick must use three-eighths (3/8) inch Red-Head anchors.
D. Where approved by the ENGINEER, manholes added to an existing sanitary sewer must be constructed per the Sanitary Manhole Detail of HSE's Gravity Sanitary Sewer Details sheet. No 'dog house' or 'saddle' structures will be permitted. Ductile iron fittings must be used outside of the manhole. The upstream and downstream sanitary sewers between the new manhole and the existing manholes must be low-pressure air tested and deflection tested. Also, the new manhole must be vacuum tested while maintaining continuous service.
E. Cast-in-place monolithic concrete manholes and other cast-in place concrete structures must be cured for a minimum of seven (7) days prior to backfilling.
F. Manholes must be placed and aligned to provide vertical sides within a tolerance not exceeding one (1) inch up to ten (10) feet in depth and two (2) inches up to twenty (20) feet in depth, plus one-eighth (1/8) inch per foot over twenty (20) feet in depth. Tolerance to be checked with a plumb line.
G. Cored Holes, Penetrations, etc.
1. Any holes cut in the field must be smoothly and cleanly drilled with a core-drill or in a manner acceptable to the ENGINEER. All pipes entering and leaving MANHOLES must utilize a resilient connector as previously described in these SPECIFICATIONS and indicated on the applicable (Common Force Main Details or Grinder Pump Details) HSE detail sheet.
2. For cored holes, penetrations and/or other opening through MANHOLES, a separation of greater than eighteen (18) inches is required between the outer edge of resilient connectors. If a separation of less than eighteen (18) inches exists, then additional reinforcement must be supplied in the MANHOLE.
3. All cored holes, penetrations and/or other openings through MANHOLES must have a minimum separation of eight (8) inches from the outer edge of resilient connectors.
4. No core will be permitted within six (6) inches of internal or external joints.
H. CONTRACTOR must install steps with a minimum horizontal separation of twelve (12) inches from all pipes entering and leaving MANHOLES.
I. Finished grade around MANHOLES and castings must be set at an elevation to prevent surface water runoff from running over or ponding on top of the MANHOLE.
J. All MANHOLE frames must be securely anchored to the structure with bolts and concrete anchors adequate in length to penetrate into the structure as shown on HSE's Gravity Sanitary Sewer Details sheet.
K. No more than eight (8) inches of adjusting rings can be installed on MANHOLES that are constructed as flat top structures.
L. The ENGINEER has the right to cut cores from such pieces of concrete manholes as he desires for such inspection and tests as he may wish to apply. Holes left by the removal of cores must be filled in an acceptable manner to form a water tight and structurally sound repair.
M. ENGINEER may, for inspection or testing purposes, take samples of concrete after it has been mixed or as it is being placed in the forms or molds.
N. All grout used to seal or join structures must be non-shrink grout.

2.07 Stubs, Connections, Bulkheads and Miscellaneous Items of PROJECT
A. Where existing sewers carrying sanitary sewage are encountered, the CONTRACTOR must provide and maintain temporary connections or redundant pumping systems to prevent a nuisance.
B. Where called for on the CONSTRUCTION PLANS, stubs for future sewer connections must be provided. Stubs must be field marked with a two by four (2" x 4") as shown on the Service Lateral Detail of HSE's Gravity Sanitary Sewer Details sheet.
C. Without written permission from the ENGINEER, the CONTRACTOR can not connect any existing sewers or house services into the PROJECT prior to the PROJECT being deemed COMPLETED by HSE.

HAMILTON SOUTHEASTERN UTILITIES, INC.
SMALL DIAMETER FORCE MAIN
SPECIFICATIONS
SHEET 1 OF 2

THIS DOCUMENT AND THE IDEAS, DESIGNS AND CONCEPTS CONTAINED HEREIN ARE THE EXCLUSIVE INTELLECTUAL PROPERTY OF SANITARY MANAGEMENT & ENGINEERING COMPANY, INC. AND ARE NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART, WITHOUT THE WRITTEN CONSENT OF SANITARY MANAGEMENT & ENGINEERING COMPANY, INC.

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REVISIONS				
NO.	BY	DATE	CHECK	
1	WHF	4/27/2015	TK	ADDED EPOXY RESIN NOTE "R" TO SECTION 2.02 LAYING PIPE

DRAWN		
BY	DATE	CHECK

CERTIFIED

SAMCO
Sanitary Management & Engineering Company, Inc.
11905 Lakeside Drive
FISHERS, INDIANA 46038
317-577-1150 Fax 317-577-3642

JOB NO.
PROJECT
PREPARED FOR
HAMILTON SOUTHEASTERN UTILITIES, INC.
TITLE
SMALL DIAMETER FORCE MAIN SPECIFICATIONS
SCALE: N/A
SHEET

D. CONTRACTOR must notify ENGINEER at least twenty-four (24) hours prior to any construction of storm sewers that may affect previously constructed SANITARY SEWER FACILITIES. Storm sewers laid parallel to SANITARY SEWER FACILITIES must maintain a minimum horizontal separation (measured from the outer spring line of each pipe) of ten (10) feet.

2.08 Existing Utilities, Structure, Property, Etc.
A. All improvements, including but not limited to, poles, trees, fences, sewer, gas, water or other pipes, wires, conduits and manholes, railroad tracks, buildings, structures, property, etc. along the route of the SANITARY SEWER FACILITIES must be supported and protected from damage by the CONTRACTOR.
B. Movable items such as mail boxes can be temporarily relocated during construction, provided their function is maintained. Unless otherwise shown on the CONSTRUCTION PLANS, place movable items in their original location immediately after backfilling is finished. Any movable items damaged during construction must be replaced by an item of equal or better quality.
C. The CONTRACTOR must proceed with caution in the excavation and preparation of trenches so that the exact location of underground utilities and structures, both known and unknown, can be determined. The CONTRACTOR is responsible for the repair of utilities and structures when broken or otherwise damaged.
D. The CONTRACTOR must make explorations and excavations whenever, in the opinion of the ENGINEER, it is necessary to determine the location of any underground structures.
E. Wherever pipes or conduits cross the trench, the CONTRACTOR must support said pipes and conduits without damage to them and without interrupting their service. The manner of supporting such pipes, etc. is subject to approval by the owner of the pipe or conduit.
F. When utility lines have to be removed or relocated for the PROJECT, the CONTRACTOR must notify the ENGINEER and utility line owner in ample time for the necessary measures to be taken to prevent interruption of the utility's service.
G. The CONTRACTOR must conduct the work so that no equipment, material or debris will be placed or allowed to fall upon private property in the vicinity of the PROJECT unless the CONTRACTOR has first obtained the property owner's written consent and provided a copy of the consent to the ENGINEER.
H. All excavated material must be piled in a manner that will avoid obstructing side walks, driveways and thoroughfares. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes or other utility controls must be left unobstructed and accessible during the PROJECT. CONTRACTOR must prevent runoff from stored piles of excavated material from entering ditches, waterways, gutters or storm sewers.

2.09 Excavating
A. De-watering
1. The CONTRACTOR must provide, install and operate sufficient trenches, sumps, pumps, hoses, piping, well points, etc. to depress and maintain the groundwater level below the base of the excavation until all SANITARY SEWER FACILITIES are COMPLETED. Provide sufficient dikes and de-watering equipment and make satisfactory arrangements for the disposal of the water without undue interference with other work, damage to property or damage to the environment. Water disposal must be in compliance with the regulations of the Environmental Protection Agency ("EPA"), Indiana Department of Environmental Management ("IDEM"), Soil Conservation Service ("SCS") and all other applicable agencies.
2. CONTRACTOR must prevent all water from entering the SANITARY SEWER FACILITIES. In the event any water enters COMPLETED SANITARY SEWER FACILITIES, the CONTRACTOR is responsible to HSE for the costs of sewage treatment, electrical power, equipment repairs, incidental damages, cleaning and any other costs or expenses related to such entry. In addition, CONTRACTOR shall pay HSE damages of $1000 per occurrence.
3. Operate de-watering equipment ahead of pipe laying or to keep the water level below the excavation until structures are secured by backfill.
4. CONTRACTOR must, at ENGINEER's discretion, provide de-watering equipment, shoring or other construction practices deemed necessary by ENGINEER.
5. All wells (potable, non-potable and de-watering) must be drilled, capped and abandoned in accordance with the requirements of the ENGINEER, the Indiana Administrative Code, Indiana Department of Natural Resources – Groundwater Section, Hamilton County Health Department and all other governmental agencies and public entities having jurisdiction.
6. As directed by the ENGINEER, CONTRACTOR must maintain the well casing in-place for all SANITARY SEWER FACILITIES, which will be extended in the future.
B. Trenching
1. All excavation work must incorporate safety measures that comply with all applicable IOSHA regulations and these SPECIFICATIONS. In the event of a conflict, the more stringent requirement will apply.
2. Trees, boulders and other surface encumbrances, located so as to create a hazard to employees involved in excavation work or in the vicinity thereof at any time during operations, must be removed or made safe before excavating is begun.
3. Unless otherwise directed by the ENGINEER, do not open more than seventy-five (75) feet of trench in advance of the installed pipe. Unless otherwise directed, excavate the trench within six (6) inches of full depth for a distance of at least thirty (30) feet.
4. CONTRACTOR must provide sloped side walls (provided that the bottom four (4) feet of trench will not be sloped), sheeting, shoring or trench boxes as safety measures for all excavations in accordance with all applicable IOSHA regulations. CONTRACTOR is responsible for the determination of the angle of repose of the soil in which the trenching is to be done. Except for areas where solid rock allows for line drilling or pre-slitting or where sheeting, shoring or trench boxes are to be used, excavate all slopes to beyond the angle of repose, but not steeper than a one (1) foot rise to each half (0.5) foot horizontally.
5. Sides, slopes and faces of all excavations must meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing or other equally effective means. Give special attention to slopes that could be adversely affected by weather or moisture content.
6. Flatten the excavation sides when an excavation has water conditions, silty materials, loose boulders and areas where erosion, deep frost action and slide planes appear.
7. A competent CONTRACTOR's representative, as defined under IOSHA regulations, must inspect excavations and approve trench safety measures for the excavation after every rain event or other hazard increasing occurrence.
8. Do not store excavated or other material nearer than four (4) feet from the edge of any excavation. Store and retain materials so as to prevent materials from falling or sliding back into the excavation. Install substantial stop logs or barricades when mobile equipment is utilized or allowed adjacent to excavations.
9. Minimize the amount of excavation around MANHOLES.
10. The design of the pipe and MANHOLES are predicated upon the width of trench as specified by the manufacturer and these SPECIFICATIONS, the more stringent of which will apply. If the specified trench width is exceeded, then the CONTRACTOR is responsible for the provision and installation, at his own expense, of all remedial measures required by the ENGINEER.
11. Test the air in excavations in locations where oxygen deficiency or gaseous conditions are possible. Establish controls to assure acceptable atmospheric conditions. Provide adequate ventilation and eliminate sources of ignition when flammable gases may be present. Emergency rescue equipment, such as breathing apparatus, a safety harness and line and basket stretcher, must be readily available where adverse atmospheric conditions may exist or develop in an excavation.
12. Provide walkways or bridges with guardrails where employees or equipment are required or permitted to cross over excavations.
13. Provide ladders where employees are required to be in excavations four (4) feet deep or more. Ladders must extend from the floor of the excavation to at least three (3) feet above the top of the excavation. Locate ladders to provide means of exit without more than twenty-five (25) feet of lateral travel.
14. Provide adequate barriers and physically protect all excavations. Barricade or cover all wells, pits, shafts and similar excavations. Backfill temporary wells, pits, shafts and similar excavations upon termination of exploration and similar operations.
C. Backfilling
1. Backfilling must meet the requirements of ANSI/AWWA C605 unless otherwise specified in these SPECIFICATIONS.
2. Do not backfill trenches and excavations until all utilities have been inspected by the ENGINEER and until all underground utilities and piping systems are installed in accordance with the requirements of the respective utility company, these SPECIFICATIONS and the CONSTRUCTION PLANS.
3. Place and tamp bedding and backfill in a manner that will not damage the pipe, pipe coating, wrapping or encasement.
4. CONTRACTOR must insure that all unstable trench bottom material is replaced with suitable material and all voids are filled prior to placement of the pipe embedment material. Excess dry replacement material without visible fines or mud will not be acceptable.
5. When used in these SPECIFICATIONS, the term "clean backfill" shall mean any backfill material of any type which is free of roots, brush, sticks, debris, junk, rocks, cinders, broken concrete or brick, large lumps of clay, frozen material, stones, etc. greater than six (6) inches in their largest dimensions. Not more than fifteen (15) percent of the rocks or lumps can be larger than two and a half (2.5) inches in their largest diameter.
6. All job excavated materials which are used for trench backfill above pipe embedment and which are to be compacted by any method except settlement by water, must be "clean backfill." The materials must be of such composition that it can be compacted to ninety (90) percent relative compaction by the compaction method used and with water added, if needed, to bring it to optimum moisture content.
7. Material excavated from an open trench can be used for backfilling from the pipe to six (6) inches below finished grade providing it meets the requirements of "clean backfill" and providing a different type of backfill material has not been specified or shown on the CONSTRUCTION PLANS. Where excavated material is used for backfilling and there is a deficiency due to the rejection of a part thereof, the CONTRACTOR, upon direction of the ENGINEER, must remove the rejected material from the site and furnish an additional quantity of "clean backfill" at his own expense.
8. Excavated material must be placed immediately after the hand backfill. Such backfilling can be done from the top of the trench by mechanical means or directly from trucks by depositing the backfill on a slope equal to the angle of repose of the material and allowing it to flow progressively forward in such a manner as to prevent the formation of voids. The earth backfill must be compacted to at least ninety-five (95) percent proctor density or mounded six (6) inches for settlement.
9. In no case must backfill be dropped from such height or in such volume that its impact damages SANITARY SEWER FACILITIES. The ENGINEER reserves the right to regulate and control the manner of depositing such backfill, but in any case, the CONTRACTOR will be held liable for damage to the SANITARY SEWER FACILITIES.
10. Settling of backfill by flooding or puddling will not be permitted.
11. Excess trench material must be roughly graded over the trench in a timely manner soon after the pipe is installed. This material must be mounded over the trench with a crown height of no more than six (6) inches, feathered to existing grade, until final settlement has occurred and the trench is ready for grading and cleanup. An exception to this would be trenches in traveled pathways. Any excess must be hauled off and disposed of or stored by the CONTRACTOR.
12. After settlement of backfill and immediately before restoration of vegetated areas, grade and remove excess earth in unpaved areas. Remove to a depth of six (6) inches below finished grade. Place six (6) inches of topsoil over entire area to be restored.

2.10 Restoration
A. This section pertains to the restoration of the PROJECT site upon Completion of the work.
B. Restoration of improvements on public and private property must be in-kind and acceptable to the owner.
C. Restoration of road surfaces, drainage ways and other similar improvements must be in accordance with the directions of the government agency or public entity having jurisdiction.
D. All vegetated areas disturbed or damaged during construction must be re-vegetated with a stand of grass. Agricultural areas and areas currently under construction do not require re-vegetation.
1. Backfills, fills and embankments must be brought to a sub-grade level six (6) inches below finished grade. When sub-grades have settled, deposit and spread fine raked topsoil ready for seeding to a finished depth of at least six (6) inches.
2. Commercial fertilizer, 6-12-12 or equal, must be uniformly spread at the rate of thirty-five (35) pounds per one thousand (1,000) square feet over the topsoil by a mechanical spreader at least forty-eight (48) hours before seeding and mixed into the soil for a depth of two (2) inches.
3. A grass seed mixture comprised of thirty-five (35) parts Kentucky Blue Grass, thirty (30) parts Perennial Rye, thirty (30) parts Kentucky 31 Fescue and no more than five (5) parts inert matter must be sown on the disturbed areas at a rate of three (3) pounds per one thousand (1,000) square feet. Seeding must be done only between April 1 and June 1 or August 15 and October 15.
4. Seeded areas must be mulched with straw, hay, wood cellulose fiber or cane fiber. Straw or hay must be applied at a rate of two and a half (2.5) tons per acre. Wood cellulose or cane fiber mulch must be applied at a rate of one thousand (1,000) pounds per acre. On special areas of high water concentration, unstable soils or sloped surfaces, manufactured mulch materials such as soil retention blankets, erosion control netting or others may be required by ENGINEER. Manufactured mulch materials must be installed according to the manufacturer's recommendations.
5. The seeded areas must be thoroughly watered with a fine spray to prevent wash out the seed. Areas must be maintained and patched as directed by ENGINEER. A satisfactory stand of grass at least one (1) inch in height without bare spots will be required.
E. Within three (3) months after PROJECT Completion, the CONTRACTOR must correct defective work, such as settled areas, uneven road surfaces, bare spots in grass coverage, erosion and gullies.

2.11 Valves and Valve Boxes
A. Install valves with stems vertical.
B. Tighten all valve glands as valves are installed; add additional gland packing, if required; and again tighten glands after valves are placed in operation and brought up to operating pressure. Replace any gland packing which is deteriorated or in unsatisfactory condition.
C. Valve boxes must be installed vertical and straight, with the base supported so that it will not bear on the force main. The operating nut must be centered in the box and readily operable with a standard valve wrench. Supply valve wrench as directed by ENGINEER.

SECTION 2 – PUMP STATION EQUIPMENT

PART 1 – PRODUCTS

1.01 Submersible Pump
A. The pumps must be capable of handling raw sewage typical of domestic waste.
B. Pumps must be easily removable for inspection or service, requiring no bolts, nuts or other fasteners to be disconnected.
C. Capable of continuous submergence under water without loss of water tight integrity to a depth of twenty-five (25) feet.
D. Materials
1. Major parts, including stator casing, oil casing, sliding bracket and volute must be cast iron, Class 25-30 with smooth surfaces devoid of blow holes and irregularities.
2. Protect surfaces in contact with sewage with two (2) part corrosion resistant epoxy finish.
3. Exposed bolts and nuts must be 304 stainless steel.
E. Mating surfaces of major parts:
1. Machined and fitted nitrile O-rings for water tight sealing.
2. Machining and fitting must permit sealing by automatic compression of O-rings in two planes for contact on four surfaces.
F. Tolerances must allow replacement of any part without additional machining to ensure seal.
G. Pump Motor Cable
1. Furnish cable with following wires:
a. Three (3) conductor wires and one (1) ground wire for three phase or two (2) conductor wires and one (1) ground for single phase.
b. Control cable.
c. High temperature alarm wire, one (1) per phase.
2. Wire Size
a. Conductor and ground wire must meet minimum size per NEC.
b. Allow for three (3) percent voltage drop.
3. Heavy duty, flexible rated for submerged service in hazardous locations.
H. Pump Motor – Oil Filled
1. Description
a. Three phase or single phase with motor and pump furnished as an integral unit.
b. Oil filled type with Class B insulation system, Class F materials rated for continuous duty in four (4) degrees Celsius liquids.
2. Construction
a. Motor frame and end shields must be corrosion resistant cast iron with stainless steel hardware and shaft.
b. Static seals for moisture exclusion O-ring type.
3. Cable Entry
a. Threaded extension in top end bell, to permit installation of armored covering or conduit.
b. Electrical leads primarily sealed with a molded neoprene compression grommet.
c. Secondary moisture seal provided by cast epoxy material, encapsulating splice connectors in motor end bell.

4. Ratings
a. Motor bearings must be pre-lubricated at factory with a minimum B-10 life of fifteen thousand (15,000) hours.
b. Motor rated thermally to NEMA MGI-12.42.
c. Motor internal pressure capability must be two hundred (200) psi.
5. Automatic reset thermal overload protection for single phase motors and external magnetic contactor and overload protection for three phase.
6. Cooling system must be adequately designed with thermal radiators integral to stator housing, cast in one unit.
I. Pump shaft must be stainless steel per ANSI 431.
J. Shaft seals.
1. Carbon and ceramic.
2. Operation and Maintenance: Require neither maintenance nor adjustment, but easily inspected and replaceable.
3. Capable of twenty-four (24) hour dry operation without damage to motor or seals.
K. Impeller
1. Non-clogging bronze vortex impeller.
2. Dynamically balanced.
3. Slip fit to shaft and key driven with non-corroding fasteners.
4. Wear ring must be cast polymer material with molybdenum sulfide additive, or equal.
L. For grinder pumps, the unit must be located on suction side of pump impeller, discharging directly into the suction inlet. There must be no exposed shafting between the impeller and cutter to permit packing of ground solids. Both stationary and rotating cutters must be made of hardened and ground stainless steel.
M. Grinder pumps must not be installed on common force main systems.
N. Effluent pumps must be Zoeller Pump Company model number 165 or ENGINEER approved equal.

1.02 Station Piping
A. Designed for operating pressure of up to one hundred fifty (150) psig and a temperature of one hundred (100) degrees Fahrenheit.
B. Pipe materials must be schedule 40 galvanized or as indicated on the shop drawings.
C. All joints must be screwed or flanged per ANSI/AWWA C115/A21.15.
D. Fittings must be schedule 40 galvanized.
E. Flanges must be 250# ductile iron per ANSI/AWWA C115/A21.15.
F. All gaskets must be ring type.
G. All bolts and nuts must be machine bolts with hex nuts, regular series, Grade B, cadmium plated.
H. Valves.
1. The station shutoff valve must be a PVC true union ball type shutoff valve with teflon seats. A handle extension must be supplied for ease of operation.
2. Station piping check valves must be heavy duty spring loaded all rubber flapper type check valve with cast iron body. It must be an integral part of the discharge seal assembly and must lift out with the pump assembly. The valve design must allow for operation when negative heads, of up to five (5) feet, are encountered. The valve must be designed to operate at all pressures in the sewer system created by the pumps. A flat set stainless steel spring, internally molded into the Buna N rubber flapper must be furnished in order to prevent collection of debris in the check valve. All fasteners must be stainless steel.

1.03 Pump Discharge Seal System
A. The pump discharge seal system must permit removal and installation of pump without entering the wet well.
B. The pump discharge connection must be bolted to the discharge piping with a double O-ring seal for vertical removal.

1.04 Level Control System and High Water Alarm System
A. Float Switches
1. Furnish float switch assemblies – mercury type switch seal in polyurethane or polypropylene housing with an adequate amount of cable based on the wet well depth (not less than fifteen (15) feet).
2. Furnish polypropylene cord grips and polypropylene mounting hardware for switch assemblies.
B. Junction Box
1. Furnish junction box for installation in wet well.
2. Non-corrosive materials.
3. Conform to specifications for NEMA Type 6 standards for occasional submergence.
4. The cover must be fastened to the junction box by means of a totally corrosion resistant tether. Cord grips must make an effective seal around the wire and to the junction box. The interior of the enclosure must be of adequate size to accommodate the wires and connections required to operate the pump. Conduit segments between the controls and junction box must be sealed to prevent gas from entering the electrical panel.
C. High Water Alarm and Alarm Silence
1. Furnish separate float switch assembly, signal relay and alarm silence relay for high water alarm function. Signal relay must complete twelve (12) volt DC circuit for external alarm device. Electrical or mechanical indicator, visible on top of control panel, must indicate high wet well level exists. Signal relay must maintain alarm signal until wet well level has been lowered and circuit has been manually reset.
2. Alarm silence switch must be provided to permit maintenance personnel to de-energize external alarm device while corrective actions are underway. After silencing alarm device, manual reset of the signal relay must provide automatic reset of alarm silence relay.

1.05 Electrical Equipment
A. Control Panel
1. All enclosures must be weather proof NEMA Type 4X, molded of glass reinforced polyester resins pigmented gray in color for ultraviolet light protection. The resin system must include a flame retardant to obtain a flammability rating which meets UL 94V-0 of single piece construction.
2. The cover must be attached with a stainless steel piano hinge. The cover must be lockable by means of two (2) high quality combination stainless steel latches and padlock hasps.
3. The enclosures must be sized to cover wiring and components mounted on back panel; with push buttons, hand-off-automatic ("H/O/A") switches and control functions, run lights, amp meters, running time meters and instrumentation.
4. Back panel must be sized to mount starters, control equipment and instrumentation.
5. Stainless steel, continuous vertical hinge to provide one hundred sixty-five (165) degree swing.
6. Three point latching device with water tight key lock.
B. Instrumentation
1. Pilot lights: Run – green; Call – amber; Fail – red.
2. Elapsed time meters must be wired to each motor starter to indicate total running time in hours and tenths of hours and be six (6) digit non-resettable.
3. H/O/A, three (3) position switch.
C. Grounding
1. Entire installation to be grounded in accordance with requirements of NEC.
2. Equipment grounding must be provided for, but not limited to, the following items; panel enclosure, motor frames, receptacles, junction boxes, etc.
3. Ground must be insulated wire conductors, green color coded, sized according to code.
D. Battery Backup
1. At option of SUBSCIBER or building owner.
2. Twelve (12) volt DC lithium ion battery with automatic one hundred twenty (120) volt charging system.
3. Provide eight (8) hour continuous operation of alarm light and horn.
4. Mounted inside control panel.
E. Alarm Appurtenances
1. Alarm signal must be initiated by float control system high level signal or, at option of SUBSCIBER or building owner, power failure relay.
2. Supply one (1) twelve (12) volt DC weatherproof exterior alarm flasher in vapor-tight fixture with red globe, conduit box and mounting fixtures. Alarm light and mounting fixtures must be designed to permit mounting to prevent rain water from standing or collecting in gasketed area of fixtures between base and globe.
3. At option of SUBSCIBER or building owner, provide power failure relay with normally open contacts for hookup to an alarm light to be de-energized with contacts closed when power to station is interrupted.
F. Conduit must be rigid-steel heavy wall type: Full weight mild steel pipe of standard pipe dimensions; threaded; hot dip galvanized, or sheradized.
G. Circuit Breaker Usage

Minimum Type of Service I.C. Rating	Amperes
120/208 volt	15-100

H. Fuses: Rated one-tenth (1/10) to six hundred (600) amperes, six hundred (600) volts AC or less must be UL listed as Class RK1, current-limiting time delay with 200,000 amperes RMS interrupting rating as manufactured by Buss model MDA or equal. Buss: Low Peak; Gould Shawmut: Amp-Trap 11, or equal. All fuse sizes greater than sixty (60) amperes to be silver link.
I. Wire and Cable (Up to six hundred (600) volts)
1. Except where otherwise noted in these SPECIFICATIONS, insulation must be color coded thermosetting or thermoplastic type rated six hundred (600) volts, as approved by ENGINEER.
2. Conductors must be soft drawn copper, each strand individually tinned or coated with approved alloy.
3. Conductors #10 and smaller:
a. Use stranded conductors for final connections to motors and all locations where vibration or movement is present.
b. Use solid conductors for all other locations.
4. Use double braid, stranded conductors #8 and larger.
5. Minimum wire size: General – #12; over one hundred (100) feet – #10; over one hundred fifty (150) feet – #8; Control – #14.
6. Types and uses (seventy-five (75) or ninety (90) degrees Celsius) – unless otherwise specified or indicated on shop drawings.
a. Feeders and service entrance conductors: XHHW.
b. Power circuits above forty (40) amperes; THWN (#8 and larger).
c. Branch, receptacle and small power circuits: THWN (#12 and #10).
d. Direct burial feeders and branch circuits: UF.
e. Control (#14): THWN or XHHW
7. Main and feeder cables must be wire tagged in all pull boxes, wire ways and wiring gutters of panels. Tags must identify wire or cable number and/or equipment served as shown on the shop drawings. Tags must be of flame resisting adhesive material, T & B type WSL or equal.
J. Cable terminals and connectors (for copper conductors only)
1. Conductor sizes #8 or smaller, to include compression/indenter type terminals, splices and wire joints.
a. For terminals (rings, forks, disconnects): Thomas & Betts; Stakon; Burndy Hydent; Buchanan Press-Sure; or equal.
b. For splices (butt-type): Thomas & Betts; Stakon; Burndy Hydent; Buchanan Press-Sure; or equal.
c. For wire joints (twist-on): Thomas & Betts; Piggy; Scothlok; Ideal Wing-Nut; or equal.
2. Conductor sizes larger than #8, to include mechanical set screw or split bolt type connectors.
a. For mechanical or set-screw type connector: Thomas & Betts; Lugit; Bundy Quiklug; Penn Union EZ; or equal.
b. For split-bolt type connectors: Thomas & Betts; Burndy Hydent; Penn Union; or equal.
3. For compression connections sizes #8 and larger, to include one hole lugs, two lugs, butt splices, H-taps, C-taps and anti-oxidizing compound: Thomas & Betts; Burndy Hydent; Penn Union; or equal.

1.06 I & A Septic Tanks
A. For common force main systems only.
B. Heavy Duty I & A Septic Tank standard model STEP-22 as manufactured by Romar, Division of AK Industries, Inc., 2055 Pidco Drive, Plymouth IN 46563 or pre-approved equal.
C. Minimum, one thousand (1,000) gallon capacity.
D. Tanks must be rotationally molded from high density polyethylene. Raw materials must be tested in accordance with the appropriate ASTM specifications for flexural modulus, melt index, and impact strength as indicated on the 1000 Gallon I & A Septic Tank Detail of HSE's Common Force Main Details sheet. Concrete and fiberglass reinforced plastic are not acceptable as alternate materials.
E. At a minimum, tanks must contain sufficient ultraviolet light inhibitor such that if the tank were stored outside for two (2) years it would prevent significant loss of physical properties.
F. All cut edges must be smooth.
G. Tanks shall be approximately spherical in shape with vertical reinforcing ribs. Inlet and outlet plumbing must be pre-installed by the tank manufacturer and must be water tight. The riser must be corrugated and made of polyethylene. A gasket material and stainless steel screws must be provided to form a water tight joint when properly installed.
H. Tanks must be designed to maintain structural and water tight integrity under the following conditions:
1. Soil cover heights of up to five and a half (5.5) feet over the outlet invert
2. Extended periods of high groundwater at the ground surface.
I. Prior to shipment, tank manufacturer must install all inlet and outlet assemblies at the factory. Inlet and outlet pipe sections (stubs) must extend at least two (2) inches outside the tank. Inlet and outlet areas must be clearly and permanently marked on the tank. The inlet and outlet pipe sections must be protected from damage during handling by placing them in a recessed area in the tank wall so that the inverts of the inlet and outlet pipe sections do not extend past the plane formed by the outermost profile of the tank.
J. Inspection ports must provide vertical access through flat horizontal areas directly over inlet and outlet assemblies. Allowing minimum six (6) inch diameter inspection pipes to be easily retrofitted to the tank. A flat located ninety (90) degrees from the inlet and outlet may also be used.
K. The riser must be corrugated and must have a minimum corrugation depth of one (1) inch. It must be screwed or bolted to the tank. The riser to tank connection must be water tight under high groundwater conditions. All fasteners must be stainless steel. The riser must be easily field trimmed to allow adjustments to grade.
L. Wet well riser cover must be constructed of high density, structural foam polyethylene or light duty cast iron. The exposed top of the polyethylene cover must be slightly domed while the under side must have reinforcing ribs. It must be capable of withstanding light lawn and garden vehicular traffic. The cover must extend around the outside of the riser a minimum of two (2) inches below grade and must rest on either the roots (valleys) or crowns of the corrugations. The cover must be fastened with stainless steel screws to the riser. It must provide a minimum of ten (10) years of ultraviolet light protection.
M. Each tank must have a serial number permanently branded into it at two (2) locations. The serial number must cross-reference raw material physical properties and manufacturing records. The locations are as follows:
1. Directly above the inlet.
2. In the riser area so it is visible after installation whenever the cover is removed.
N. Pump Vault:
1. The vault must be manufactured of high density or linear low density polyethylene.
2. The bottom of the tank must support the vault. An additional support pad at the bottom of the vault will provide sufficient support for a typical effluent pump.
3. Effluent holes must be placed in the vault so as to draw from the clear zone of the tank, and at such a depth so as to maximize the anticipated scum and sludge storage in the tank.
4. The vault must be removable through the wet well riser. Provisions must be made through a sliding key mechanism so that the vault, when placed in the tank, will always be aligned such that the effluent holes of the vault will face toward the outlet side of the tank.
5. The vault must not be bolted to the tank. A protrusion from the bottom of the vault must fit into the bottom of the tank so as to prevent lateral movement.
6. The vault must be eccentrically located within the wet well riser to provide for the passage of pump discharge piping for cold weather installations. The vault must extend into the riser and must be held in a vertical position. Six (6) inch diameter inspection and pumping ports must be provided.
O. The manufacturer must provide a pre-installed grommet to fit one and one quarter (1.25) inch pipe at the recommended discharge point in the tank wall. The grommet must allow passage of the pump discharge piping as indicated on the 1000 Gallon I & A Septic Tank detail of HSE's Common Force Main Details sheet and remain water tight under high groundwater conditions.

1.07 Individual Grinder Pump Fiberglass Basin (Optional)
A. As an alternative, CONTRACTOR may install fiberglass basins in lieu of concrete for individual grinder stations.
B. Unless otherwise indicated, the plastic terminology used in this specification shall be in accordance with the definitions given in ASTM D 3299. This specification is for the hand lay-up, chopped spray technique and filament-wound methods for manufacturing of vertical underground fiberglass basins. Other methods of manufacturing will not be acceptable.
C. The resin used must be of a commercial grade and must be evaluated as a laminate by test or determined by previous service to be acceptable for the environment. The resins used may contain the minimum amount of fillers or additives required to improve handling properties. Up to five (5) percent by weight of thixotropic agent that will not interfere with visual inspection may be added to the resin for viscosity control. Resins may contain pigments and dyes by agreement between fabricator and ENGINEER recognizing that such additions may interfere with visual inspection of laminate quality.
D. The reinforcing material must be a commercial grade of glass fiber having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin.
E. The laminate must consist of an inner surface, and interior layer and a filament-wound structural exterior layer of laminate body.
F. The inner surface must be free of cracks and crazing with a smooth finish and with an average of not over two (2) pits per square foot, providing the pits are less that one-eighth (1/8) inch in diameter with not over one-thirty second (1/32) inch deep and are covered with sufficient resin to avoid exposure of inner surface fabric. Some waviness will be permissible as long as the surface is smooth and free of pits. Between 0.100 and 0.020 inches of resin rich surface must be provided.
G. A minimum of 0.100 inch of the laminate next to the inner surface must be reinforced with thirty (30) percent by weight of chopped strand fiber having fiber lengths from one half (0.5) to two (2.0) inches.
H. Subsequent reinforcement must be continuous strand roving fiberglass. The thickness of the filament-wound portion of the basin shell must vary with the basin height to provide the aggregate strength necessary to meet the tensile and flexural requirements. If additional longitudinal strength is required, the use of other reinforcement, such as woven fabric, chopped strand mat or chopped strands must be interspersed in the winding to provide additional strength. Glass content of this filament-wound structural layer must be fifty (50) to eighty (80) percent by weight. The exterior surface must be relatively smooth with no exposed fibers or sharp projections. Hand work finish must be present to prevent fiber exposure.
I. The basin wall must be designed to withstand wall collapse based on the assumption of hydrostatic type loading by backfill with density of one hundred twenty (120) pounds per cubic feet. The basin wall laminate must be constructed to withstand or exceed two (2) times the assumed loading for any depth of basin.
J. For the basin bottom, subsequent reinforcement must be of one and a half (1.5) ounces per square feet chopped strand fiber or woven roving to a thickness to withstand applicable hydrostatic uplift pressure, with a safety factor of two (2). In saturated conditions, the center deflection of any empty basin bottom must be less than three-eighths (3/8) inch (elastic deflection) and can not interfere with bottom pump mounting requirements nor the rail system.
K. The width of the first layer of joint overlay must be three (3) inches minimum. Successive layers must uniformly increase in width to form a smooth contour laminate that is centered on the joint within one half (0.5) inch. A highly filled resin paste may be placed in the crevices between joined pieces leaving a smooth surface for lay-up. The cured resin surface of the parts to be jointed must be roughened to expose glass fiber. This roughened area must extend beyond the lay-up areas so that no reinforcement is applied to an unprepared surface. Surfaces must be clean and dry before lay-up. The entire roughened area must be coated with resin after joint overlay is made.
L. The finished laminate must be free from visual defects such as foreign inclusions, dry spots, air bubbles, pinholes, pimples and de-lamination.
M. The surface must be relatively smooth, hand finish is acceptable, with no exposed fibers or sharp projections.
N. The basin bottom must extend past the basin walls so that the outside diameter is approximately four (4) inches larger in diameter than the outside diameter of the side walls. This larger diameter must serve as an anti-flotation flange. Anti-flotation flange must not require bolt holes to secure the basin to the concrete pad.
O. Basins must include national pipe thread discharge fittings. A water tight bolt-on thermoplastic influent hub must be provided for mounting in the field. The hub must be beveled approximately three (3) degrees to accommodated gravity pipe coming in from various angles.
P. The top flange and cover outside diameter must assure a tight fit and afford ease of access not possible with recessed covers. Non-corroding stainless steel heli-coils must be inserted in all bolt holes of the top flange and must be positively locked with threads and resin to prevent stripping. A minimum four (4) hole pattern must accommodate the mounting of a one piece or split cover.

PART 2 – EXECUTION

2.01 Site Work
A. Excavating
1. De-watering must be provided as described previously in the section entitled Manholes, Piping, Valves & Fittings of these SPECIFICATIONS.
2. Trenching must comply with the excavation requirements as described previously in the Section entitled Manholes, Piping, Valves & Fittings of these SPECIFICATIONS.
B. Wet Well
1. If required, pour anti-flotation collars at the same time that the base is set or poured.
2. Promptly place backfill to minimize risk of flotation.
3. Protect and support piping during backfill operations.
C. CONTRACTOR is responsible for providing a permanent power supply and all other necessary utilities to the pump station.

2.02 Pump Stations
A. Unless approved in writing by the ENGINEER, pump stations must be located external to the building. Sewage backups into the wet well and/or building may occur due to failure of the pump, check valve or appurtenances, thus allowing sewage to flow into the wet well and/or building. Any backup into the wet well and/or building will be the sole responsibility of the SUBSCRIBER and/or property owner. HSE is not liable or responsible in any way for damages due to sewage backups in wet wells and/or buildings served by grinder/effluent pumps.
B. The top of the wet well/sump must be:
1. One (1) foot below the lowest elevation to have sanitary service in the home or building.
2. Eighteen (18) inches above the one hundred (100) year flood elevation of nearby waterways.
3. Finished grade must slope away from the wet well/sump.
C. Individual Grinder Pump Fiberglass Basin (Optional)
1. Contractor must place the basin on a four (4) inch concrete pad.
2. Either fill with grout covering the anti-floatation flange or secure with steel clips catching the anti-flotation flange and anchored to the concrete pad.

2.03 I & A Septic Tanks
A. Backfill per manufacturer's requirements or completely cover the tank to a minimum depth of twelve (12) inches with "clean" sand backfill as indicated on the 1000 Gallon I & A Septic Tank Detail of HSE's Common Force Main Details sheet, the more stringent requirement will apply.
B. Do not attempt to force the tank to the bottom of an excavation that contains water. De-water the excavation to allow proper placement of bedding and backfill material.
C. While placing the tank do not lift the tank by the inlet or outlet hardware.

These SPECIFICATIONS were last revised on April 27, 2015.

HAMILTON SOUTHEASTERN UTILITIES, INC.
SMALL DIAMETER FORCE MAIN
SPECIFICATIONS
SHEET 2 OF 2

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REVISIONS

NO.	BY	DATE	CHECK	
1	WHF	4/27/2015	TK	ADDED EPOXY RESIN NOTE "R" TO SECTION 2.02 LAYING PIPE

DRAWN: BY / DATE / CHECK

CERTIFIED

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PROJECT
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SCALE: N/A
SHEET